



EIP Practice Abstracts – batch 1

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List of Abbreviations

CFD	Climate Farm Demo
NC	National Coordinator
TL	Thematic Leader
PDF	Pilot Farm Demo
WP	Work Package
WPL	Work Package Leader
PA	Practice Abstract
EIP-AGRI	European Innovation Partnership for Agricultural productivity and Sustainability

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Abstract

This document provides a detailed overview of the methodology used for developing, reviewing, and disseminating 100 practice abstracts (PAs) within the Climate Farm Demo project. The PAs are designed to share knowledge on climate-smart farming practices and facilitate knowledge exchange across Europe.

The first part of the document describes the systematic process for creating these abstracts, including author profiles, templates, and review mechanisms to ensure quality and consistency. The second part of the document includes the full set of 100 practice abstracts, each focusing on different aspects of climate change adaptation and mitigation, pilot demo farms, living labs, and more. These PAs are presented in both summary and extended formats, available in multiple languages, and will be accessible on the EIP-AGRI platform and the Climate Farm Demo website. The PAs will also be promoted through various communication channels to maximise their impact and support the adoption of climate-smart farming practices across Europe.

Chapter 1

Introduction

This chapter provides a brief overview of the Climate Farm Demo project, including its ambition and goals. It also introduces the concept and purpose of practice abstracts, as well as CFD's approach towards their production and use. It will allow the reader to understand what they can expect from the document and where specific pieces of information can be found within it



1.1 About Climate Farm Demo

Climate Farm Demo is a unique pan-European network of Pilot Demo Farmers (PDFs) covering 27 countries and all pedo-climatic areas. Its overall aim is to accelerate the adoption of Climate Smart Farming (CSF) practices and solutions by farmers and all actors of the Climate Smart Agriculture Knowledge & Innovation Systems (AKIS), with a view of adapting agricultural production systems to climate change and of achieving a carbon neutral agricultural sector by 2050, thereby meeting the targets of the EU Climate strategy.

To reach this objective, the project adopts a Multi-Actor approach by connecting 1,500 Pilot Demo Farmers and their Climate Farm Advisors (CFAs) at European and national levels to increase knowledge exchange & cross-fertilisation in their respective AKIS. Technical and social innovations covering a broad range of thematic areas will be demonstrated to the wider farming community across six annual demo campaigns (4,500 demo-events) supporting interactive and peer-to-peer learning.

Project objectives

Climate Farm Demo overall aims to (1) network Pilot-Demo-Farmers (PDFs) to boost CSF knowledge exchange and cross-fertilisation among agricultural sectors and EU and national Agriculture Knowledge and Innovation Systems (AKIS), (2) support and advise PDFs in implementing and demonstrating CSF practices to increase innovation uptake and finally, (3) to incentivise the adoption of CSF practices across Europe thanks to standardised methodologies and relevant rewarding mechanisms that will support farmers in their systemic transition.

Climate Farm Demo project has eight specific objectives, shown in the following table.

No	Climate Farm Demo objectives
Objective 1	To build and manage a well-connected network of 1,500 Pilot Demo Farmers (PDFs) and Climate Farm Advisors (CFAs) covering 24 EU Member States, 1 associated country (Republic of Serbia), Switzerland and UK, and structured across pedo-climatic areas, agricultural sectors and Adaptation & Mitigation thematic areas, accelerating the knowledge exchanges (KE) and capacity building within and between Climate Smart AKIS (CS-AKIS).
Objective 2	To support 1,500 Pilot Demo Farmers, through tailored, regular and long-term advice , in planning, implementing and monitoring their farm Adaptation and Mitigation Measures (AMM) by using a standardised and adapted methodology, towards the achievement of 35% GHG emission reduction
Objective 3	To support the delivery of 4,500 high-quality demonstration events in a multi-actor setting in the 1,500 PDFs during 6 annual demonstration campaigns in 27 EU countries , thereby resulting in substantially increased uptake and application of CSF approaches and practices by other Pilot Demo Farmers and average farmers
Objective 4	To co-create a set of new and innovative CSF solutions in 10 multi-actor Living Labs (LL) covering all adaptation and mitigation measures and located in all European pedo-climatic areas ; explore lessons learned on implementation of LL approach embedded in national or regional CS-AKIS for scaling and future multi-actor partnerships engaged in innovation and adoption of CSF.
Objective 5	To build a common framework on adaptation & mitigation by collecting and comparing climate and carbon tools across Europe to elaborate (i) a harmonised carbon assessment method & environmental adaptation indicators , to define (ii) a common MRV methodology and (iii) guidelines for climate adaptation and mitigation.
Objective 6	To analyse rewarding mechanisms that support (i) the adaptation and risk reduction of farming practices to climate change, (ii) the mitigation of all GHG emissions including the carbon sequestration in soils and agricultural landscapes in order to build capacity of PDFs and CFAs and to support a wide use and adoption of rewarding mechanisms as a lever for transformation based on systemic analysis of farmers' needs
Objective 7	To build a network of (i) related EU projects , (ii) Flagship EU initiatives and (iii) Policy makers (at EU and national levels) to give visibility to the project , create cooperation , integrate research and knowledge from

	other projects, produce common policy and operational recommendations and prepare a sustainability strategy for the whole Climate Farm Demo network.
Objective 8	To develop Dissemination, Exploitation and Communication (DEC) plans and an integrated knowledge reservoir (KR) & associated tools that accelerate the scaling and uptake of climate change adaptation & mitigation measures among practitioners and their understanding by the society in the 27 European CS-AKIS and at EU level

Table 1: Climate Farm Demo objectives

1.2 Concept of EIP-AGRI Practice Abstracts

Practice Abstracts are concise, user-friendly summaries designed to communicate key project findings, insights, and best practices to farmers, advisors, policymakers, and other relevant stakeholders. They serve as a bridge between innovation and practical application, ensuring that valuable knowledge, methodologies or insights are easily accessible.

Under the EIP-AGRI framework, Europe Horizon projects play a key role in stimulating knowledge exchange and spreading innovative solutions across the EU. To ensure consistency and clarity, projects are expected to share the results and practice-oriented solutions in the EIP-AGRI common format, which promotes a more harmonised and practice-oriented approach to sharing results.

Practice Abstracts in the **EIP-AGRI common format**:

- Help projects share their results in an easily understandable way for practitioners
- Foster knowledge flows, ensuring project results are widely disseminated at a faster pace
- Support the development of new project proposals by providing added value and reducing duplication of ongoing or completed work
- Facilitate networking by connecting project partners with practitioners
- Respond to real needs from the field by making innovative solutions more accessible and applicable

CFD EIP-AGRI Practice Abstracts

In the Climate Farm Demo project, Practice Abstracts play a crucial role in disseminating practical knowledge, fostering knowledge exchange, and supporting the adoption of climate-smart farming practices. The project's approach to Practice Abstracts emphasizes **clarity, relevance, and usability**, ensuring that the information is tailored to end users' needs.

Considering the **size of the project** and the **number of stakeholders (practitioners) involved**, Climate Farm Demo will produce a total of **300 Practice Abstracts**, divided into **three batches**. The **first batch** is presented in this deliverable.

To cover all relevant topics while keeping the information well-organized, Climate Farm Demo practice abstracts are categorized into the following clusters: **Adaptation and Mitigation Measures, Pilot Demo Farms, Living Labs, Rewarding Mechanisms, MRV Tools, and Cross-Cutting Topics**.

In addition to being uploaded to the EU CAP Network, Climate Farm Demo will feature a dedicated section on its website (www.climatefarmdemo.eu). Beyond static PDF documents, each Practice Abstract will be presented as an **individual landing page**, enabling automatic translation into all project languages and English to reach broader audiences. See the [Annexes Section](#) for references.

The Practice Abstracts will be widely disseminated through **social media channels, newsletters, and press articles**, maximizing their impact and accessibility.

Chapter 2

Methodology

2.1 Methodology

Given the large number of the first batch of Practice Abstracts (100), it was essential to establish an efficient and structured approach to ensure the work is completed on time, the quality is maintained, the content remains relevant, and the Practice Abstracts are accessible. To achieve this, Work Package 8 Leaders - **BIOS**, in collaboration with the coordination team **IDELE** and **ACTA** agreed on the following strategic decisions:

- **Cluster the content:** To ensure a well-organised structure, and cover all relevant topics, the content is grouped into relevant clusters.
- **Widen the team of authors:** A broader team of experts is involved in the development of Practice Abstracts to cover the diverse areas of expertise and multiple perspectives
- **Enable translations:** To maximise the accessibility of the Practice Abstracts across different countries, translations was one of our priorities
- **Allow flexibility in length:** While Practice Abstracts follow a 2,000-character limit, if a topic requires a more in-depth explanation, we found a way to accept longer format, ensuring that valuable insights are fully captured

Content Clusters

To systematically ensure the first batch of Practice Abstracts address key topics most relevant for agriculture practitioners 6 content categories/cluster was defined as follows:

1. Adaptation and Mitigation Measures
2. Pilot Demo Farms
3. Living Labs
4. Rewarding Mechanisms
5. MRV Tools
6. Cross-Cutting Topics (Other)

Dividing the content into clusters not only ensures that all relevant aspects of the project are covered but also helps identify the most suitable authors for each topic, improves filtering, and makes it easier for end-users to access relevant content.

Team of Authors

Although National Coordinators were initially assigned to write Practice Abstracts to address country-specific challenges, it was decided to expand the list of authors to ensure: (1) multiple perspectives, (2) expertise across all clusters, and (3) a balanced workload. As a result, the task of writing practice abstracts has been assigned to National Coordinators, Work Package Leaders (WPLs), Thematic and sector Leaders.

Content Translations

To maximise the accessibility and impact of Climate Farm Demo Practice Abstracts, it was aimed to make them available in all project languages. Given the large number of Practice Abstracts and the need for efficient multilingual dissemination, a practical and scalable solution was found.

Namely, each Practice Abstract will have a **dedicated web page** on www.climatefarmdemo.eu, where the English and original version (in the author's native language) will be uploaded. See the

[Annexes Section](#). For all other languages, browser-based automatic translation tools will enable users to instantly translate the content into their preferred language.

This approach ensures that all Practice Abstracts are easily accessible across Europe while keeping the process efficient and user-friendly, eliminating the need for time-consuming manual translations.

Flexibility in length

While Practice Abstracts are limited to 2,000 characters, it was recognised that some topics may require more in-depth explanation. To ensure that valuable insights are not lost due to strict length constraints, a flexible approach to content length was adopted.

Since all Practice Abstracts will be available on the Climate Farm Demo website (uploaded throughout April 2025), this platform will serve as the place where longer versions will be published. Authors who wish to provide additional details beyond the standard limit should submit both a concise version, up to 2,000 characters, for the EIP-AGRI website and an extended version for the Climate Farm Demo website.

By enabling this flexibility, Climate Farm Demo Practice Abstracts aim to enhance knowledge-sharing and maximise the value of the practice abstracts for a diverse audience.

The Process of Developing Practice Abstracts

To ensure that all Practice Abstracts are delivered on time, with high quality and consistency—and to maximize the project's ability to leverage the knowledge they contain—a comprehensive delivery system was developed. This structured approach ensures clarity for authors, maintains quality standards, and enhances the impact of the Practice Abstracts.

The process consists of three key stages:

- Preparation
- Development and Review
- Visibility.

Preparation stage

In the **Preparation** stage, developed tools helping in preparing and delivering Practice Abstracts on time and in good quality were developed:

Comprehensive guidelines with instructions to all authors on how to prepare their Practice Abstracts were developed and circulated to all authors. The document explains the concept of Practice Abstracts, purpose and CFD approach. It also explains our internal procedures for developing and collecting Practice Abstracts. Finally, the guidelines explain how the authors should fill the templates that we produced. See the [Annexes Section](#) for references.

Templates for developing Practice Abstracts (See Figure 1) were created to ensure consistency across all Practice Abstracts and to guarantee that each Practice Abstract contains the necessary information. Since it was internally agreed to develop content for both the EIP-AGRI platform and the Climate Farm Demo website, and to organize content into thematic clusters, six different templates, one per cluster were created. Each template includes the following elements:

- Cluster Identification – Cluster title

- EIP-AGRI Requirements – Title, short summary in English (up to 2,000 characters), and author details.
- Climate Farm Demo Website Content (Optional) – Extended description in English, extended description in the native language, space for visuals (photos or graphics), keywords to support easier navigation through the website, and sections for additional information and dissemination materials.

By structuring the templates this way, we ensure that all practice abstracts are well-organised, relevant, and tailored for both platforms, making them accessible and useful for a broad audience.



ADAPTATION AND MITIGATION MEASURES

***PRACTICE ABSTRACT NUMBER #**

SHORT TITLE IN NATIVE LANGUAGE*

Provide a self-explanatory title that clearly summarises the challenge/opportunity and the project result(s) that address(es) key(s) theme(s) and are relevant for the practitioners. (max. 200 characters)

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SHORT TITLE IN ENGLISH*

Provide a self-explanatory title that clearly summarises the challenge/opportunity and the project result(s) that address(es) key(s) theme(s) and are relevant for the practitioners. (max. 200 characters)

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COUNTRY AND CLIMATIC ZONE*

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CONTACT*

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3 BENEFITS OF THE PRACTICE - ADD KEYWORDS*

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PRODUCTION SYSTEM (IF RELEVANT) *

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THEMATIC AREA*

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ADAPTATION AND MITIGATION MEASURES

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SUMMARY FOR PRACTITIONERS ON THE MAIN FINDINGS/INNOVATIVE SOLUTION(S) - IN NATIVE LANGUAGE*

Maximum 2,000 characters word count, including spaces

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SUMMARY FOR PRACTITIONERS ON THE MAIN FINDINGS/INNOVATIVE SOLUTION(S) - IN ENGLISH*

Maximum 2,000 characters word count, including spaces

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ADAPTATION AND MITIGATION MEASURES

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LONGER SUMMARY FOR THE CLIMATE FARM DEMO WEBSITE - IN NATIVE LANGUAGE

Maximum 4,000 characters word count, including spaces

Add text here.

LONGER SUMMARY FOR THE CLIMATE FARM DEMO WEBSITE - IN ENGLISH

Maximum 4,000 characters word count, including spaces

Add text here.

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ADAPTATION AND MITIGATION MEASURES

Add text here.

ADDITIONAL INFORMATION

List facilitating elements or obstacles for the implementation of the generated results, suggest future actions/research, and/or provide messages to end users etc. Maximum 2,000 characters, including spaces.

PHOTOS*

Please insert photographs/images in high resolution here, or store it on Drive and share.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Add text here:

URL:

Add text here:

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Figure 1: CFD Practice Abstracts Templates

Monitoring table for Practice Abstracts

An internal monitoring table (See Figure 2) was created to organise and distribute work among authors, track the progress of Practice Abstract development, and facilitate feedback exchange between reviewers. The table is divided into two sections: one for authors and one for reviewers:

- **Author Section** – Authors fill in key details about each practice abstract, including its assigned number, cluster, title, author contact, and an indicator showing whether the abstract is finalized and uploaded.
- **Reviewer Section** – Reviewers provide comments and indicate whether the abstract is ready for submission or requires further revisions.

This structured approach ensures a clear workflow, progress tracking, and an efficient review process.

Practice Number	Name and Surname	Organisation/Institution	Role on the project	Topic Group	Title (in English)	PA Drafted	PA Reviewed	Comments (in English, unless the ACT/IDELE comment)	Ready for submission (for ACT/IDELE)
#1	Fabrizio D'Amico	NTS	Thematic Leader	Other Cross-Cutting Topic	Reducing Greenhouse Gas and Nitrogen Emissions from Cattle Housing				
#3	Fabrizio D'Amico	IPCC/NTS	Climate Farm Advisor	Adaptation and Mitigation Measures	Calculation of carbon and nitrogen emissions				
#5	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#6	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Climate change impact assessment				
#8	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Climate change impact assessment				
#9	Andrea Lazzarini	ACT/IDELE	Thematic Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#10	Marco Scaramia	Thematic Leader	Thematic Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#11	Marco Scaramia	Thematic Leader	Thematic Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#12	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#13	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#14	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#15	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#16	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#17	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#18	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#19	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#20	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#21	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#22	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#23	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#24	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#25	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#26	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#27	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#28	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#29	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
#30	Laura Tassi	EUROD	Work Package Leader	Other Cross-Cutting Topic	Thematic leader network and co-developers				
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Figure 2: Screenshot of an internal monitoring table

Development and Review stage

The Development and Review stage begins with authors drafting practice abstracts based on the established framework. To ensure quality and relevance, drafts undergo an internal review process, where feedback is provided to refine the content before final submission. This ensures that all Practice Abstracts are concise, practical, and valuable to the target audience.

Following the agreement on six thematic clusters, author roles to ensure comprehensive coverage of all topics were defined. National Coordinators (NCs) were responsible for drafting PAs related to activities in their countries or assigning Climate Farm Advisors (CFAs) to specific PAs. Additionally, Work Package Leaders (WPLs) drafted Practice Abstracts related to their work packages, while Thematic or sector Leaders focused on Practice Abstracts within their thematic or sector areas.

To streamline the assignment process, an email containing instructions, templates, and guidelines was sent to Work Package Leaders and the National Management Unit (responsible for coordinating National Coordinators), requesting them to assign relevant authors within their teams.

Authors then filled in the monitoring table, providing an overview of the topics covered. Once Practice Abstracts were drafted and uploaded to the shared repository, reviewers (BIOS, IDELE, and ACTA) conducted two rounds of reviews, assessing structure, content quality, and uniformity before finalisation.

Visibility

The final stage, Visibility, focuses on maximising the impact of the Practice Abstracts. Once finalised, the Practice Abstracts are published on the EIP-AGRI platform. Moreover, from end of April 2025, all Practice Abstracts will be uploaded on the Climate Farm Demo website, with the dedicated page containing advanced searching and filtering options for easy access and navigation. See the [Annexes Section](#) for references. To further enhance dissemination, practice abstracts will be actively promoted through the project's communication channels, including social media, newsletters, and press articles. Additionally, since the Practice Abstracts will be available in all project languages, their promotion will be incorporated into national DEC plans and actively shared with national stakeholders. This multi-channel approach ensures that the Practice Abstracts reach the intended audience, fostering knowledge exchange and supporting the adoption of climate-smart farming practices.

Chapter 3

Analysis of Practice Abstracts and Recommendations for Future Batches

3.1 Topics covered in the first batch of Practice Abstracts

As mentioned in the Methodology chapter, six topic clusters were defined, and each author could choose between "Pilot Demo Farms", "Adaptation and Mitigation Measures", "Living Labs", "MRV Tools", "Rewarding Mechanisms" and "Cross-Cutting Topics".

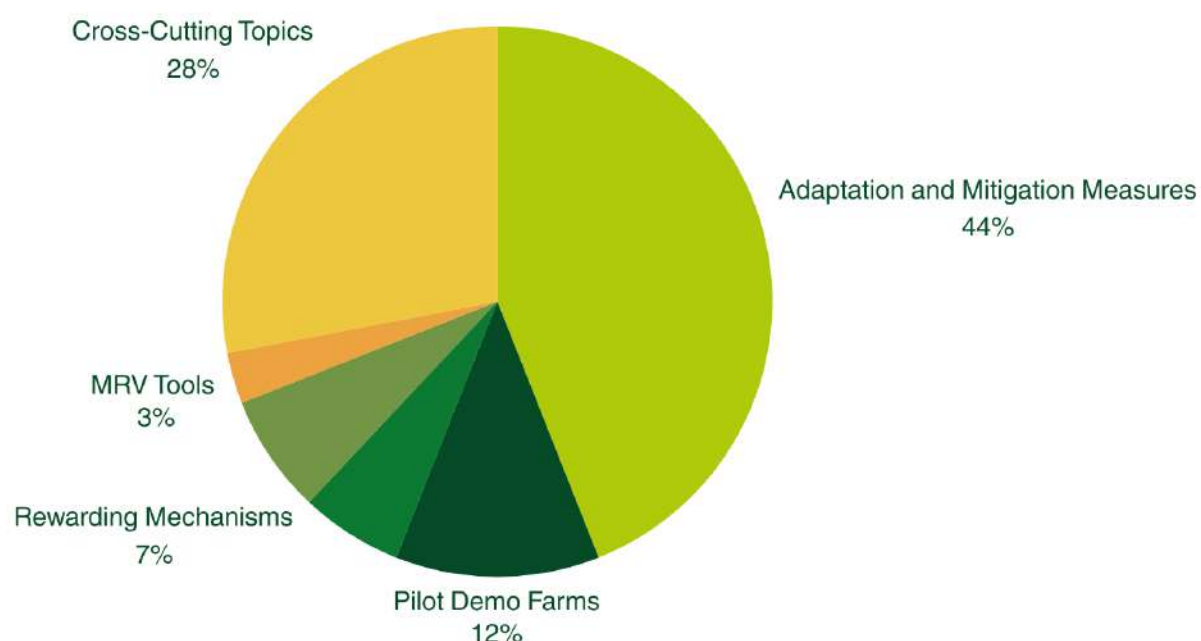


Figure 3: PA themes in %

As visible at the Figure 1, the majority PAs (44%) focusing on Adaptation and Mitigation Measures, Pilot Demo Farms represent 12% of the abstracts, Rewarding Mechanisms make up 7%, MRV Tools is at 3%, while Cross-Cutting topics account for 28% of the abstracts.

The lower number of abstracts in the MRV Tools and Rewarding Mechanisms categories is understandable, considering the current stage of the project. However, we expect these topics to gain more attention in future batches. As the broadest category, "Cross-Cutting Topics" was expected to be dominant. Closer examination of the specific topics covered in PAs within this category shows that this cluster is quite heterogeneous, which is also understandable.

At first glance, it may seem surprising that Pilot Demo Farms were selected as a category in only 12% of abstracts. However, it is important to note that many abstracts could fit into more than one category. This number might have been higher if, for example, selecting multiple categories had been allowed.

Over 90 authors contributed to the writing of Practice Abstracts—some authored multiple abstracts, others participated as co-authors on one or more, and some abstracts were written in co-authorship.

3.2 The use of template

Overall, authors adhered to the template guidelines, indicating that the template structure was generally effective. However, some inconsistencies were observed in its use.

One notable inconsistency was in the Contact Section. While all authors provided some form of contact information, the details varied—some included only their name and email, others added their organization, and some listed only their name and organization. A more standardized approach to filling in this section would improve clarity and uniformity.

Most authors correctly filled in only the designated sections in their native language, as instructed. However, a few attempted to complete the entire abstract in both languages, despite the template explicitly highlighting which parts should be in the native language. Ensuring strict adherence to these guidelines in future batches will help maintain consistency and readability across all abstracts.

Although the template includes a dedicated section for photos, some authors also inserted images in the Summary section. While this may improve visual appeal, photos cannot be uploaded to the EIP-AGRI portal. As a result, if these images contain important information not mentioned in the text, the final product for the EIP-AGRI portal may be incomplete.

3.3 Recommendations for Future Batches

- **Including a “Country” field** – It would be helpful to include a “Country” field in the monitoring table, especially if the Practice Abstract (PA) focuses on a specific country. The same applies to climatic zone and production system. While this may slightly increase the workload for authors and duplicate some information, it would improve the quality of the analysis and contribute to the overall success of the Practice Abstract batch.
- **Removal of summary in the native language** – Since EIP-AGRI does not require text in the native language, it could be worth considering the removal of the summary in the native language, while retaining the longer description for the Climate Farm Demo website. In most cases, the summary is a repetition of content already covered in the longer description, so omitting the native-language summary would not result in a significant loss of information.
- **Language usage clarification** – Further discussion is needed to determine which abstracts should be written exclusively in English and which should be provided in both English and the native language. This issue was not addressed before the templates were distributed, and analysis of the PAs has revealed varying interpretations by authors. For instance, in cases of cross-cutting topics relevant to all countries, climatic zones, and production systems, some authors opted to write only in English (even if it was not their native language), while others provided texts in both languages. A unified approach would ensure greater consistency.
- **Inserting a marketing introduction** – A brief marketing introduction to the Practice Abstracts could be added to the template in both English and the native language. This would support the communication team in conveying key messages during dissemination.
- **Review of cluster topics** – While the existing clusters cover the major aspects of the project, the analysis of the PAs showed that some abstracts could reasonably fall into more than one category. Requiring authors to select only one category in such cases may compromise the

reliability of the analysis. To address this, either the topic clusters should be refined, or authors should be allowed to select multiple categories where appropriate.

- **Use of photos** – Some authors included images in the Summary section, despite the template providing a dedicated section for photos. To avoid this, it is recommended to emphasize in the template that photos should not be placed in the Summary. For example, the instructions could state: “Please avoid including photos, graphs, or other visuals in this section, as the Summary will be uploaded to the EIP-AGRI portal, which only accepts text.”
- **Clarification of the “Additional Information” section** – The analysis of the first batch of PAs showed inconsistent use of this section by authors. Providing clearer guidelines on its intended content would enhance uniformity. For instance, it should be explicitly stated that no essential information should be included here, as this section appears at the end of the document and may not receive sufficient attention.

Chapter 4

Climate Farm Demo Practice Abstracts – First Batch

4.1 List of all Practice Abstracts

Table 2 presents the complete list of all Practice Abstracts (PAs) included in this document, organized according to their assigned topic groups and the original numbering order.

Index	Practice Abstract Number	Title (in English)
Topic group: Pilot Demo Farm		
1	#7	Direct Seeding and Renovation Plants as Carbon Sequestration Method at a Pilot Demo Farm in Finland
2	#14	Soil Health as Capital: How Ongoing Experimentation Builds Sustainable and Productive Farming
3	#15	Family Farm in Transition: Climate-Smart Practices on a Dairy Farm in Geraardsbergen (Belgium)
4	#22	Helping Future French “Bordeaux” Winegrowers to Invent the Agriculture of Tomorrow, More Resilient and Capable of Surviving Increasingly Frequent and Violent Climatic Hazards
5	#23	The Pays de la Loire “Low-Carbon Pathway”: Studying the Carbon Footprint and the Production’s Costs Simultaneously
6	#25	Help the Organizers of Climate Farm Demo Demonstrations (or Other Livestock Open Days) to Close Their Demonstrations by Offering a Discussion and Conclusion Exercise with the Visitors/Breeders Present at the Demonstration
7	#49	Water Management Dialogue Matrix: A Good Conversation About Climate Smart Solutions
8	#53	Széchenyi István University’s Demonstration Farm Network: Knowledge Transfer, Knowledge Exchange and Sustainable Agricultural Innovation
9	#58	Beef Days - Success for the Digital Transition in Walloon Livestock Farming
10	#86	Improving Soil Organic Content on Vegetable Farms in Brittany: Material, Technical and Cultural levers
11	#90	Farming With Trees – Opportunities Through Agroforestry
12	#95	Pastured Poultry: Portion Herding for Laying Hens
Topic group: Rewarding Mechanisms		
13	#9	Definitions and Categorization of Rewarding Mechanisms for Climate Smart Farming
14	#10	Farmers and Advisors’ Needs from Rewarding Mechanisms

15	#11	Rewarding Mechanisms – The example of Label-Bas Carbone
16	#17	Agroforestry Systems: Introduction and Funding Opportunities in Germany
17	#33	The Carbon Removals and Carbon Farming (CRCF) Regulation
18	#55	AgroImpact - a Multi-stakeholder Association to Promote and Support Decarbonization Efforts by Swiss Farmers
19	#68	Rewarding Climate Action: Recognizing the Contributions of Organic Farmers
Topic group: Living Labs		
20	#24	Co-Constructing a Step-by-Step Design Approach in a Multi-Skill Group on Adapting to Climate Change in the Dairy Sector in the North of the Nouvelle-Aquitaine Region
21	#41	Monitoring and Evaluation of Living Labs
22	#51	Living Lab - Method for Interactive Generation and Prioritization of Ideas
23	#60	Living Laboratory on Living and Healthy Soil, Capable of Producing Healthy Food that Positively Affects People's Health
24	#93	Enriching Agricultural Landscapes with Hedges and Shrub Strips
25	#94	Impact of Minimized Tillage on Soil Properties, Biota, and Environmental Conditions
Topic group: MRV Tools		
26	#38	ESGreenTool – A Digital Sustainability Solution for Danish Agriculture
27	#54	Soil Fertility Management with Innovative Soil Scanner Technology
28	#57	Description of a Methodology for Validating GHG Assessment Tools at Farm Level
Topic group: Adaptation and Mitigation Measures		
29	#2	Increasing Organic Matter by Intercrops
30	#8	Climate Smart Farming of Finnish Peatlands
31	#18	"Probiotechnology" - Probiotics technology in agricultural production
32	#19	How to Keep Nitrogen in Slurry by Acidification?
33	#20	Additives for Reducing Enteric Methane Emissions from Cattle
34	#21	The Benefits of Carbon Farming
35	#26	Adapting to a Loss of 20 to 30% of Grassland Production in Brittany: The Levers Put in Place by "SCEA de l'Ellé"

36	#27	Energy Efficiency in Agriculture - A guide to Reducing Energy Costs on the Farm
37	#28	Saving Fuel in Agriculture - How much Savings Potential is in your Farm?
38	#29	Precision Farming
39	#30	Carbon Farming as a Climate Change Adaptation and Mitigation Tool for Forage Production
40	#34	Integrated Pest Management in the Fruit and Vegetable Sector
41	#35	Establishing a Rotational Grazing Calendar in Mixed Farming Systems in Portugal
42	#36	Water Management on Raspberry Farm on the South of Portugal
43	#37	The Impact of Climate Change on Water Management in Agriculture
44	#40	Adaptation to Climate Change in Crop Production
45	#44	Optimisation of Irrigation in Olive Cultivation Using Sensors, Drip Irrigation and Monitoring of Climatic Conditions
46	#45	Optimized Fertilization in Olive Cultivation Using Soil Analysis, New Stabilized Fertilizers and New Technologies
47	#47	Nest Boxes for Vole Control in Agricultural Crops
48	#50	Tool to Discuss Climate Change Adaptation at a Farm Level
49	#56	How Soil Cover and Reduced Tillage Enhance the Stability and Resilience of Agriculture to Extreme Weather Events
50	#59	Control Traffic Farming
51	#61	Using Thermal Screen to Reduce Energy Consumption in Greenhouses
52	#62	Climate and Soil Benefits of Cover Crops: Carbon Sequestration, Nitrogen Management, and Weed Control
53	#66	Carbon Audits and Adaptation and Mitigation Plans (AMPs) to Support Farms in Improving their Environmental Performance
54	#67	Effect of Water Stress on Alfalfa Yield
55	#74	Sowing Stubble Crops
56	#75	Subsoiling
57	#76	Digitalization and Precision Livestock Farming: What are the Benefits for Reducing the Environmental Impact in Dairy Farms
58	#77	How to Reduce the Carbon Footprint in Arable Crop Production?

59	#78	Good Practices for Soil Carbon Retention in Perennial Crops (berry)
60	#79	Modular Anaerobic Digestion Systems for Circular Agriculture
61	#80	Optimisation of Crude Protein Intake in Sheep – a measure ensuring both increased efficiency as well as the reduction of the GHG emission of the milk production
62	#81	Pea-Rapeseed Rotation: Improving Performance and Reducing Production Costs
63	#82	Dairy Cow Feed Rations and Ammonia Emissions
64	#83	Fat Supplementation of Dairy Cow Diets
65	#84	Sustainable Soil Management Strategies to Improve Fertility and Water Efficiency in Agriculture
66	#85	Use of Biochar in German Farms - Benefits for Climate, Soil and Animal Health
67	#87	Reducing the Age of Slaughter to Mitigate GHG Emissions and Increasing Farm Profitability
68	#89	Green Manure: Environmental Measure for Sustainable Fruit Production
69	#96	Adopting Agroforestry by Planting Trees in Open-field Vegetal Farms
70	#97	Implementing Rotational Grazing Within a Low-input Sheep Milk Production System
71	#98	Profitable Climate Actions on Dairy Farms
72	#99	The Benefits of Cover Crops
Topic group: Other Cross Cutting Topics		
73	#1	Reducing Greenhouse Gas and Ammonia Emissions from Cattle Housing
74	#3	Thematic Online Events to Boost Knowledge Exchange on Climate Smart Farming and Advice Across Europe.
75	#4	A Climate Lighthouse Farm Network to Inspire AKIS Actors to Transition to Climate Proof Agricultural Systems
76	#5	1500 Pilot Demo Farms are Engaged to Implement Climate Smart Farming Practices and Share their Experiences in the Climate Farm Demo Network
77	#6	Reduced Environmental Impact through Biogas Production and Subsequent Digestate Treatment
78	#12	Reducing GHG Emissions in Laying Hens Buildings, with Practices Related to Energies Consumptions and Manure Management
79	#13	Identification of Resources, Capabilities, Collaborations, and Innovations in Living Labs for Climate-Smart Farming
80	#16	Agronomic Methods for Producing Productive Arable Crops with Low Carbon Emissions

81	#31	Ten Steps to Organising a Demo Event
82	#32	Involving the Host Farmer in Demo Events
83	#39	Denmark's Carbon Tax – What does it Mean for the Danish Farmers?
84	#42	Digital Repositories and Carbon Tools for Climate Smart Agriculture
85	#43	Storytelling for Impact – A Narrative-Based Communication Approach in Climate Farm Demo
86	#46	Reducing Ammonia Emissions by Optimizing the Feed Rations of Dairy Cows
87	#48	Reinforcing Your Key Message During Demonstration Events with the use of Props
88	#52	Effective Communication for Demo Events - Boosting Reach, Engagement, and Impact
89	#63	Farmers with Power - A 6-Step Approach to Sustainable Energy Management in Climate Farming
90	#64	The Use of LED Lighting in Dairy Housing to Increase Performance and Lower Costs and Carbon Footprint
91	#65	Inventory of Projects, Flagship Initiatives, and Policymakers for the Climate Farm Demo (CFD) Network
92	#69	Manure Cooling, a Practice for Reducing Energy Consumption and GHG Emissions of Pig Buildings with Slurry Systems
93	#70	How to Structure an Effective European Project with a Wide Range of Agricultural Actors in Several Countries
94	#71	The Impact of Slurry Separation on Nutrient Content of the Separated Fractions
95	#72	The Key Role of the National Coordinator in a Project such as CFD: Scope and Limits of His/Her Tasks
96	#73	The Role of Soils for Climate Mitigation and Adaptation
97	#88	Environmental Impact Assessment in Livestock Farming
98	#91	Advisors Supporting Farmers in Climate Action
99	#92	How Can Methane Emissions from Ruminants be Reduced? (Roques et al., 2024)
100	#100	GEEP - An Environmental Assessment Tool for Pig Farming in France

Table 2: List of PAs in order and according to topic groups

4.2 “Pilot Demo Farms”: A Collection of Practice Abstracts

This subchapter presents insights from 12 Practice Abstracts developed within the project, highlighting key findings and innovations from pilot demonstration farms across multiple countries. By covering diverse geographic contexts, this collection provides valuable knowledge for stakeholders looking to implement lessons learned and best practices in their regions.

PRACTICE ABSTRACT #7**SHORT TITLE IN NATIVE LANGUAGE**

Suorakylvöllä ja saneerauskasveilla lisää hiiltä peltoon pilottimaatilalla

SHORT TITLE IN ENGLISH

Direct Seeding and Renovation Plants as Carbon Sequestration Method at a Pilot Demo Farm in Finland

COUNTRY AND CLIMATIC ZONE

Finland Nordic Climate

CONTACT

Henna Latvala (henna.latvala@proagria.fi)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Direct sowing
2. Cover crops
3. Renovation plant

PRODUCTION SYSTEM (IF RELEVANT)

Crop production farm

THEMATIC AREA

Crops Management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Länsi-Suomalaisella erikoiskasvitilla koetaan haasteeksi maan kasvukunnon ylläpitäminen muuttuvissa sääoloissa. Rouhaisen tila on jo kahden vuosikymmenen ajan harjoittanut suorakylvöä useilla viljelykasveilla – myös sokerijuurikkaan viljelyssä. Maan orgaanista ainesta on pyritty lisäämään myös käyttämällä saatavilla olevia orgaanisia lannoitteita, kuten karjanlantaa ja kierrätyslannoitteita. Viimeisimpänä tilalla on otettu käyttöön erilaisia väli- ja aluskasveja, kuten kerääjä- ja saneerauskasveja, joilla paitsi lisätään vihreitä viikkoja, parannetaan maan rakennetta ja biologista aktiivisuutta.

Viljelijä on havainnut suorakylvön suotuisat vaikutukset maan rakenteeseen ja vesitalouteen. Suorakylvö vähentää maan orgaanisen aineksen hajoamista ja siten parantaa maan fysikaalista, kemiallista ja biologista kasvukuntoa. Hyvänä osoituksena tästä on lisääntynyt lierojen määrä viljelijän pelloilla, joita ei ole häiritty muokkauksilla.

Tilalla järjestetyssä demotapahtumassa esiteltiin osallistujille suorakylvön ja saneerauskasvien vaikutusta maan kasvukunnon parantamiseen ja hiilen sidontaan. Osallistajat pääsivät seuraamaan suorakylvönäytöstä tilan muokkausretikkakasvustossa sekä tutkimaan maan kasvukuntoa ja biologista aktiivisuutta kaivamalla kuoppia ja laskemalla lierojen määrää. Jokaisesta lapionpistosta löytyi yli 10 lieroa ja ennätys oli yli 20 lieroa.

Rouhiasien tilalla syvä- ja vahvajuurisilla saneerauskasveilla on pystytty hoitamaan ja ehkäisemään peltomaan tiivistymiä ja lisäämään maahan orgaanista ainesta, mikä parantaa maan rakennetta ja vesitaloutta, biologista aktiivisuutta ja ravinnetaloutta. Lisäksi kerääjäkasveilla voi olla kasvitauteja ja -tuholaisia torjuvia vaikutuksia.

Erityisesti sokerijuurikkalla saneerauskasvit ovat hyvä ratkaisu pellon rakenteen hoitoon ja orgaanisen aineksen määrän lisäämiseen. Jatkossa tila aikoo yhteistyössä tutkijoiden kanssa kokeilla myös muita oheiskasveja ja menetelmiä sokerijuurikkaan viljelyssä.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

A special plant farm in Western Finland faces a climate challenge in maintaining soil health in changing and extreme weather conditions. For two decades, Rouhiainen Farm has practiced direct seeding with several

crops – including sugar beet cultivation. Efforts have also been made to increase soil organic matter by using available organic fertilizers, such as livestock manure and recycled fertilizers. Recently, various intermediate and understory crops, such as catch and renovation crops, have been introduced on the farm, improving soil structure and biological activity.

The farmer has observed the benefits of direct seeding for soil structure and water management. It reduces organic matter decomposition, enhancing the soil's physical, chemical, and biological condition. A key indicator is the increased number of earthworms in the farmer's fields, which have not been disturbed by tilling.

The demo event at the farm showcased the effects of direct seeding and renovation crops on soil fertility and carbon sequestration. Participants observed a no-till demonstration in the farm's tilling radish vegetation and studied soil fertility and biological activity by digging holes and counting earthworms. Each shovel puncture revealed more than 10 earthworms, with a record of over 20.

At the Rouhiainen farm, deep- and strong-rooted renovation plants have been able to manage and prevent compaction of arable land and add organic matter to the soil, which improves soil structure, water management, biological activity and nutrient economy. In addition, catching crops can have effects on controlling plant diseases and pests.

Especially for sugar beet, renovation crops are a good solution for maintaining the structure of the field and increasing the amount of organic matter. In the future, the farm plans to experiment with researchers with other spin-off crops and methods in sugar beet cultivation.

ADDITIONAL INFORMATION

This Finnish Pilot Demo Farm is a modern farm producing special arable crops. The farmer is a pioneer of direct sowing in Finland: over 20 years of experience with field crops and sugar beet. Cultivation area 106 ha, crops: sugar beet, wheat, radish as renovation plants, grasses.

PHOTOS



Photo 1: Rouhiainen Pilot Demo Farm



Photo 2: Rouhiainen Pilot Demo Farm – direct seeding with several crops



Photo 3: Rouhiainen Pilot Demo Farm – soil and earthworms, soli examination

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

CFD Rouhiainen Pilot Demo Farm on the map

URL:

<https://climatefarmdemo.eu/cfd/en/#/farm/226>

PRACTICE ABSTRACT #14**SHORT TITLE IN NATIVE LANGUAGE**

Een gezonde bodem is zorg dragen voor jouw kapitaal!

SHORT TITLE IN ENGLISH

Soil Health as Capital: How Ongoing Experimentation Builds Sustainable and Productive Farming

COUNTRY AND CLIMATIC ZONE

Belgium, temperate maritime climate

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Improved soil health
2. Reduced chemical inputs
3. Visible improvements in crop resilience

PRODUCTION SYSTEM (IF RELEVANT)

Mixed system: Arable land and dairy

THEMATIC AREA

Soil health and biodiversity

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Belangrijkste Bevindingen:

1. **Overgang naar duurzame praktijken:** Stijn De Wulf schakelde over van traditioneel ploegen naar niet-kerende bodembewerking, complexe groenbemesters en slimme teeltcombinaties. Deze overgang was uitdagend, maar heeft positieve effecten in het veld laten zien.
2. **Vermindering van chemische inputs:** Stijn heeft het gebruik van kunstmest en pesticiden aanzienlijk verminderd. Hij teelt nu volledig autonoom zijn eigen veevoeder en ziet organische mest als een waardevolle bron.
3. **Verbeterde bodemgezondheid:** De veranderingen in bodembeheer hebben geleid tot een betere bodemstructuur en vruchtbaarheid, met zichtbare verbeteringen in gewasopbrengsten en veerkracht.

Aanpak:

1. **Complexe groenbemesters:** Deze bestaan uit minstens 7-9 componenten, die de bodembiologie en plantweerbaarheid verbeteren. Ze helpen bodemverdichting te doorbreken, verbeteren de beschikbaarheid van nutriënten en water, en bieden extra voordelen zoals onkruidonderdrukking en koolstofopslag.
2. **Directzaaimachine:** Deze machine combineert strip-till en directzaai, waardoor de bodemverstoring wordt verminderd en de bodemvochtigheid behouden blijft. Het werkt op verschillende grondsoorten en maakt directe inzaai na gewassen zoals tarwe, bieten en maïs mogelijk.
3. **Carbon Farming:** Dit omvat klimaatvriendelijke praktijken die de koolstofvastlegging in bodems verbeteren en de uitstoot van broeikasgassen verminderen. Boeren kunnen compensatie ontvangen via ecoregelingen en de private markt voor het implementeren van deze praktijken.

Conclusie: De aanpak van Stijn De Wulf benadrukt het belang van op maat gemaakte bodembeheerpraktijken. Door continu te experimenteren en aan te passen, heeft hij duurzame landbouw bereikt met verbeterde bodemgezondheid en productiviteit.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

By continuously experimenting and adapting, Stijn De Wulf, one of the Belgium Pilot Demo Farmers was able to manage sustainable farming with improved soil health and productivity.

Main Findings:

1. **Transition to Sustainable Practices:** Stijn De Wulf shifted from traditional plowing to non-inversion tillage, complex cover crops, and smart crop combinations. This transition was challenging but has shown positive effects in the field.
2. **Reduction in Chemical Inputs:** Stijn has significantly reduced the use of synthetic fertilizers and pesticides. He now grows his own animal feed autonomously and uses organic manure as a valuable resource.
3. **Improved Soil Health:** The changes in soil management have led to better soil structure and fertility, with visible improvements in crop yields and resilience.

Innovative Solutions:

1. **Complex Cover Crops:** These consist of at least 7-9 components, enhancing soil biology and plant resilience. They help break soil compaction, improve nutrient and water availability, and provide additional benefits like weed suppression and carbon storage.
2. **Direct Seeding Machine:** Demonstrated by Bert Defruyt, this machine combines strip-till and direct seeding techniques, reducing soil disturbance and preserving soil moisture. It works on various soil types and allows for immediate seeding after crops like wheat, beets, and maize.
3. **Carbon Farming:** This involves adopting climate-friendly practices that enhance carbon sequestration in soils and reduce greenhouse gas emissions. Farmers can receive compensation through eco-schemes and private markets for implementing these practices.

Conclusion: Stijn De Wulf's approach highlights the importance of tailored soil management practices. By continuously experimenting and adapting, he has achieved sustainable farming with improved soil health and productivity.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Stijn De Wulf ontving de deelnemers op zijn gemengd bedrijf in Ledegem, waar hij 75 melkkoeien heeft en 100 ha akkerland bewerkt. Een vijftal jaar geleden vielen een aantal puzzelstukken in elkaar en gooide hij het roer om wat betreft zijn bodembeheer. Hij stopte met ploegen en is zo o.a. met niet kerende grondbewerking, complexe groenbemesters en slimme teeltcombinaties (zoals bijvoorbeeld kruidenrijkgrasland) aan de slag gegaan. Dat ging niet zonder slag of stoot, maar de positieve effecten beginnen zich nu in het veld te tonen. Voor Stijn is dit een extra stimulans om te blijven experimenteren met nieuwe maatregelen en elk jaar kleine zaken aan te passen.

Stijn teelt nu volledig autonoom zijn eigen veevoeder, gebruikt minder fyto en ziet organische mest als troef. Hij moet roeien met de riemen die hij heeft. Zo zette hij 11 jaar geleden een nieuwe melkveestal met mestkelder. Hij beschikt dus over drijfmest, maar zou eigenlijk meer stalmest willen gebruiken. Die situatie kan hij nu niet veranderen, maar wel hoe hij met zijn drijfmest omgaat. Kortom, elk bedrijf en elke situatie is anders en vraagt een individuele aanpak om de bodem centraal te stellen.

De demonstratie op het bedrijf van Stijn was geslaagd. Technieken werden getoond, experts waren aanwezig en de positieve impact van een aantal maatregelen op de bodemgezondheid was zichtbaar.

Meer specifiek werd er door Diederik Van Colen van Natural Grown stilgestaan bij het belang van een goede samenwerking tussen de bodembioïologie en de plant voor een goede productie en voor de plantweerbaarheid tegen ziektes en plagen. Hoe complexer de activiteit bovengronds, hoe groter de rijkdom ondergronds. Complexe groenbemesters bestaan uit minstens 7 à 9 componenten en stimuleren door die diversiteit de werking van de bodembioïologie. De verschillende componenten kennen een andere en vaak sterkere en diepere beworteling, waardoor ze ook bodemverdichting kunnen doorbreken en zo nutriënten- en waterbeschikbaarheid te verhogen. Daarnaast geven ze nog andere voordelen zoals meer drainerend vermogen, onkruidonderdrukking en organische koolstofopslag. Stijn maakt zo gebruik van een aantal complexe mengsels die we ter plaatse konden gaan waarnemen. Vlinderbloemigen zijn een belangrijk onderdeel van de mengsels, want die 'vangen gratis stikstof uit de lucht', waardoor veel minder bemest moet worden.

Loonwerken Defruyt demonstreerde de directzaaimachine van Claydon, welke een vereenvoudigde zaaitechniek biedt waarbij de strip-till-techniek

met directzaai wordt gecombineerd. Een voordeel is dat door de beperkte grondbewerking de bodem minder uitdroogt. Andere voordelen zijn dat het bodemleven niet wordt verstoord en zo de vaste ondergrond zorgt voor een betere toegankelijkheid op het veld in het voorjaar. Er is de mogelijkheid om direct na tarwe, bieten, maïs en zelfs in gras te zaaien. De machine werkt op alle grondsoorten.

Doorheen de demonstraties en presentaties werd duidelijk dat zorg dragen voor je bodem op termijn leidt tot een meer weerbare en vruchtbare bodem. Dat dit soms leertijd en inspanningen vraagt, staat buiten kijf. Daarom kan het helpen om te kijken naar manieren om de eventuele risico's te ondervangen door bijvoorbeeld subsidies en vergoedingen via een private markt. Daar komt carbon farming om de hoek kijken. Een ingewikkelde term die nu veel genoemd wordt, maar die simpelweg inhoudt dat je als landbouwer vergoed wordt voor klimaatvriendelijke praktijken die de vastlegging en opslag van koolstof de bodems verbeterd en de uitstoot van broeikasgassen door de bodem te vermindert. Een aantal ecoregelingen die al beschikbaar zijn kunnen ondersteuning bieden, waaronder de bedrijfsgebonden ecoregeling 'Het verhogen van organische koolstofgehalte'. Daarnaast kan je vandaag ook al beroep doen op de private markt, zoals het lokale compensatieplatform Claire, maar ook de samenwerking tussen Soil Capital en Arvesta. Deze initiatieven gaan koolstofopslag binnen of buiten de agrovoedingsketen verkopen onder de vorm van CO₂-compensatie aan bedrijven die hun eigen uitstoot niet volledig zelf weggewerkt krijgen.

LONGER DESCRIPTION – IN ENGLISH

Stijn De Wulf welcomed the participants to his mixed farm in Ledegem, where he has 75 dairy cows and cultivates 100 hectares of arable land. About five years ago, he changed his approach to soil management. He stopped plowing and started using non-inversion tillage, cover crops, and smart crop combinations (such as herb-rich grassland). This transition was not without challenges, but the positive effects are now beginning to show in the field. For Stijn, this is an extra incentive to continue experimenting with new measures and to make small adjustments every year.

Stijn now grows his own animal feed completely autonomously, uses fewer phytosanitary products, and sees organic manure as an asset. He has to make do with what he has. For example, 11 years ago, he built a new dairy barn with a manure cellar. He thus has slurry but would actually like to use more farmyard manure. He cannot change that situation now, but he can

change how he handles his slurry. In short, every farm and every situation are different and requires an individual approach to focus on the soil.

The demonstration at Stijn's farm was successful. Techniques were shown, experts were present, and the positive impact of several measures on soil health was visible

More specifically, Diederik Van Colen from Natural Grown emphasized the importance of good cooperation between soil biology and plants for good production and plant resistance to diseases and pests. The more complex the activity above ground, the greater the richness below ground. Complex cover crops consist of at least 7 to 9 components and stimulate soil biology through this diversity. The different components have different and often stronger and deeper rooting, which can also break through soil compaction, increasing nutrient and water availability. Additionally, they offer other benefits such as improved drainage capacity, weed suppression, and organic carbon storage. Stijn uses several complex mixtures that we could observe on-site. Legumes are an important part of the mixtures because they 'capture free nitrogen from the air,' reducing the need for fertilization.

Bert Defruyt (Loonwerken Defruyt) demonstrated the Claydon direct seeding machine, which offers a simplified seeding technique combining strip-till with direct seeding. One advantage is that limited soil tillage reduces soil drying. Other benefits include not disturbing soil life and ensuring a firm subsoil for better field accessibility in spring. It is possible to sow directly after wheat, beets, maize, and even in grass. The machine works on all soil types.

Throughout the demonstrations and presentations, it became clear that taking care of your soil leads to a more resilient and fertile soil in the long term. This sometimes requires learning and effort, without a doubt. Therefore, it can help to look for ways to mitigate potential risks, such as subsidies and compensations through a private market. This is where carbon farming comes into play. A complicated term often mentioned now, but it simply means that as a farmer, you are compensated for climate-friendly practices that improve carbon sequestration and storage in soil and reduce greenhouse gas emissions from the soil. Today, several eco-schemes are available to provide support, including the farm-based eco-scheme 'Increasing organic carbon content.' Additionally, you can turn to the private market, such as the local compensation platform Claire, and the collaboration between Soil Capital and Arvesta. These initiatives sell your carbon storage within or outside the agri-food chain in the form of CO₂ compensation to companies that cannot fully offset their own emissions.

PHOTOS



Photo 1: Farm Demo Event in Stijn De Wulf farm in Belgium



Photo 2 Farm Demo Event in Stijn De Wulf farm in Belgium



Photo 3: Farm Demo Event in Stijn De Wulf farm in Belgium

PRACTICE ABSTRACT #15**SHORT TITLE IN NATIVE LANGUAGE**

Familiebedrijf in transitie: klimaatslimme praktijken op een melkveebedrijf in Geraardsbergen (België)

SHORT TITLE IN ENGLISH

Family Farm in Transition: Climate-Smart Practices on a Dairy Farm in Geraardsbergen (Belgium)

COUNTRY AND CLIMATIC ZONE

Belgium, temperate maritime climate

CONTACT

Audrey Miserez (Audrey.Miserez@ilvo.vlaanderen.be)

3 BENEFITS OF THE PRACTICE

1. Adoption of climate-smart practices through peer learning
2. Improved soil health, biodiversity, and feed quality
3. Increased resilience and sustainability of mixed farming systems

PRODUCTION SYSTEM

Mixed system: Arable land and dairy cattle

THEMATIC AREA

Forage production

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Twee jaar geleden namen Veerle en Colin het melkveebedrijf van Veerle's ouders over, en transformeerden het van een klassiek melkveebedrijf, gericht op de productie van matten voor Geraardsbergse mattentaarten, naar een duurzamer bedrijf. Ze hebben nu 12 English Longhorns voor vlees en 70 melkkoeien, samen met 35 ha akkerland en 30 ha grasland.

Veerle, met haar achtergrond als milieujuriste, verwelkomde het voorstel voor een klimaatscan. De eerste resultaten van de Klimrek-tool benadrukten nuttige maatregelen, waarvan sommige onmiddellijk werden geïmplementeerd, terwijl andere voor de toekomst zijn gepland.

Hun klimaatmaatregelen omvatten:

- **Hagen en Bomen:** Met steun van Bos+ en Regionaal Landschap Vlaamse Ardennen richten ze zich op hagen, bomen en bloemenranden voor koolstofopslag en biodiversiteit.
- **Grasklaver-Luzerne:** Ze verminderden voedermaïs van 22 ha naar 10 ha, en vervingen het door een grasklaver-luzerne mengsel, dat minder bemesting vereist.
- **Triticale – Veldbonen:** Ze plantten 6 ha triticale-veldbonen om soja in het voer te vervangen, met begeleiding van collega's en projectadviseurs.
- **Bodemgezondheid en Waterhuishouding:** De overstap naar grasklaver-luzerne en méteil heeft de bodemstructuur en waterhuishouding verbeterd, hoewel het uitdagend blijft.
- **Boerderijcompostering:** Ze zien mogelijkheden in het gebruik van houtige snippers en mest voor compostering, en hopen op snelle goedkeuring van regelgeving.
- **Zonnepanelen en Warmteterugwinning:** Deze worden overwogen voor toekomstige implementatie.

Hun bedrijf maakt deel uit van het Climate Farm Demo-netwerk, dat proefboerderijen verbindt om klimaatslimme praktijken te demonstreren en kennis te delen. Lokale boeren bieden onschatbare steun, vooral Waalse collega's die verder zijn in biologische landbouw en agro-ecologie.

Veerle en Colin geloven in boeren met de natuur, terwijl ze de economische levensvatbaarheid behouden, en benadrukken de noodzaak van meer waardering en zichtbaarheid voor de inspanningen van boeren.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Two years ago, Veerle and Colin took over Veerle's parents' dairy farm, transforming it from a classic dairy farm focused on producing mats for *Geraardsbergen mattentaarten* to a more sustainable operation. They now have 12 English Longhorns for meat and 70 dairy cows, along with 35 ha of arable land and 30 ha of grassland.

Veerle, with her background as an environmental lawyer, welcomed the climate scan proposal. The initial results from the *Klimrek tool* highlighted useful measures, some of which were implemented immediately, while others are planned.

Their climate measures include:

- **Hedges and Trees:** Supported by Bos+ and Regional Landscape Flemish Ardennes, they focus on hedges, trees, and flower borders for carbon storage and biodiversity.
- **Grass Clover-Lucerne:** They reduced fodder maize from 22 ha to 10 ha, replacing it with a grass clover-lucerne mix, requiring less fertilization.
- **Triticale – Field Beans:** They planted 6 ha of triticale-field beans to replace soy in feed, with guidance from colleagues and project advisors.
- **Soil Health and Water Management:** Switching to grass clover-lucerne and méteil has improved soil structure and water management, though it remains challenging.
- **Farm Composting:** They see potential in using wood chips and manure for composting, hoping for regulatory approval soon.
- **Solar Panels and Heat Recovery:** These are considered for future implementation.

Their farm is part of the Climate Farm Demo network, which connects pilot farms to demonstrate climate-smart practices and share knowledge. Local farmers provide invaluable support, especially Walloon colleagues who are more advanced in organic farming and agro-ecology.

Veerle and Colin believe in farming with nature while maintaining economic viability, emphasizing the need for greater appreciation and visibility of farmers' efforts.

LONGER DESCRIPTION - IN NATIVE LANGUAGE

Twee jaar geleden namen Veerle en Colin het melkveebedrijf van de ouders van Veerle over. Het bedrijf was toen nog een klassiek melkveebedrijf, met focus op de productie van matten voor de Geraardsbergse mattentaarten.

Omdat hun zonen het familiebedrijf absoluut willen verderzetten, hebben ook zij hun schouders gezet onder het bedrijf.

Ze beschikken over 12 English Longhorns die puur op gras en voor het vlees gekweekt worden, en 70 melkkoeien. Daarnaast hebben ze nog akkerland (35 ha) en grasland (30 ha).

Wat vonden ze van de klimaatscan?

Met haar achtergrond als milieujuriste is Veerle zich bewust van de huidige uitdagingen op vlak van klimaat. Ze ging dus ook graag in op het voorstel om een klimaatscan te laten opmaken.

De eerste resultaten van de klimaatscan (Klimrek-tool) waren niet heel bijzonder. De cijfers maakten wel een aantal zaken duidelijk en onderlijnden welke maatregelen zinvol kunnen zijn. Een aantal maatregelen werden meteen aangepakt, andere staan ingepland voor de toekomst. Ze kiezen uit het plan wat ze zelf haalbaar zien.

Welke klimaatmaatregelen nemen ze op hun bedrijf?

- **Hagen, heggen en bomen:** Met steun en hulp van een boslandbouwproject van Bos+ en Regionaal Landschap Vlaamse Ardennen zetten ze in op hagen, heggen, (fruit)bomen en bloemenranden. Deze zorgen voor koolstofopslag en dragen bij aan een biodivers en klimaatrobuust landschap. Ze nemen ook deel aan het leader-project "Van stronk tot snipper" voor ondersteuning bij het onderhoud. Deze hulp is zeer welkom.
- **Grasklaver-luzerne:** Ze zijn van 22 ha naar 10 ha voerdermaïs gegaan, door deze te vervangen met een grasklaver – luzerne mengsel. Een aandachtspunt is wel dat deze minder bemest mogen worden zodat de klaver terugkomt. Dat is even aanpassen, zowel voor hen als voor de loonwerkers. Daarnaast hebben ze een aantal Waalse bioboeren bezocht om ervaring op te doen bij het hooien van zo'n weides. Zo leren ze veel bij. Balen van eind vorig jaar (november 2024) hebben erg goede analyses op vlak van verteerbaarheid. Sommige weides werden al dertig jaar lang niet vernieuwd. Hier zetten ze nu ook volop in, door bijvoorbeeld weides te scheuren, in te zaaien met maïs en zo te vernieuwen. Dat is niet voor alle weides haalbaar.
- **Triticale – veldbonen:** Ze hebben 6 ha ingezaaid met triticale - veldbonen, met als doel een deel van de soja te vervangen in de voeder. Ze hebben wel wat schrik voor de teelt en opbrengst van de veldbonen. Weinig landbouwers doen dit. Ze vonden wel nog een

collega die hier reeds mee aan de slag gaat en hen daarin begeleidt. Bovendien krijgen ze hierin ook advies van de projectadviseurs.

- **Bodemgezondheid en waterhuishouding:** de overstap naar grasklaver-luzerne en bijkomend ook méteil, een mengteelt van granen en vlinderbloemigen, hebben een zichtbaar positief effect op de bodemstructuur en waterhuishouding. Ook hier is het wel een zoektocht. In het eerste jaar is het zeer goed gelukt om méteil na de maïs in te zaaien en te maaien. Vorig jaar (tweede jaar) helaas niet. Door de natte omstandigheden hebben ze veel te laat kunnen maaien waardoor het gewas veel te taai was. Het was echter ook een moeilijker jaar voor andere teelten.
- **Boerderijcompostering:** Hier zouden ze in de nabije toekomst graag op inzetten. Met hun houtige snippers, stalmest, ... zien ze zeker mogelijkheden. Hun eigen mest gebruiken is tot op vandaag een uitdaging, bij hun Waalse buren lijkt dat gemakkelijker te verlopen. Ook het kader rond boerderijcompostering is nog niet goedgekeurd. Ze hopen dat hier binnenkort verandering in komt.
- **Zonnepanelen en heat recovery:** Deze overwegen ze in de toekomst te implementeren.

Welke boodschap willen ze meegeven aan hun collega's?

Hun bedrijf maakt deel uit van het Climate Farm Demo-netwerk, een Europees initiatief dat proefboerderijen samenbrengt om klimaatslimme landbouwpraktijken te demonstreren en kennis te delen. Dit netwerk biedt hen de mogelijkheid om samen te werken met andere boeren, onderzoekers en beleidsmakers, waardoor ze innovatieve oplossingen sneller kunnen implementeren.

Collega-landbouwers uit de buurt zijn van onschatbare waarde. Ze helpen hen om enkele stappen te durven zetten en angst te overwinnen. Waalse collega's – ze wonen vlakbij de grens – staan naar hun aanvoelen al wat verder op vlak van biologische landbouw en agro-ecologie en zijn voor hen een echte steun voor praktijkgerichte tips: waar ze het zaad moeten halen, aan welke dichtheid ze best zaaien, enzovoort. Boeren blijft een ambacht, een kunst; je hebt de ervaring echt nodig en hun ervaringen halen hen over de streep om acties te ondernemen.

Ze zijn ervan overtuigd dat ze met de natuur kunnen boeren, zonder daarbij het economisch aspect uit het oog te verliezen. Het vergt wel bijzondere inspanningen. Onze landbouwers mogen hier gerust meer voor gewaardeerd worden, hun werk mag meer 'zichtbaar' worden.

LONGER DESCRIPTION – IN ENGLISH

Two years ago, Veerle and Colin took over Veerle's parents' dairy farm. At the time, it was still a traditional dairy operation, primarily focused on producing milk for *Geraardsbergen mattentaarten*. Since their sons are eager to continue the family business, they have also committed to supporting the farm's development.

The farm currently includes 12 English Longhorns—purely grass-fed and bred for meat—and 70 dairy cows. Additionally, they manage 35 hectares of arable land and 30 hectares of grassland.

What did they think of the climate scan?

With her background as an environmental lawyer, Veerle is well aware of current climate challenges. She gladly accepted the proposal to carry out a climate scan. The initial results, using the Klimrek tool, were not extraordinary but clarified several key areas and highlighted useful climate measures. Some actions were implemented immediately; others are planned. They select measures from the plan they consider feasible.

What climate measures are they taking on their farm?

- **Hedges and trees:** With support from the forestry project by Bos+ and Regional Landscape Flemish Ardennes, they are planting hedges, fruit trees, and flower borders. These contribute to carbon storage and support a biodiverse, climate-resilient landscape. They also participate in the LEADER project “From Stump to Chip” for maintenance assistance.
- **Grass-clover-lucerne mix:** They reduced their fodder maize area from 22 to 10 hectares by replacing it with a grass-clover-lucerne mixture. These fields require less fertilisation to allow clover to return—a shift that also involves adapting contractor practices. Visits to Walloon organic farms helped them learn about mowing and haying techniques. For instance, bales from November 2024 tested well for digestibility. Some meadows haven't been renewed for 30 years; they are now actively restoring them where feasible.
- **Triticale-field beans:** They sowed 6 hectares with this mixture to reduce reliance on soy in feed. Although field beans are not widely grown, they found a fellow farmer and advisors to support them.
- **Soil health and water management:** The transition to grass-clover-lucerne and méteil (a mixed crop of grains and legumes) has improved soil structure and water retention. Results have varied due

to the weather: in year one, they had success after maize; in year two, wet conditions delayed mowing, reducing quality.

- **Farm composting:** They aim to develop on-farm composting using wood chips and manure. However, current regulations are a barrier, especially compared to their Walloon neighbours.
- **Solar panels and heat recovery:** These are under consideration for future implementation.

A message to fellow farmers:

Their farm is part of the Climate Farm Demo network, a European initiative that brings together pilot farms to showcase climate-smart practices and share knowledge. This network fosters collaboration with farmers, researchers, and policymakers, enabling quicker adoption of innovative solutions.

Support from local and Walloon farmers has been crucial. Their experience and practical tips—like seed sourcing and sowing density—have inspired confidence. Farming remains a craft, and learning from peers is vital. Veerle and Colin believe in working with nature while staying economically viable. It takes effort, and farmers deserve more recognition and visibility for this important work.

PHOTOS



Photo 1: Farmer Veerle at a dairy Pilot Demo Farm in Geraardsbergen, Oost-Vlaanderen, België



Photo 2: A dairy Pilot Demo Farm in Geraardsbergen, Oost-Vlaanderen, België

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Portrait published in newsletter of the Expertise Centre for Agriculture and Climate (ELK – ILVO).

URL:

<https://elk.ilvo.vlaanderen.be/nl/nieuws/portret-van-een-klimaatboer-veerle-colin>

PRACTICE ABSTRACT #22**SHORT TITLE IN NATIVE LANGUAGE**

Aider les futurs viticulteurs bordelais français à inventer l'agriculture de demain, plus résiliente et capable de survivre à des aléas climatiques de plus en plus fréquents et violents.

SHORT TITLE IN ENGLISH

Helping Future French “Bordeaux” Winegrowers to Invent the Agriculture of Tomorrow, More Resilient and Capable of Surviving Increasingly Frequent and Violent Climatic Hazards

COUNTRY AND CLIMATIC ZONE

France – Atlantic area

CONTACT

- Léna Plusquellec, viticulture advisor and specialist in the environment, carbon and HVE topics, at the Organic and Agricultural Transition Unit of the Gironde Chamber of Agriculture
- Emilie Reynier, Deputy Director of the Agro Campus Bordeaux Gironde, in charge of farms and agricultural development
- Christine Berger (christine.berger@idele.fr)

3 BENEFITS OF THE PRACTICE

1. Education
2. Multi-actor capacity building
3. Adaptation to climate change

PRODUCTION SYSTEM

Wine production, viticulture

THEMATIC AREA

Crops management, Water management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Château Dillon, 40 ha en AOC Haut Médoc - Crus Bourgeois Supérieur, situé au nord de Bordeaux, est l'une des 3 fermes viticoles de l'Agro Campus Bordeaux Gironde. C'est également l'une des fermes pilotes du projet Climate Farm Demo.

Le lycée agricole est convaincu que la montée en compétences et la formation doivent de plus en plus être basés sur les échanges entre pairs et être conçus sur la base d'un « travail en commun ». Sa devise est : « intelligence collective, transfert et partage des connaissances », afin de guider les étudiants sur une voie radicalement nouvelle. Il s'efforce de maintenir l'accès aux connaissances opérationnelles pour les acteurs de terrain et s'appuie sur la force de l'approche collective et multipartite. Il est également fortement engagé dans le transfert de connaissances par le biais de nombreux événements sur le terrain. Cela correspond tout à fait à l'objectif principal de Climate Farm Demo !

Il participe également au développement d'outils pédagogiques innovants, tels que des simulateurs (pour la taille, la gestion des parcelles, le réglage des pulvérisateurs, etc.), afin que la formation ne soit pas dépendante du cycle de la plante et des saisons. Une autre de leurs grandes missions est d'être un site vitrine et un site d'expérimentation et d'innovation pour la filière. Ainsi, en 2024, ils ont créé un vignoble expérimental de 5 hectares pour évaluer des pratiques innovantes, compatibles avec les attentes de la société et économiquement viables. L'objectif premier est de créer une banque de biodiversité génétique des cépages. Le deuxième objectif est de tester des scénarios de rupture. La liste des techniques innovantes est longue : taille, densité de plantation, ombrage, conservation des sols, robotisation, etc. Et à l'avenir, d'autres paramètres seront testés, comme la sobriété énergétique et technique, la diversification des productions, l'agroforesterie, la réduction de l'utilisation des produits phytosanitaires, etc.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Château Dillon, 40 ha in « AOC Haut Médoc – Crus Bourgeois Supérieur », is located North of Bordeaux and is one of the three Agro Campus Bordeaux Gironde wine farms. It is also one of the 'Pilot Demo Farms' in the Climate Farm Demo project.

They strongly believe that knowledge exchange, capacity building and training should increasingly be based on peer-to-peer sharing and designed based on 'working together'. The school's motto — "collective intelligence, knowledge transfer and sharing" — guides students along a radically new path. They are working hard to maintain access to operational knowledge for those working in the field. And they rely on the strength of the collective and multi-stakeholder approach. They are strongly committed to transferring knowledge through numerous events in the field — very much aligned with Climate Farm Demo main objective!

Château Dillon is also involved in developing innovative teaching tools, such as simulators (for pruning, plot management, sprayer adjustment, etc.), ensuring that training is not dependent on the plant cycle and the seasons. Another of their major missions is to serve as a showcase site and a site for experimentation and innovation in the sector.

Therefore, in 2024, they created a 5-hectare experimental vineyard for assessing innovative practices that are both compatible with society's expectations and economically viable. The primary aim is to create a reservoir of genetic diversity. This vineyard houses vine conservatories designed to safeguard the genetic diversity of grape varieties in the Nouvelle-Aquitaine region. The second objective is to test breakthrough scenarios. There is a long list of innovative techniques, including pruning, planting density, shading, soil conservation, robotisation, etc. And in the future, other parameters will be tested, such as energy and technical sobriety, diversification of production, agroforestry, reduction in the use of phytosanitary products, etc.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Nous présentons ici le témoignage d'Emilie REYNIER, Directrice adjointe de l'Agro Campus Bordeaux Gironde, en charge des exploitations et du développement agricole qui nous reçoit dans l'une des trois exploitations viticoles de l'Agro Campus : le Château Dillon et de Léna PLUSQUELLEC, conseillère viticulture et spécialiste environnement, Carbone et HVE, au Pôle bio et transition agricole, à la Chambre d'Agriculture de la Gironde.

Le changement climatique se fait sentir de multiples manières en Gironde

Le changement climatique ne fait pas de doute ! Après plusieurs mois exceptionnellement humides et plutôt frais pendant l'automne hiver 2023- et même tout le printemps 2024, la chaleur s'est abattue d'un coup sur le bordelais en début d'été, obligeant les viticulteurs à agir vite pour s'adapter ! Ces événements météo beaucoup plus contrastés et extrêmes (comme l'intense grêle qui a ravagé les vignobles en 2022, ou des gels tardifs de 2023, ou des canicules intenses ces dernières années et les immenses feux de forêt de l'été 2022) par rapport aux références climatiques antérieures sont très évidents depuis 5 à 6 ans, perturbant très fortement les pratiques culturales de la vigne (pression fongique, pertes de rendement, dépérissement de ceps, etc.) et appelant, dans l'urgence, des solutions d'adaptation novatrices pour faire face et tenter d'endiguer les cessations d'activité viticole constatées depuis 2 ou 3 ans.

S'appuyer sur la génération montante pour redynamiser la Filière face aux profondes perturbations liées au changement climatique

Le maître mot d'Emilie est « intelligence collective, transfert et partage des connaissances ». Cette ancienne enseignante en Bac Techno et BTS, maintenant en charge des exploitations de l'Agro Campus Bordeaux Gironde, porte haut et fort l'importance de la formation des nouvelles générations et prône l'accompagnement des jeunes dans un chemin radicalement nouveau :

« Il faut renouveler les références car climat et météo sont fondamentalement en train de changer et nos repères ne peuvent plus s'appliquer ! Les jeunes générations sont très sensibilisées au changement climatique, mais il faut arriver à rompre avec les a priori et les amener à s'ouvrir à des pratiques inspirées d'autres zones géographiques, tant en France qu'ailleurs en Europe. »

Un engagement fort pour développer l'accès aux connaissances opérationnelles indispensables sur le terrain

La filière vit un de ses temps de crise majeur et il apparaît ces dernières années un effondrement des inscriptions en formation, mais aussi en Bac Techno... Le déploiement massif des pratiques agroécologiques nécessite donc un renouvellement des solutions déployées pour toucher massivement les viticulteurs et Climate Farm Demo se positionne en bonne place dans ce processus.

Le transfert de connaissance, l'apprentissage et la formation – tant au niveau initial pour les futurs viticulteurs, que continue pour les viticulteurs en

activité – ont de plus en plus besoin de s'appuyer sur le partage entre pairs et doivent être conçus sur le « faire ensemble » en proposant des solutions de formation intégrées avec la filière (l'institut technique de la filière : l'IFV, la Chambre d'Agriculture, l'INRAE, etc.). La demande du terrain est par exemple forte pour une formation : « adaptation au changement climatique à travers les pratiques culturales (travail du sol, taille, etc.) ».

“Par exemple, nous aménageons des temps dédiés, en pluridisciplinarité, qui leur permettent aux élèves de se déplacer et d'aller à la rencontre d'experts et de praticiens, mais aussi de s'ouvrir à des échanges européens via le dispositif « Erasmus+ ». Il y a par exemple le programme « Demain, j'irai vinifier chez toi », en partenariat avec quatre autres pays viticoles européens, terminé il y a quelques semaines seulement, centré sur les pratiques d'adaptation au changement climatique en viticulture. Il est primordial d'avoir des sites de démonstration qui dépassent l'échelle locale. Celui-ci se rapproche fortement dans ses principes de la démarche de Climate Farm Demo, qui permet de faire le lien et de « prolonger » ce travail en continuité. Il faut travailler sur des actes et objectiver les conseils », nous explique Emilie.

Miser sur la force du collectif et des approches multi-acteurs

Château Dillon s'implique fortement dans le campus viticole régional, créé depuis novembre 2023 à l'échelle de la Région Nouvelle Aquitaine, le « campus régional des métiers de la vigne et du vin », afin de rassembler toutes les forces, tous les organismes de formation publiques ou privés au niveau de l'enseignement technique et supérieur, afin de proposer une offre de formation plus lisible et plus visible, intégrative, partagée et proposant les nouvelles compétences indispensables notamment en lien avec le changement climatique.

Château Dillon a à cœur de développer les synergies entre projets locaux, régionaux, nationaux et européens ! Emilie insiste sur l'importance de s'ouvrir à des partenariats variés et de bénéficier de l'effet décuplant de ces collaborations. Mettre en réseau permet de partager des données et de mutualiser, ce qui est un point essentiel pour arriver à faire changer les pratiques.

LONGER DESCRIPTION – IN ENGLISH

We present here the testimonial of Emilie REYNIER, Deputy Director of the Agro Campus Bordeaux Gironde, in charge of farms and agricultural development, and Léna PLUSQUELLEC, viticulture advisor and specialist in the environment, carbon and HVE topics, at the Organic and Agricultural Transition Unit of the Gironde Chamber of Agriculture.

Climate change is at work in many ways

Here, in the Bordeaux winegrowing region, there's no doubt about climate change! As an example, at the beginning of the summer of 2024, after several exceptionally wet and cool months, the heat has suddenly hit the Bordeaux region, requiring farmers to make sudden and very swift changes to their cropping practices! Léna and Emilie note that these weather events, which are much more contrasted and extreme (such as the intense hail which ravaged the vineyards in 2022, or the late frosts in 2023, or the intense heatwaves of recent years and the huge forest fires in the summer of 2022) compared with previous climatic references, have been very evident for the last 5 to 6 years, causing major disruption to vine-growing practices (fungal pressure, yield losses, vine dieback; but also an increase in alcohol content during the wine-making process, etc.) and calling for a more urgent response. This has led to a pressing need for innovative solutions to deal with the situation, and to try and contain the cessation of winegrowing activity that has been observed over the last 2 or 3 years.

Relying on the younger generation to save the sector from the profound disruptions caused by climate change

Emilie's motto is 'collective intelligence, knowledge transfer and sharing'. This former teacher of "Bac Techno" and "BTS", who is now in charge of the farms at the Agro Campus Bordeaux Gironde, is a strong advocate of the importance of training the next generation, and of guiding young people along a radically new path:

« We need to update our references, because the climate and weather are changing fundamentally, and our benchmarks can no longer be applied! Younger generations are very aware of climate change, but we need to break down stereotypes and get them to open to practices inspired by other geographical areas, both in France and elsewhere in Europe.» says Emilie.

Working hard to maintain access to operational knowledge for those working on the field.

The sector is going through one of its major crises, and in recent years there has been a collapse in enrolments for training courses, as well as for technical high school... The mass deployment of agro-ecological practices therefore requires a renewal of the solutions deployed to reach winegrowers on a massive scale, and Climate Farm Demo is well placed in this process.

Knowledge exchange, capacity building, apprenticeship and training [both initial for future winegrowers and ongoing for established winegrowers] increasingly need to be based on peer-to-peer sharing and need to be designed on the basis of 'working together' by offering training solutions

that are integrated with the industry (the French sector's technical institute: the IFV (L'institut Français de la vigne et du Vin), the Chamber of Agriculture, INRAE, etc.). For example, there is a strong demand from the field for training in 'adapting to climate change through farming practices (tillage, pruning, etc.)'.

“As an example, we provide our students with dedicated, multi-disciplinary time to travel and meet experts and practitioners, as well as opening them up to European mobility via the ‘Erasmus+’ scheme. For example the programme : « Demain, j’irai vinifier chez toi » (‘Tomorrow, I’ll go and make wine with you’), in partnership with four other European wine-producing countries, and completed in 2024, focused on practices for adapting to climate change in viticulture. It is crucial to have demonstration sites that go beyond the local scale. The principles of this project are very similar to those of the Climate Farm Demo approach, which will enable us to make the link and ‘extend’ this work. We need to work on actions and objectify advice ». Says Emilie.

Relying on the strength of the collective and multi-stakeholder approach

Château Dillon is becoming more and more involved in the regional winegrowing campus, created in November 2023 at the “Nouvelle Aquitaine” Region territorial level, the « campus régional des métiers de la vigne et du vin » (“regional campus for vine and wine professions”), in order to bring together all the efforts, all the public or private training bodies at technical and higher education level, to offer a more visible, integrative and shared training offer providing the new skills that are essential, particularly in relation to climate change.

Château Dillon is committed to developing synergies between local, regional, national and European projects! Emilie insists on the importance of opening up to a diversity of partnerships and benefiting from the multiplier effect of these collaborations. Networking is a way of sharing data and pooling resources, which is essential if we are to succeed in changing practices.

ADDITIONAL INFORMATION

Increasing peer-to-peer exchanges at showcase events

The Agro Campus is strongly committed to organising numerous trial visits to highlight the results to sector professionals. In fact, one of their major missions is to be a showcase site for the sector.

Château Dillon estate is testing “disruptive” practices. In partnership with the Blanquefort branch of the IFV and the Chamber of Agriculture 33, it has set up an experimental vineyard, with a test plot of resistant grape varieties adapted to climate change (with the idea of testing a number of innovative levers, such as introducing innovative management methods, testing vineyard shading, etc.).

But the farm also implements ‘sheep in the vineyards’ practice, with a flock of around a hundred ewes that are herded by a shepherd in the off-season and come to tend the vineyard plots throughout the winter (from October to May).

PHOTOS



Photo 1: Château Dillon, 40 ha in « AOC Haut Médoc – Crus Bourgeois Supérieur », located North of Bordeaux and is one of the three Agro Campus Bordeaux Gironde wine farms and Pilot Demo Farm

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Vinipôle

URL:

<https://www.vinopole.com/> et : <https://www.vinopole.com/fiches-pratiques/>

Title/Description

Campus régional des métiers de la vigne et du vin

URL:

<https://entreprises.nouvelle-aquitaine.fr/actualites/le-campus-regional-de-la-vigne-et-du-vin>

Title/Description

« Demain, j'irai vinifier chez toi »

URL:

<https://portailcoop.educagri.fr/jirai-vinifier-chez-toi/>

Title/Description

Erasmus Lycée Blanquefort

URL:

<https://www.lyceeblanquefort.formagri33.com/erasmus-2/>

Title/Description

Institut Français de la vigne et du Vin (IFV)

URL:

<https://www.vignevin.com/>

Title/Description

Sustainable Farming in France: Château Dillon's Response to Climate Change

URL:

<https://climatefarmdemo.eu/sustainable-farming-in-france/>

Title/Description

Information about the Farm

URL:

<https://climatefarmdemo.eu/cfd/en/#/farm/405>

PRACTICE ABSTRACT #23**SHORT TITLE IN NATIVE LANGUAGE**

Le parcours bas carbone des Pays de la Loire : analyser l'empreinte carbone et le coût de production simultanément.

SHORT TITLE IN ENGLISH

The Pays de la Loire “Low-Carbon Pathway”: Studying the Carbon Footprint and the Production’s Costs Simultaneously

COUNTRY AND CLIMATIC ZONE

France – Atlantic area

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Competitiveness
2. Carbon sequestration
3. Global approach

PRODUCTION SYSTEM

Beef cattle production

THEMATIC AREA

Herd management, grassland management, energy management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Lors de la DEMO organisée fin 2024 chez Florent, l'un des « Pilot Demo Farmer », engagé dans Climate Farm Demo et accompagné par la Chambre d'Agriculture, nous avons pu mesurer l'intérêt de coupler environnement (CAP2ER®) et économie (COUPROD®). Cet éleveur sélectionneur de vaches Limousines est un animalier dans l'âme, ce qui ne l'empêche pas de porter une attention fine et attentive à ses performances environnementales et économiques ! Le CAP'2ER® a permis à Florent de réduire son chargement, en augmentant les surfaces à pâturer de prairies permanentes et a réduit de 25% ses apports en azote minéral en 5 ans. Son objectif est de développer l'autonomie protéique par un mode de récolte humide, de continuer la culture de légumineuses (trèfle) et de dérobées (seigle fourrager) ; enfin d'augmenter la durée de pâturage. Grâce au pilotage génétique du troupeau, Florent est réactif pour trier ses animaux et ajuster le planning d'accouplement. Le COUPROD® lui a permis d'améliorer la productivité des unités de gros bétail (UGB). Son objectif est d'arriver à un âge au 1er vêlage de 30 mois, de réduire le nombre d'UGB par vêlage à moins de 1,6 et de maintenir l'Intervalle Vêlage-Vêlage à 365-370 jours. Enfin, Florent a investi dans la décarbonation de l'énergie sur son exploitation. Il a équipé la toiture d'un bâtiment de stockage de panneaux photovoltaïques lui permettant d'atteindre l'autonomie en électricité sur l'exploitation et l'habitation (économies de 1 000 €/an sur la facture d'électricité) et réalisant des ventes de 145 000 kWh sous contrat/an. Cela correspond à 933 tonnes d'émissions de CO2 évitées sur 25 ans.

Cette démarche combinée (CAP'2ER® + COUPROD®) lui a permis d'atteindre plusieurs objectifs importants : 1/ une empreinte carbone meilleure que la moyenne des élevages comparables ; 2/ une amélioration de la productivité des UGB (+34kg/UGB en 4 ans) ; 3/ la mise en place d'un système pâturant plus extensif et herbager ; 4/ une autonomie électrique avec les panneaux photovoltaïques.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

During the DEMO organised in 2024 at Florent's, one of the 'Pilot Demo Farmers' involved in the Climate Farm Demo project and supported by the Chamber of Agriculture, we experienced the benefits of combining the environment (CAP2ER®) and the economy (COUPROD®). This breeder of Limousin cows is an 'animal farmer' at heart, but that doesn't prevent him from paying close attention to his environmental and economic performance! The CAP'2ER® audit enabled Florent to rationalise his crop

rotation and refine his mechanisation strategy. As a result, he has reduced his stocking rate by increasing the amount of permanent grassland and has reduced his mineral nitrogen inputs by 25% in 5 years. His aim is to develop his protein autonomy through wet harvesting, to continue growing legumes (clover) and cover crops (fodder rye), and to increase the grazing period. Thanks to the genetic management of the herd, Florent can sort his animals quickly and adjust the mating schedule. COUPROD® has enabled him to improve the productivity of his livestock units. He aims at reaching an age at 1st calving of 30 months, to reduce the number of livestock units (LU) per calving to less than 1.6 and to maintain the Calving-Calving Interval at 365-370 days. Finally, Florent has invested in decarbonising energy on his farm, by equipping the roof of a storage building with photovoltaic panels, enabling him to be self-sufficient in electricity for the farm and the home (saving €1,000 a year on the electricity bill) and selling 145,000 kWh under contract per year (933 tonnes of CO2 emissions avoided over 25 years).

This combined approach (CAP'2ER® + COUPROD®) has enabled Florent to achieve a number of important objectives: 1/ a carbon footprint that is better than the average for comparable farms; 2/ an improvement in the productivity of livestock (+34kg/livestock unit in 4 years); 3/ the introduction of a more extensive grazing and grassland system; 4/ self-sufficiency in electricity thanks to the photovoltaic panels.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Initié en 2020 par la Région Pays de la Loire, le « parcours bas carbone » permet aux éleveurs de bovins de faire le point et d'améliorer leurs performances environnementales et économiques en parallèle. En couplant la réalisation d'un diagnostic CAP2ER® et d'un bilan COUPROD®, les éleveurs ont ainsi une vue globale très précise de leurs marges de manœuvre ! Le projet Climate Farm Demo permet de créer de belles synergies au plan local en mettant l'accent sur les démonstrations en fermes et en boostant la diffusion de ces bonnes pratiques environnementales ET économiques à un plus grand nombre.

Au-delà du cas concret de Florent, notre Pilot Demo Farmer, les retours des éleveurs sont très positifs !

« Grâce au diagnostic environnemental CAP'2ER® j'ai pu mieux réaliser que nous, éleveurs, ne sommes pas aussi destructeurs de l'environnement que l'on voudrait nous faire croire ! Au contraire, mes pratiques, en tant que naisseur-engraisseur en système herbagé, permettent de stocker du carbone grâce à mes prairies et à mon linéaire de haies, et d'entretenir la

biodiversité tout en nourrissant la population ! De plus, sur des sols à faibles potentiels, les vaches permettent de préserver les prairies. En faisant le diagnostic économique COUPROD® en parallèle, j'ai mieux pu comprendre les coûts de production et les prix de revient de mes kg de viande. Avant, je produisais sans le connaître et c'est bien dommage car il permet de comprendre ce qui va et ce qui ne va pas et pouvoir s'améliorer. Par exemple, j'ai pu constater que j'avais beaucoup d'animaux improductifs, ce qui diminuait mon efficacité technico-économique. Maintenant j'essaie d'améliorer cela en faisant partir rapidement les vaches vides ou celles à problèmes. J'essaye aussi de sevrer mes mâles plus tôt. » Nous dit Jacky, un éleveur de 58 ans.

« J'ai réalisé ce « parcours bas carbone » au sein d'un groupe de progrès d'éleveurs allaitants. Ce qui m'a surtout plu c'est la confiance entre nous et la transparence des chiffres. Cela nous a permis de nous enrichir grâce à nos différents points de vue. Nous avons pu comparer nos performances. Avec le CAP'2ER® j'ai pu mieux visualiser mon impact sur l'environnement grâce à des chiffres concrets. J'ai appris par exemple que mes prairies et mes haies permettaient de compenser mes émissions de carbone à hauteur de 44 %, ce qui diminue nettement mon empreinte carbone, surtout en système extensif comme le mien. Il faut arrêter de dénigrer la production de bovins viande qui est l'une des rares à compenser une bonne partie de ses émissions. L'analyse des coûts de production m'a permis de pointer mes points faibles, comme l'âge au premier vêlage où le nombre trop important de vaches par rapport à celui des veaux. J'ai pu voir qu'un de mes points forts est la production de viande vive/UGB/UMO, et que je maîtrise mes charges de production. J'essaye d'avoir une politique d'investissement modérée et adaptée à l'exploitation. Ces notions sont un véritable atout dans la compréhension de son système et de ses pratiques, et permettent de s'améliorer. Les données sont de bons outils pour communiquer. » Nous rapporte Jean-Marc, éleveur de 41 ans.

LONGER DESCRIPTION – IN ENGLISH

Launched in 2020 by the Pays de la Loire Region, the 'low-carbon pathway' enables cattle farmers to evaluate and improve their environmental and economic performance simultaneously. By combining a CAP2ER® diagnosis with a COUPROD® assessment, farmers have a very precise overall view of their potential room for manoeuvre! The Climate Farm Demo project is helping to create synergies at local level by focusing on on-farm demonstrations and boosting the spread of these good environmental AND economic practices to a wider audience.

Beyond the concrete case of Florent, our Pilot Demo Farmer, the feedback from farmers is very positive!

“Thanks to the CAP’2ER® environmental assessment, I’ve come to realise that we farmers are not as destructive of the environment as people would have us believe! On the contrary, my grassland system allows me to store carbon thanks to my pastures and my hedgerows, and to maintain biodiversity while feeding the population! What’s more, on low-potential soils, cows help to preserve grassland. By carrying out the COUPROD® economic analysis at the same time, I was able to better understand the production costs and the cost price of my kg of meat. Before, I was producing without knowing this, and that’s a shame, because it helps you to understand what’s going well and what’s not, and to be able to improve. For example, I realised that I had a lot of unproductive animals, which reduced my technical and economic efficiency. Now I’m trying to improve that by getting rid of empty cows or problem cows quickly. I’m also trying to wean my males earlier.” Says Jacky, a 58-year-old farmer.

“I carried out this ‘low carbon course’ as part of a progress group of beef farmers. What I liked most was the trust between us and the transparency of the figures. This enabled us to learn from each other’s different points of view. We were able to compare our performances. With CAP’2ER® I was able to see my impact on the environment more clearly, thanks to concrete figures. I learned, for example, that my grasslands and hedgerows compensate for 44% of my carbon emissions, which significantly reduces my carbon footprint, especially in an extensive system like mine. We need to stop denigrating beef cattle production, which is one of the few to compensate for a large proportion of its emissions. The analysis of production costs enabled me to point out my weak points, such as the age at first calving or the excessive number of cows compared with the number of calves. I’ve been able to see that one of my strong points is the production of live meat per LU, and that I’ve got my production costs under control. I try to have a moderate investment policy that’s adapted to the farm. These elements are a real advantage when it comes to understanding your system and your practices and help you to improve. Data is a good tool for communicating”. Reports Jean-Marc, a 41-year-old farmer.

ADDITIONAL INFORMATION

The ‘low-carbon pathway’ initiative and the WASABIS project in the Pays de la Loire region offer some insight into this question!

Faced with new challenges in terms of the environment (greenhouse gases, maintaining biodiversity), society (animal welfare), labour and the economy (remunerative supply chains, rising commodity costs), livestock farmers need to equip and understand where they are starting from, both in terms of production costs and their environmental footprint. Studies based on production costs and the results of the Beef Carbon project have shown a very strong convergence between improved economic performance and a reduction in greenhouse gases.

The recent regional 'Ferme Bas Carbone' (Low Carbon Farm) programme, initiated by the industry (Interbev Pays de la Loire) and strongly supported by the Region's Council, provides a recent, solid database that systematically combines COUPROD® and CAP'2ER®. Cross-analysis of this data will enable us to detail the winning trajectories on the different levels.

Why:

- Equip farmers with reliable, up-to-date indicators for managing their business.
- Promote winning strategies that are profitable and adapted to climate change: emit less, endure less, implement reduction and storage solutions.
- Move quickly, because it may already be late: when disseminating the results, do not hesitate to shake up habits, awaken minds, stimulate the future and thus hasten change.

PHOTOS



Photo 1: Florent MELIAND Perche Sélection - Pilot Demo Farm in France



Photo 2: Farm Demo Event in Florent MELIAND Perche Sélection - Pilot Demo Farm in France



Photo 3: Farm Demo Event in Florent MELIAND Perche Sélection - Pilot Demo Farm in France

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Florent MELIAND Perche Sélection Pilot Demo Farm

URL:

<https://climatefarmdemo.eu/cfd/en/#/farm/231>

Title/Description

CAP'2ER® - Calcul Automatisé des Performances Environnementales pour des Exploitations Responsables

URL:

<https://idele.fr/detail-article/cap2err>

Title/Description

COUPROD - Un outil de calcul et de diagnostic des coûts de production toutes filières herbivores

URL:

<https://idele.fr/detail-article/couprod>

Title/Description

PARCOURS BAS CARBONE

URL:

<https://pays-de-la-loire.chambres-agriculture.fr/etre-accompagne/je-suis-agriculteur/toutes-nos-prestations/detail-de-la-prestation/parcours-bas-carbone>

Title/Description

Magazine article in Calameo

URL:

<https://www.calameo.com/read/005711475fa32af171c7a?authid=CemRpt5QYHYn>

Title/Description

Florent Meliand (72) a extensifié son système et amélioré ses performances économiques

URL:

<https://www.web-agri.fr/bilan-carbone/article/877496/florent-meliand-72-a-extensifie-son-systeme-et-ameliore-ses-performances-economi>

Title/Description

Fermes Bas Carbone - Zoom sur le dispositif dans le 72

URL:

<https://www.youtube.com/watch?v=Mp5-i3lwUmU>

Title/Description

Solenat – Facebook page

URL:

https://www.facebook.com/SolenatPaysdelaLoire/?locale=fr_FR

Title/Description

Solenat – website

URL:

<https://solenat.fr/>

PRACTICE ABSTRACT #25**SHORT TITLE IN NATIVE LANGUAGE**

Aider les organisateurs de démonstrations Climate Farm Demo (ou autres journées portes ouvertes en élevage) à clôturer leurs démonstrations en proposant un exercice d'échanges et de conclusion avec les visiteurs/éleveurs présents à la démonstration.

SHORT TITLE IN ENGLISH

Help the Organizers of Climate Farm Demo Demonstrations (or Other Livestock Open Days) to Close Their Demonstrations by Offering a Discussion and Conclusion Exercise with the Visitors/Breeders Present at the Demonstration

CONTACT

Marine Tessier (marine.tessier@seenovia.fr)

3 BENEFITS OF THE PRACTICE

1. Help with summarizing the day
2. Improvements for future demonstrations
3. Time saving by using a facilitating tool

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Dans le cadre du projet Climate Farm Demo, nous sommes amenés à ouvrir les fermes de nos éleveurs engagés dans le projet. Nous avons réalisé plusieurs démonstrations à ce jour. A l'issue des premières portes ouvertes, nous nous sommes rendu compte de l'intérêt de conclure la démonstration sur un dernier échange avec les participants.

Cet échange de « clôture » a 2 objectifs

- Recueillir les retours des visiteurs présents à la démo (ce qui vous a plu sur l'exploitation, dans l'organisation de la journée, ce qui serait à améliorer...) dans l'objectif de s'améliorer encore dans les prochaines démonstrations à venir
- Faire un retour aux agriculteurs qui nous ont reçus en proposant aux participants présents de leur renvoyer un point positif, un conseil.

Il permet ainsi de clôturer la démonstration sur une note d'échanges entre les participants.

Pour créer cet échange de conclusion nous proposons d'utiliser le dessin en forme de fleur ci-dessous. Un animateur interroge les participants et note sur la fleur leurs retours, soit directement au crayon dessus, soit à l'aide de post-its à positionner ensuite sur le schéma.

Cet outil "fleur", que nous avons repris et adapté du "tool-kit" de FARM DEMO, se révèle un allier très intéressant et puissant pour les DEMOs. Il permet de valoriser le travail de l'éleveur / agriculteur et d'impliquer les participants. Il renforce les échanges et crée du lien.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

As part of the Climate Farm Demo project, we are opening the farms of our breeders involved in the project. We have carried out several demonstrations to date. At the end of the first open days, we realized how interesting it is to conclude the demonstration with a final exchange with the participants.

This “closing” exchange has 2 objectives:

- Collect feedback from visitors present at the demo (what you liked about the demonstration, on the organization of the day, what could be improved, etc.) with the aim of improving the next demonstrations.
- Give feedback to the farmers who received us by proposing to the participants present to send them a positive point, a piece of advice.

The benefit is it helps to end the demonstration with an exchange between the participants.

To create this concluding exchange we suggest using the flower-shaped drawing below. A facilitator questions the participants and notes their feedback on the flower, either directly with a pencil on it or using post-its and positions them on the diagram.

This 'flower' tool, which we have adapted from the FARM DEMO toolkit, is proving to be a very interesting and powerful ally for DEMOs. It enhances the value of the farmer's work and gets the participants involved. It strengthens exchanges and creates links.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Cet outil « fleur », utilisé en fin de DEMO, se positionne très naturellement dans l'organisation des journées que nous programmons avec nos éleveurs pilotes.

Nous l'avons simplifié par rapport au modèle proposé dans le cadre du projet Climate Farm Demo, en focalisant un plus petit nombre de questions (dans les « pétales » de la « fleur ») portant sur ce qui nous concerne le plus dans notre travail au quotidien. Cette adaptation et transformation de cet outil le rend plus opérationnel dans le cadre de notre fonctionnement actuel d'entreprise et s'inscrit ainsi mieux dans le processus de génération d'impact que nous recherchons. En effet, les participants aux événements de DEMOs ont peu de temps en fin de DEMO et sont plus confortables avec cet atelier de fin qui apparaît ainsi moins « impressionnant » et a priori moins « long ».

Nous prévoyons d'intégrer cet atelier dans notre processus en routine. Il participe à relever les défis classiquement rencontrés dans l'organisation d'une DEMO ! Notre objectif avec ces journées portes ouvertes de démonstration est en effet de trouver des moyens de communication efficaces vers les éleveurs et les renouveler pour conserver un certain dynamisme.

La préparation de la logistique liée à la démo (messages à faire passer, impression, stands, tables, micro...) reste bien entendu une étape clé pour garantir une DEMO de qualité, fluide et agréable aussi bien pour l'éleveur hôte, pour les participants et aussi pour nous ! Nous réfléchissons toujours à l'avance à la meilleure option concernant le mode de fonctionnement de la démo, à savoir faire des groupes ou bien laisser les discussions s'organiser d'elles-mêmes au fil de l'eau. Cela se décide en fonction du thème, du nombre de participants inscrits (aussi du type de participants – par exemple lorsqu'il y a des élèves de classes agricoles, etc.) ; s'il y a des experts invités pour certains ateliers ; du type de supports de démonstration, etc.

Dans notre expérience, le principal facteur de succès d'une DEMO est la co-organisation de celle-ci avec l'agriculteur. Sans motivation de sa part, les DEMO ne trouveront pas leur sens ! Nous cherchons donc toujours en

premier quelle seront les motivations pour les éleveurs. Nous travaillons avec sur ce qui les intéresse le plus pour partager les réussites, les échecs et les points à améliorer auxquels ils font face sur leur exploitation afin de pouvoir progresser. La co-organisation, un atout pour créer du lien avec l'éleveur et avoir une compréhension plus fine de l'exploitation et des choix réalisés.

Enfin, ces DEMOs dans le cadre de Climate Farm Demo, sont une vraie opportunité pour créer du lien avec nos autres activités sur le thème « Climat ». Le projet Climate Farm Demo nous donne l'opportunité d'avoir une douzaine d'élevages « référents » que nous accompagnons sur une longue période de 6 ans pour aborder des leviers de réduction des GES. Cela représente un support de formation avec les éleveurs, grâce à ces exemples concrets. Cela nous permet de créer une dynamique sur un territoire ou auprès d'éleveurs au fil des journées de démonstration pour rendre moins abstraite la thématique du changement climatique.

LONGER DESCRIPTION – IN ENGLISH

This 'flower' tool, used at the end of the DEMO, fits in very naturally with the organisation of the days we schedule with our pilot farmers. We have simplified it compared with the model proposed as part of the Climate Farm Demo project, by focusing on a smaller number of questions (in the 'petals' of the 'flower') relating to what concerns us most in our day-to-day work. This adaptation and transformation of the tool makes it more operational in the context of the way we currently operate as a company and is therefore more in line with the process of generating impact that we are seeking. Indeed, participants in DEMO events have little time at the end of the DEMO and are more comfortable with this final workshop, which therefore seems less 'impressive' and a priori less 'long'.

We plan to integrate this workshop into our routine process. It helps to meet the challenges typically encountered in organising a DEMO! Our aim with these demonstration open days is to find effective ways of communicating with breeders and renewing them to maintain a dynamic approach. Preparing the logistics for the demo (messages to be conveyed, printing, stands, tables, microphones, etc.) is of course a key stage in guaranteeing a high-quality, smooth-running and enjoyable DEMO for the host farmer, the participants and for us too! We always think in advance about the best option for the way the demo will run, i.e. whether to set up groups or let the discussions organise themselves as they go along. This is decided based on the theme, the number of registered participants (and the type of participants - for example, if there are students from agricultural schools,

etc.); whether there are invited experts for certain workshops; the type of demonstration materials, etc.

In our experience, the main factor in the success of a DEMO is its co-organisation with the farmer. Without the farmer's motivation, the DEMOs will be meaningless! So, we always look first at what motivates the farmers. We work with them on what interests them most, so that we can share the successes, problems and areas for improvement that they are facing on their farms, so that they can make progress. Co-organisation is an asset for creating a link with the farmer and gaining a more detailed understanding of the farm and the choices made.

Finally, these DEMOs as part of the Climate Farm Demo are a real opportunity to create links with our other activities on the 'Climate' topic. The Climate Farm Demo project gives us the opportunity to work with a dozen 'reference' farms (our PDFs) over a long period of 6 years to look at ways of reducing greenhouse gas emissions. This represents a training medium with the farmers, thanks to these concrete examples. This enables us to create a dynamic within a region or with farmers over the course of demonstration events, to make the issue of climate change less of a theoretical one.

PHOTOS



Photo 1: 'flower' tool, used at the end of the Farm Demo Event

PRACTICE ABSTRACT #49**SHORT TITLE IN NATIVE LANGUAGE**

Dialoogmatrix rond watermanagement: een goed gesprek over klimaat
slimme oplossingen

SHORT TITLE IN ENGLISH

Water Management Dialogue Matrix: A Good Conversation About Climate
Smart Solutions

COUNTRY AND CLIMATIC ZONE

All

CONTACT

Emma Knol (emma.knol@wur.nl), Ellen Bulten (ellen.bulten@wur.nl)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Climate smart water measures
2. Dialogue
3. Engaging farmer

PRODUCTION SYSTEM

Arable crops

THEMATIC AREA

Water management

**SUMMARY FOR PRACTITIONERS ON THE MAIN
FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE**

Droogtes en hevige regenval bedreigen de landbouwproductie in heel Europa. Hoe kunnen experts, boeren en adviseurs constructieve gesprekken voeren over klimaat slim waterbeheer? En hoe kun je deze gesprekken op een interactieve manier faciliteren? In Nederland hebben we goede ervaringen met de dialoogmatrix rond watermanagement; een hulpmiddel om te praten over watermanagementmaatregelen en met boeren de implicaties van zulke maatregelen te bespreken.

Doel: bezoekers van demo bijeenkomsten informeren en een gesprek starten over klimaat slimme watermaatregelen. In de regio Veenkoloniën hebben we het bijvoorbeeld gehad over bovengrondse wateropslag.

Dialoogmatrix:

De dialoogmatrix tool bestaat uit 6 eenvoudig te volgen stappen. De eerste en tweede stap vereist enige voorbereiding door een expert (bijv. een onderzoeker, boer met veel ervaring, adviseur).

1. Maak een lijst van maximaal 10 klimaat slimme maatregelen, passend bij je lokale context. Denk bijvoorbeeld aan boven- of ondergrondse wateropslag, vruchtwisseling of bodemmaatregelen
2. Definieer elke maatregel in één of twee zinnen
3. Maak de onderstaande tabel en print deze uit op A4-papier;
4. Deel de tabel uit aan elke demobezoeker
5. Laat ze individueel elke maatregel scoren op effectiviteit en haalbaarheid (1= laag, 5= hoog) - *check Table 1 for more detail*
6. Bespreek plenair de antwoorden en plaats elke maatregel in de onderstaande matrix: hoe effectief is elke maatregel? En hoe haalbaar is het om te implementeren? - *check Figure 1 for more details*

Doelgroep: De dialoogmatrix kan worden gebruikt in gesprek met boeren en adviseurs.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Droughts and heavy rainfall are threatening agricultural production across Europe. How can experts, farmers and advisors have constructive conversations about climate smart water management? And how can you facilitate these conversations in an interactive way? In the Netherlands, we have good experience with the water management dialogue matrix; a tool to talk about water management measures and discuss implications for farmers.

Objective: to inform farm visitors and start a conversation about climate smart water measures. For example, in the Netherlands we talked about above-ground water storage.

Dialogue matrix:

The dialogue matrix tool consists of 6 easy to follow steps. The first and second steps require some preparation by an expert (e.g. a researcher, farmer with lots of experience, and an advisor).

1. Prepare a list of maximum 10 climate smart water measures, appropriate to your local context. Think about e.g. above or below ground water storage, crop rotations or soil measures.
2. Define each measure in one or two sentences
3. Prepare the table below and print on A4 paper
4. Hand out the table to each demo visitor
5. Let them individually score each measure on effectiveness and feasibility (1= low, 5= high)
6. Plenaries discuss the answers of the audience and place each measure within the matrix below: how effective is each measure? And how feasible is it to implement?

Target audience: The water management dialogue matrix can be used in sessions with farmers, local stakeholders, and advisors.

PHOTOS

Measure and definition	Effectiveness	Feasibility
X	3	4
Y	5	2
Z	5	3

Table 1 – Dialogue Matrix, step 5



Figure 1 – Dialogue Matrix, step 6

PRACTICE ABSTRACT #53**SHORT TITLE IN NATIVE LANGUAGE**

Széchenyi István Egyetem mintagazdasági hálózata: Tudásátadás, tudáscsere és fenntartható mezőgazdasági innovációk

SHORT TITLE IN ENGLISH

Széchenyi István University's Demonstration Farm Network: Knowledge Transfer, Knowledge Exchange and Sustainable Agricultural Innovation

COUNTRY AND CLIMATIC ZONE

Hungary, Continental Climate

CONTACT

András Vér (ver.andras@sze.hu), Albert Kázmér

3 BENEFITS OF THE PRACTICE

1. Practical knowledge transfer
2. Sustainable and climate-smart farming solutions
3. Collaboration between academia, advisors, and farmers

PRODUCTION SYSTEM

Crop and livestock farming, mixed farming systems, precision agriculture

THEMATIC AREA

All, especially Grassland management, Forage production, Crops management, Soil health and biodiversity, Biogas production, Water management and Herd management.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

A Széchenyi István Egyetem Albert Kázmér Karának mintegy 70 mintagazdasága/mintaüzeme/elismert gyakorló helye átfogó gyakorlati demonstrációs és tudásátadási infrastruktúrát biztosít.

A hálózat sokszínű és innovatív gazdaságokat és vállalkozásokat foglal magában, a kis, specializált gazdaságoktól a nagyméretű, több ágazatot lefedő agrárvállalkozásokig. A tagok tevékenysége többek között kiterjed az állattenyésztésre, a vegyes gazdálkodásra, a szántóföldi növénytermesztésre, a kertészetre, az élelmiszeriparra és a pénzügyi szektorra. A hálózatba tartozó gazdaságok 12%-a biogazdálkodást folytat.

A Kar aktív kapcsolatot ápol a hálózat tagjaival, és közös projekteken és kutatásokon keresztül dolgozik együtt azokkal a partnerekkel, akik elkötelezettek az innováció, a fenntarthatóság és a digitalizáció iránt.

Számos mintagazdaság holisztikus, körforgásos gazdálkodási megközelítést alkalmaz, amely biztosítja az erőforrások hatékony felhasználását és a hosszú távú fenntarthatóságot.

A bemutató gazdaságok lehetőséget biztosítanak a klímaadaptációs megoldások, precíziós gazdálkodási technikák és fenntartható talajhasználati módszerek valós környezetben történő kipróbálására és megismerésére. A résztvevők nemcsak elméleti tudást kapnak, hanem lehetőségük nyílik a legmodernebb technológiák gyakorlati alkalmazására is.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH*

The Albert Kázmér Faculty of Széchenyi István University operates a network of approximately 70 demonstration farms, model farms, and recognized training sites, providing a comprehensive practical demonstration and knowledge transfer infrastructure.

The network consists of diverse and innovative farms and enterprises, ranging from small, specialized farms to large multi-sector agribusinesses. Members are engaged in various agricultural sectors, including livestock farming, mixed farming, arable crop production, horticulture, the food industry, and agricultural finance. 12% of the network farms operate under organic farming principles.

The Faculty actively collaborates with network members, engaging in joint projects and research with partners committed to innovation, sustainability, and digitalization.

Many demonstration farms apply a holistic, circular farming approach, ensuring efficient resource use and long-term sustainability.

The demonstration farms serve as living laboratories, allowing for the real-world testing and implementation of climate adaptation solutions, precision farming techniques, and sustainable soil management practices. Participants gain not only theoretical knowledge but also hands-on experience with cutting-edge agricultural technologies, equipping them with practical skills for sustainable and modern farming.

LONGER SUMMARY FOR THE CLIMATE FARM DEMO WEBSITE – IN NATIVE LANGUAGE

A Széchenyi István Egyetem Albert Kázmér Kara mintegy 70 mintagazdaságból/mintaüzemből/elismert gyakorlóléhelyből hálózatot működtet, amely átfogó gyakorlati demonstrációs és tudásátadási infrastruktúrát biztosít. Ez az egyedülálló kezdeményezés valós betekintést nyújt a gazdálkodóknak, kutatóknak, hallgatóknak és további AKIS szereplőknek az innovatív mezőgazdasági gyakorlatokba, támogatva a fenntartható, digitális és klímatudatos gazdálkodásra való átállást.

Változatos és Innovatív Hálózat

A hálózat különböző típusú mintagazdaságból/mintaüzemekből/elismert gyakorlóléhelyekből hálózatot foglal magában, a kis, specializált gazdaságoktól a nagy, több ágazatot lefedő agrárvállalkozásokig. A hálózat tagjai a mezőgazdaság különböző területein tevékenykednek, többek között:

- Állattenyésztés, beleértve a tej-, marha-, baromfi- és sertésenyésztést.
- Vegyes gazdálkodás, ahol növénytermesztés és állattenyésztés kombinációja valósul meg.
- Szántóföldi növénytermesztés, gabona- és ipari növények termesztésével.
- Kertészet, szőlészet, borászat, gyümölcs- és zöldségtermesztés.
- Élelmiszeripar, feldolgozás és értéknövelt termékek előállítása.
- Mezőgazdasági finanszírozás a gazdálkodás és beruházások támogatására.
- Mezőgazdasági szaktanácsadás.

A hálózatba tartozó gazdaságok 12%-a biogazdálkodást folytat, bemutatva a fenntartható és környezettudatos termelési módokat.

Együttműködés, Kutatás és Tudásátadás

A Kar aktívan részt vesz közös projektekben és kutatási együttműködésekben a hálózat tagjaival, kiemelt figyelmet fordítva az innovációra, fenntarthatóságra és digitalizációra. Ezek az együttműködések lehetővé teszik új technológiák és gazdálkodási módszerek fejlesztését, tesztelését és bemutatását, amely által a hálózat értékes tudásközponttá válik a mezőgazdasági ágazat számára.

A bemutató gazdaságok élő laboratóriumként működnek, ahol a legjobb gyakorlatokat a következő formákban mutatják be:

- Kísérleti parcellák és kutatások, új növényfajták, talajművelési technológiák és digitális eszközök tesztelése.
- Workshopok és képzések, amelyek gyakorlati ismereteket és tapasztalatcserét biztosítanak a hallgatók, szaktanácsadók és gazdálkodók számára.
- Pilot projektek, amelyek fenntartható megoldásokat vizsgálnak, úgymint a precíziós gazdálkodás, regeneratív mezőgazdaság és körforgásos gazdálkodás.

Dinamikus információáramlás a fenntartható agrárium és vidékfejlesztés szolgálatában

A hálózat tagjai különböző méretű gazdaságokat képviselnek, a családi gazdaságoktól a közepes és nagy agrárvállalkozásokig, sokan pedig holisztikus, körforgásos gazdálkodási modellt alkalmaznak. Ez magában foglalja az erőforrás-hatékonyság optimalizálását, a hulladék csökkentését és a mezőgazdasági rendszerek ellenálló képességének növelését. A körforgásos modellek közé tartozik:

- Tápanyag-visszaforgatás, ahol az állati trágyát a talaj termékenységének javítására használják.
- Helyszíni energiaelőállítás, például biogázüzemek és napelemek telepítése.
- Vízmegőrző technológiák, mint a precíziós öntözés és az esővízgyűjtés.

A Széchenyi István Egyetem mintagazdasági hálózatával úttörő szerepet vállal a mezőgazdasági innováció és fenntarthatóság előmozdításában, összekapcsolva a tudományos kutatást a gyakorlati alkalmazásokkal.

LONGER SUMMARY FOR THE CLIMATE FARM DEMO WEBSITE – IN ENGLISH

The Albert Kázmér Faculty of Széchenyi István University operates a network of approximately 70 demonstration farms, model farms, and recognized training sites, providing a comprehensive practical demonstration and knowledge transfer infrastructure. This unique initiative offers real-world insights into innovative agricultural practices for farmers, researchers, students, and other Agricultural Knowledge and Innovation System (AKIS) actors, supporting the transition to sustainable, digital, and climate-smart farming.

A Diverse and Innovative Network

The network consists of various types of demonstration farms, model farms, and recognized training sites, ranging from small, specialized farms to large multi-sector agribusinesses. The network members operate in various agricultural sectors, including:

- Livestock farming, including dairy, beef, poultry, and pig production.
- Mixed farming, integrating both crop production and livestock farming.
- Arable crop production, focusing on cereals and industrial crops.
- Horticulture, viticulture, and winemaking, including fruit and vegetable production.
- Food industry, focusing on processing and value-added production.
- Agricultural finance, supporting farm management and investments.
- Agricultural advisory services for knowledge transfer and farm optimization.

Approximately 12% of the farms in the network practice organic farming, demonstrating sustainable and environmentally conscious production methods.

Collaboration, Research, and Knowledge Transfer

The Faculty is actively engaged in joint projects and research collaborations with network members, with a strong focus on innovation, sustainability, and digitalization. These partnerships enable the development, testing, and demonstration of new technologies and farming techniques, making the network a valuable knowledge hub for the agricultural sector.

The demonstration farms serve as living laboratories, where best practices are showcased through:

- Experimental plots and research trials, testing new crop varieties, soil management techniques, and digital tools.
- Workshops and training sessions, providing practical knowledge and experience exchange opportunities for students, advisors, and farmers.
- Pilot projects, exploring sustainable solutions such as precision agriculture, regenerative farming, and circular economy principles.

Dynamic Information Flow for Sustainable Agriculture and Rural Development

The network includes farms of various sizes, from family-owned businesses to medium and large enterprises, many of which adopt a holistic, circular farming approach. This ensures optimal resource efficiency, waste reduction, and improved resilience of agricultural systems. The circular models demonstrated within the network include:

- Nutrient recycling, where livestock manure is used to improve soil fertility.
- On-farm renewable energy production, such as biogas plants and solar panels.
- Water conservation technologies including precision irrigation and rainwater harvesting.

With its demonstration farm network, Széchenyi István University plays a pioneering role in fostering agricultural innovation and sustainability, bridging the gap between scientific research and practical farming applications.

ADDITIONAL INFORMATION

Facilitating Elements:

- Strong collaboration between Széchenyi István University, researchers, and industry partners.
- Practical training approach ensures knowledge is directly applicable in farm settings.
- Access to cutting-edge technologies and expert guidance.

Obstacles:

- Adoption of new practices may require initial investment in training and equipment.
- Farmers may face challenges in adapting traditional methods to more innovative systems.

Future Actions:

- Expansion of the demo farm network to include more regions and farming systems.
- Increased engagement with policymakers to support sustainable agricultural transitions.
- Further integration of digital and precision farming tools in training programs.
- Our approach is based on the farmers' and the market's needs.

PHOTOS

Photo 1: From Soil to Sprout: Understanding soil composition is the first step to unlocking full crop potential



Photo 2: Precision from Above: Drone-guided spraying for targeted, efficient, and sustainable crop management.



Photo 3: Knowledge Exchange in Action: Connecting research, technology, and farmers for climate-smart agriculture.



Photo 4: Hands-On Innovation: Demonstration farms showcase precision tools for sustainable soil management.



Photo 5: Knowledge Exchange in Action: Connecting research, technology, and farmers for climate-smart agriculture.

Description/Title

SZE - Department of Food Science

URL:

<https://food.sze.hu/mintagazdasagok>

PRACTICE ABSTRACT #58**SHORT TITLE IN NATIVE LANGUAGE**

Beef Days - Un succès pour la transition numérique dans l'élevage wallon

SHORT TITLE IN ENGLISH

Beef Days - Success for the Digital Transition in Walloon Livestock Farming

COUNTRY AND CLIMATIC ZONE

Belgium, temperate maritime climate

CONTACT

- Audrey Miserez (audrey.miserez@ilvo.vlaanderen.be)
- Benoit Wyzen, Edouard Reding (AWÉ Groupe)

3 BENEFITS OF THE PRACTICE

1. Monitoring
2. Herd management
3. Forage production

PRODUCTION SYSTEM

Livestock farming

THEMATIC AREA

Forage production

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Lors des Beef Days 2024, Elevéo, Inovéo et Digital Wallonia ont exploré en profondeur l'optimisation de la gestion des élevages bovins pour un avenir durable. Près de 260 passionnés d'élevage ont participé à l'événement.

La visite de la ferme s'est concentrée sur la présentation des services offerts aux éleveurs de bovins et sur la ferme de la famille Van Eyck. Cette ferme élève environ 500 bovins et cultive des pommes de terre, des céréales, du maïs, des betteraves ainsi que des légumes (haricots, épinards et fèves des marais). De plus, elle dispose d'un réseau d'irrigation innovant. Une grande partie de l'alimentation du bétail est produite sur place : herbe, pulpe de betterave, céréales, etc.

La viande est principalement commercialisée en circuit court via une coopérative d'éleveurs. Les propriétaires choisissent eux-mêmes les animaux destinés à chaque point de vente, et les taureaux comme les vaches sont engraisés sur la ferme.

Pour améliorer leur élevage, les propriétaires utilisent des logiciels et des applications facilitant la prise de décisions.

Pendant les Beef Days, six ateliers ont été organisés, mettant en avant des pratiques ou méthodes appliquées dans cette ferme :

- Atelier performances technico-économiques et comptabilité : Les différents indicateurs permettent aux éleveurs de suivre de près la performance des bovins et de prendre les meilleures décisions.
- Atelier suivi de croissance : Avec des balances à la ferme ou le service de pesée d'Elevéo, il est possible de suivre de près les poids des bovins au cours de leur croissance.
- Atelier outils de monitoring des bovins : Ces outils offrent un gain de temps et d'efficacité pour optimiser la santé et le cycle de reproduction des vaches.
- Atelier outils de mesure des fourrages : De nombreux outils existent pour estimer la quantité de fourrage.
- Atelier Génétique & Génomique : La génomique révolutionne la sélection animale en permettant de mieux anticiper les critères génétiques.
- Atelier conseil d'accouplement : Un outil disponible sur My Awé Net fournit des conseils personnalisés sur les accouplements dans chaque troupeau, avec des calculs de consanguinité.

Ces services visent à accompagner les éleveurs pour améliorer à la fois la rentabilité et la durabilité de leur exploitation.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

During the Beef Days 2024, Elevéo, Inovéo, and Digital Wallonia delved into optimizing cattle farm management for a sustainable future. Nearly 260 livestock enthusiasts participated in the event.

The farm visit focused on presenting the services offered to beef farmers and showcasing the Van Eyck family farm. This farm raises about 500 cattle and cultivates potatoes, cereals, maize, beets, and vegetables (beans, spinach, and broad beans). Additionally, it has an innovative irrigation network. A significant portion of the forage is produced on-site: grass, beet pulp, cereals, etc.

The meat is mainly marketed through short supply chains via a farmer cooperative. The owners themselves select which animals are destined for each point of sale, and both bulls and cows are fattened on the farm.

To advance their farming practices, the owners use software and applications that facilitate decision-making.

During the Beef Days, six workshops were organized, related to practices or methods applied on this farm:

- Workshop on Technical-Economic Performance and Accounting: Various indicators allow farmers to closely monitor cattle performance and make the best decisions.
- Growth Monitoring Workshop: With farm scales or Elevéo's weighing service, it is possible to closely monitor cattle weights during their growth.
- Cattle Monitoring Tools Workshop: These tools save time and increase efficiency in optimizing cow health and reproductive cycles.
- Forage Measurement Tools Workshop: Numerous tools exist to estimate forage quantity.
- Genetics & Genomics Workshop: Genomics revolutionizes animal selection by better anticipating genetic criteria.
- Mating Advice Workshop: A tool available on My Awé Net provides personalized mating advice for each herd, including inbreeding calculations.

These services aim to help farmers improve both the profitability and sustainability of their operations.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Durant les Beef Days 2024, Elevéo, Inovéo et Digital Wallonia ont approfondi la question de l'optimisation de la gestion des élevages bovins pour un avenir durable. Près de 260 passionnés d'élevage ont participé à la première édition des Beef Days. Cette journée a permis de mettre en lumière des outils essentiels pour les éleveurs bovins, visant à optimiser la production et la rentabilité tout en s'inscrivant dans une vision durable de l'agriculture.

La visite de la ferme était centrée sur la présentation des services proposés aux éleveurs de bovins et sur la ferme de la famille Van Eyck. Cette ferme élève environ 500 bovins et cultive des pommes de terre, des céréales, du maïs, des betteraves ainsi que des légumes (haricots, épinards et fèves des marais). De plus, la ferme dispose d'un réseau d'irrigation innovant. Une grande partie de la ration du bétail est produite sur place : herbe, pulpe de betterave, céréales, etc.

La viande est principalement commercialisée en circuit court via une coopérative d'éleveurs. Les propriétaires choisissent eux-mêmes les animaux destinés à chaque point de vente, et les taureaux comme les vaches sont engraisés sur la ferme.

Pour améliorer leur élevage, les propriétaires utilisent le logiciel de gestion de troupeau Ariane et son application AriSmart, ainsi que l'application awéSmart, qui leur permettent de synchroniser les données avec les colliers SenseHub. Ces outils facilitent la prise de décisions.

Pendant les Beef Days, six ateliers ont été organisés, mettant en avant des pratiques ou méthodes appliquées dans cette ferme :

- **Les paramètres technico-économiques:** Les services proposés par Elevéo permettent aux éleveurs de surveiller attentivement leurs coûts de production et de se comparer aux autres fermes. Outre la comptabilité de gestion Elevéo qui permet de quantifier finement la productivité en euros de l'exploitation, de nombreux indicateurs techniques sont disponibles. Les différents indicateurs existants permettent aux éleveurs de suivre de près la performance des bovins sur la ferme et de prendre les meilleures décisions.
- **Le suivi de croissance:** Ce suivi permet de suivre le troupeau et de détecter rapidement un retard de croissance. Cette détection précoce rend possible la mise en place de solutions comme l'adaptation de l'alimentation du groupe ou des mères dans le cas des troupeaux allaitants. Ce suivi permet de faire du tri afin de choisir les futurs reproducteurs et permet de connaître la productivité globale d'un troupeau.

- **Outils de monitoring des bovins:** La détection des chaleurs, des naissances et le suivi de santé sont un gain de temps et d'efficacité et permettent d'optimiser la santé et le cycle de reproduction des vaches.
- **Outils de mesure des fourrages:** Les outils numériques d'estimation des quantités d'herbe et de fourrages sur la ferme ont été présentés (herbomètre, satellite, drone, spectromètres, ...). De nombreux outils sont en effet disponibles pour caractériser la pousse de l'herbe et les fourrages, tant en quantité qu'en qualité, et affiner de la sorte les plans de rationnement
- **Génétique & Génomique :** Pour comparer des animaux entre eux dans ses choix de sélection, il est important de corriger les performances observées par les effets d'environnement et donc de regarder uniquement la partie génétique. C'est d'ailleurs la seule partie qui va se transmettre de génération en génération. Les index sont une estimation du potentiel génétique des animaux. Ils sont calculés grâce à la banque de données d'Elevéo, en combinant les pedigrees connus, les performances, et, depuis quelques années, l'ADN des individus. On parle d'évaluation génomique quand on intègre l'analyse ADN de l'animal.
- **Conseil d'accouplement Blanc-Bleu Belge:** Un outil disponible sur My Awé Net permet d'obtenir des conseils personnalisés sur les accouplements dans chaque troupeau, avec des calculs de consanguinité. Un atout indispensable pour optimiser son cheptel.

Ces services visent à accompagner les éleveurs pour améliorer à la fois la rentabilité et la durabilité de leur exploitation.

LONGER DESCRIPTION – IN ENGLISH

During the Beef Days 2024, Elevéo, Inovéo, and Digital Wallonia delved into optimizing cattle farm management for a sustainable future. Nearly 260 livestock enthusiasts participated in the first edition of the Beef Days. This event highlighted essential tools for cattle farmers, aiming to optimize production and profitability while adhering to a sustainable agricultural vision.

The farm visit focused on presenting the services offered to beef farmers and showcasing the Van Eyck family farm. This farm raises around 500 cattle and cultivates potatoes, cereals, maize, beets, and vegetables (beans, spinach, and broad beans). Additionally, the farm has an innovative irrigation network. A significant portion of the cattle feed is produced on-site: grass, beet pulp, cereals, etc.

The meat is mainly marketed through short supply chains via a cooperative of farmers. The owners themselves select which animals are destined for each point of sale, and both bulls and cows are fattened on the farm.

To advance their farming practices, the owners use the Ariane herd management software and its AriSmart application, as well as the awéSmart application, which allows them to synchronize data with SenseHub collars. These tools facilitate decision-making.

During the Beef Days, six workshops were organized, highlighting practices or methods applied on this farm:

- **Technical-Economic Parameters:** The services offered by Elevéo allow farmers to closely monitor their production costs and compare themselves to other farms. Besides Elevéo's management accounting, which allows for a detailed quantification of the farm's productivity in euros, many technical indicators are available. These various indicators enable farmers to closely track the performance of cattle on the farm and make the best decisions.
- **Growth Monitoring:** This monitoring allows tracking the herd and quickly detecting any growth delays. Early detection makes it possible to implement solutions such as adjusting the groups or mothers' diet in the case of suckler herds. This monitoring also allows for sorting to choose future breeders and to know the overall productivity of a herd.
- **Cattle Monitoring Tools:** Detecting heat cycles, births, and health monitoring saves time and increases efficiency, optimizing the health and reproductive cycle of cows.
- **Forage Measurement Tools:** Digital tools for estimating the quantities of grass and forage on the farm were presented (herbometer, satellite, drone, spectrometers, etc.). Many tools are available to characterize grass and forage growth in terms of both quantity and quality, thus refining rationing plans.
- **Genetics & Genomics:** To compare animals in selection choices, it is important to correct observed performances by environmental effects and thus look only at the genetic part. This is the only part that will be transmitted from generation to generation. Indexes are an estimate of the animals' genetic potential. They are calculated using Elevéo's database, combining known pedigrees, performances, and, for several years now, the DNA of individuals. It is called genomic evaluation when the animal's DNA analysis is integrated.

- **Belgian Blue Mating Advice:** A tool available on My Awé Net provides personalized mating advice for each herd, including inbreeding calculations. An essential asset for optimizing the herd.

These services aim to help farmers improve both the profitability and sustainability of their operations.

PHOTOS



Photo 1: Beef Days



Photo 2: Beef Days



Photo 3: Beef Days



Photo 4: Beef Days

Source: Digital Wallonia

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description:

Document about Beef Days with more details about the farm (PDF) and the workshops.

URL:

<https://www.awenet.be/awe/UserFiles/file/WE/Catalogue-Beef-Days-2024.pdf>

PRACTICE ABSTRACT #86**SHORT TITLE IN NATIVE LANGUAGE**

Améliorer la teneur en matière organique des sols en exploitation légumière bretonne : les leviers matériels, techniques et culturels.

SHORT TITLE IN ENGLISH

Improving Soil Organic Content on Vegetable Farms in Brittany: Material, Technical and Cultural levers

COUNTRY AND CLIMATIC ZONE

France, Atlantic zone

CONTACT

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Morgane Adamolle

3 BENEFITS OF THE PRACTICE

Increasing organic matter in soils has several benefits:

1. Increased water retention
2. Carbon storage
3. Improved soil structure and fertility

PRODUCTION SYSTEM

Organic fresh and processed vegetables

THEMATIC AREA

Soil health and biodiversity

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Une exploitation bio de légumes plein champ en Nord Finistère fait face aux défis du changement climatique en mettant en place des solutions innovantes pour améliorer la santé de ses sols et renforcer leur résilience.

1. Mise en place d'une plateforme de compostage (en réflexion)

Face à la raréfaction du fumier, l'exploitation souhaiterait composter ses propres déchets organiques (notamment 55 tonnes de déchets de poireaux) au lieu de les envoyer à un méthaniseur voisin. Cette solution permettrait :

- D'être plus autonome en matière organique, essentielle pour la fertilité et la rétention en eau des sols.
- De limiter les trajets et donc l'impact environnemental.
- De produire un amendement riche en carbone, améliorant la structure et la vie biologique du sol.

2. Optimisation des couverts végétaux

L'exploitant utilise systématiquement des couverts végétaux après les cultures pour enrichir ses sols. Il participe à un GIEE (Groupe d'Intérêt Economique et Environnemental) pour affiner ses choix d'espèces et de mélanges adaptés aux rotations légumières. Un semis innovant a été développé :

- Semer des couverts dans les allées non cultivées des champs de chou-fleur, afin de stocker davantage de carbone et d'améliorer la structure du sol.
- Maximiser la biomasse produite pour une meilleure rétention en eau et une fertilité accrue.

Afin de réduire le tassement des sols, l'exploitant a également équipé un tracteur d'un système de télégonflage des pneumatiques. La pression d'air est réduite lors des travaux des champs (récoltes de légumes d'hiver, travail du sol, semis de couverts). La réalisation de mini-profils a permis d'observer l'effet de ce matériel lors des récoltes de poireaux pendant l'hiver 2023-2024.

Ces pratiques renforcent la résilience de l'exploitation en limitant l'érosion, en augmentant le stockage du carbone et en améliorant la capacité des sols à faire face aux sécheresses et aux excès d'eau.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

An organic open-field vegetable farm in Nord Finistère (France, Brittany region) is addressing the challenges of climate change by implementing innovative solutions to improve soil health and enhance resilience.

1. Setting up a composting platform (under consideration)

In response to the increasing scarcity of manure, the farm aims to compost its own organic waste (particularly 55 tonnes of leek waste) instead of sending it to a nearby biogas plant. This solution would:

- Increase self-sufficiency in organic matter, which is essential for soil fertility and water retention.
- Reduce tractor trips, thereby lowering the environmental impact.
- Produce a carbon-rich soil improver that enhances soil structure and biological activity.

2. Optimizing plant cover

The farmer systematically plants cover crops after harvests to enrich the soil. He is participating in an economic and environmental interest group to refine species selection and mixtures suited to vegetable rotations. An innovative seeding system has been developed to:

- Sow cover crops in the uncultivated alleys of cauliflower fields, increasing carbon storage and soil structure.
- Maximize biomass production to improve water retention and fertility.

To reduce soil compaction, the farmer has equipped a tractor with a remote tyre inflation system. Air pressure is reduced when working in the fields (harvesting winter vegetables, tilling the soil, and sowing cover crops). Mini-profiles have been created to observe the effect of this equipment during leek harvests in the winter of 2023–2024.

These practices enhance the farm's resilience by limiting erosion, increasing carbon storage, and improving the soil's ability to withstand drought and excess water.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Amélioration de la santé des sols face au changement climatique : Solutions innovantes d'une exploitation de légumes bio en plein champ

Nous vous présentons ici l'exploitation de Lionel, l'un des « Pilot Demo Farmer » engagé dans Climate Farm Demo. Cette exploitation de légumes bio en plein champ en Nord Finistère (en France, dans la région Bretagne) fait face à des défis croissants liés au changement climatique. L'alternance de sécheresses et d'excès de pluies, l'augmentation des températures et la modification des cycles biologiques affectent la fertilité des sols et la productivité des cultures. Pour renforcer la résilience de ses sols, l'exploitation met en place deux leviers : un projet de plateforme de compostage et l'optimisation des couverts végétaux.

1. Projet de plateforme de compostage : Vers une autonomie en matière organique

La raréfaction du fumier, remplacé par des systèmes à lisier plus pauvres en carbone, pose un défi pour l'exploitation. Par ailleurs, elle produit chaque année 55 tonnes de déchets organiques issus des cultures de poireaux, jusqu'ici envoyés vers un méthaniseur sans retour en matière organique.

Pour y remédier, l'exploitation travaille sur une plateforme de compostage visant à recycler ces déchets et à produire un amendement riche en carbone. Ce compost améliorera la fertilité des sols, optimisera la rétention d'eau et réduira la dépendance aux intrants extérieurs.

Mise en place et perspectives

Le projet prévoit :

- Un espace dédié avec un suivi de l'humidité et de la température,
- L'incorporation de déchets verts pour équilibrer le compost,
- Des essais pour évaluer son impact sur la structure et la fertilité des sols.

2. Optimisation des couverts végétaux : Un levier pour la fertilité des sols

Bénéfices des couverts végétaux

L'exploitation utilise systématiquement des couverts végétaux pour :

- **Limiter l'érosion** et améliorer la structure du sol,
- **Optimiser la rétention d'eau** et la fertilité,
- **Réduire les adventices et ravageurs** grâce à des espèces adaptées.

Innovations mises en place

Une technique innovante a été introduite : **le semis de couverts végétaux dans les allées non cultivées des champs de chou-fleur**, réduisant l'érosion et restituant de l'azote aux cultures suivantes.

L'exploitation fait partie d'un GIEE (Groupement d'Intérêt Économique et Environnemental), ce qui lui permet d'expérimenter de nouvelles associations de couverts et d'affiner leur intégration dans ses rotations.

Diversification des espèces et réduction du tassement des sols

L'exploitation teste différents mélanges selon les saisons et les rotations :

- **Légumineuses (trèfle, féverole, vesce)** pour la fixation de l'azote,
- **Graminées (seigle, avoine)** pour la structuration du sol,
- **Crucifères (radis chinois, moutarde)** pour la captation des nutriments.

Afin de réduire le tassement des sols, l'exploitant a également équipé un tracteur d'un système de télégonflage des pneumatiques. La pression d'air est réduite lors des travaux des champs (récoltes de légumes d'hiver, travail du sol, semis de couverts). La réalisation de mini-profils a permis d'observer l'effet de ce matériel lors des récoltes de poireaux pendant l'hiver 2023-2024.

À retenir ! En développant une plateforme de compostage et en optimisant les couverts végétaux, l'exploitation met en place des solutions adaptées au changement climatique. Ces initiatives améliorent la santé des sols, renforcent leur résilience et contribuent à une agriculture plus durable, conciliant performance économique et respect de l'environnement.

LONGER DESCRIPTION – IN ENGLISH

Improving soil health to cope with climate change: innovative solutions from an organic field- grown vegetable farm

Here we present the farm of Lionel, one of the 'Pilot Demo Farmers' involved in Climate Farm Demo. This organic open-field vegetable farm in Nord Finistère (in the Brittany region of France) is facing increasing challenges linked to climate change. Alternating droughts and excess rainfall, rising temperatures and changes to biological cycles are affecting soil fertility and crop productivity. To strengthen the resilience of its soils, the farmer is implementing two levers: a composting platform project and the optimisation of plant cover.

1. Composting platform project: Towards self-sufficiency in organic matter

The scarcity of manure, which has been replaced by slurry systems that are lower in carbon, presents a challenge for the farm. In addition, the farm produces 55 tons of organic waste from leek crops every year, which until now has been sent to the biogas plant with no return in terms of organic matter.

To remedy this, the farm is working on a composting platform to recycle this waste and produce a carbon-rich soil improver. This compost will improve soil fertility, optimise water retention and reduce dependence on external inputs.

Implementation and perspectives

The project includes:

- A dedicated area with humidity and temperature monitoring,
- The incorporation of green waste to balance the compost,
- Tests to assess its impact on soil structure and fertility.

2. Optimising plant cover: a lever for soil fertility

Benefits of plant cover crops

The farm systematically uses plant cover crops to:

- Limit erosion and improve soil structure,
- Optimise water retention and fertility,
- Reduce weeds and pests using adapted species.

Innovations introduced

An innovative technique has been introduced: sowing plant cover in the uncultivated alleys of cauliflower fields, reducing erosion and restoring nitrogen to subsequent crops.

The farm is part of a GIEE (Groupement d'Intérêt Économique et Environnemental - economic and environmental interest group), which enables it to experiment with new cover crop combinations and refine their integration into its rotations.

Diversifying species and reducing soil compaction

The farm tests different plant mixes depending on the season and rotation:

- Legumes (clover, broad bean, vetch) for nitrogen fixation,
- Grasses (rye, oats) for soil structure,
- Crucifers (daikon, mustard) for nutrient uptake.

To reduce soil compaction, the farmer has also fitted a tractor with a remote tyre inflation system. Air pressure is reduced when working in the fields (harvesting winter vegetables, cultivating the soil, sowing cover crops). Mini profiles have been produced to observe the effect of this equipment during leek harvests in the winter of 2023-2024.

Something to remember! By developing a composting platform and optimising plant cover crops, the farm is putting in place solutions adapted to climate change. These initiatives improve soil health, boost soil resilience and contribute to more sustainable agriculture, reconciling economic performance with environmental care.

ADDITIONAL INFORMATION

Facilitating factors

- **Participation in a GIEE** (economic and environmental interest group): Allows experience to be shared and plant cover to be optimised.
- **Technical support and training:** Expert support in implementing measures to improve soil management.
- **Access to machinery:** Adapted machinery, such as remote inflation, to help preserve the soil.

Obstacles

- **Cost of facilities:** Setting up the composting platform requires significant investment.
- **Labour required:** Monitoring cover crops and compost requires time and human resources.
- **Technical and regulatory constraints on composting:** plant waste alone does not provide standardised compost. It has to be mixed with other organic sources, which may require sanitary management and handling.

PHOTOS



Photo 1: Tractor equipped with a remote tire inflation system to reduce soil compaction



Photo 2: Innovative planting of cover crops (phacelia) in trailer passages not cultivated with cauliflower

Photo 3: Lionel GRALL, Pilot Demo Farmer



Photo 4: An example of soil profiles produced to assess the impact of the equipment on soil compaction

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

À Plouvorn (29) : UNE JOURNÉE INNOV'ACTION LÉGUMES - Page 26

URL:

<https://bretagne.chambres-agriculture.fr/agritheque/detail-publication/actualites/le-mag-des-agricultures-de-bretagne-n26/>

Title/Description

Grall Lionel - Pilot Demo Farm in France

URL:

<https://climatefarmdemo.eu/cfd/en/#/farm/64>

PRACTICE ABSTRACT #90**SHORT TITLE IN ENGLISH**

Farming With Trees – Opportunities Through Agroforestry

COUNTRY AND CLIMATIC ZONE

United Kingdom, practices can be adapted and applied to other temperate zones.

CONTACT

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3 BENEFITS OF THE PRACTICE

1. **Carbon Sequestration & Soil Health:** Trees enhance carbon storage above and below ground, improve soil organic matter, structure, drainage, and nutrient cycling.
2. **Protection & Erosion Control:** Trees provide shelter against extreme weather, safeguard livestock and crops, limit wind and water erosion, and offer shade.
3. **Diversification & Resilience:** Agroforestry increases farm income by utilizing marginal land, enhances climate resilience, and reduces input needs for feed, water, and pest control.

PRODUCTION SYSTEM

Agroforestry- Silvo pasture, Silvo arable, individual orchard or forestry plot(s) or integration across the whole farm landscape.

THEMATIC AREAS

Agroforestry and relationship to the landscape

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Integrating trees into UK farmland is not new; some argue the landscape is naturally a mix of farmland and trees. However, post-WWII until the mid-80s, farmers were incentivized to remove hedges and enlarge fields for machinery, later risking payment losses if planting trees on arable land (1). Today, tree farming benefits are recognized, with grants supporting diversification. The UK Government Agroforestry Handbook categorizes tree integration into in-field (silvoarable, silvopasture, wood pasture, orchards) and around-field (trees in hedges, trees in fields, windbreaks, riparian buffers) systems. Farmers can combine these based on farm needs and funding.

EcoFarm in Nottingham, a 26-hectare Climate Demo Farm, is managed by a Community Benefit Society. It integrates trees into two agroforestry systems: 740 trees in arable fields between 24-meter cropping alleys with wildflower strips and 3,700 trees in woodland with grazing sheep.

After 10 years, research with the University of Reading found alley planting delivers greater environmental gains than broadacre planting, also improving soil health. A key non-cash benefit is community involvement, as volunteers help with planting and harvesting (2).

Whitehall Farm in Cambridgeshire, another Climate Demo Farm, established a silvoarable orchard system in 2009, planting 4,500 apple trees across 52 hectares. Trees are spaced 3 meters apart, with an understory of clovers, vetch, and wildflowers. 27-meter cropping alleys allow machinery access. Tree row orientation reduces shading and wind erosion, a common Fens challenge. Late-ripening apples enable cereal harvests in late summer, followed by apple picking in autumn. With a 15-year tenancy, apples provided a strong return on investment, while also improving soil protection, pest control, and biodiversity (3).

Sources:

- (1) *UK Government Guide to Agroforestry*
- (2) [Farmers Weekly - Agroforestry in Nottingham](#)
- (3) [Agroforestry Net - Whitehall Farm](#)

LONGER DESCRIPTION – IN ENGLISH

Integrating trees across the farm landscape in the UK is not a new practice, some would argue the UK is a mix of farmland and trees or forest (1). However, after the second World War until the mid-80's farmers were incentivised to take up hedges and increase field size to accommodate larger machinery to boost yield and food production; later farmers risked losing payments if

they planted trees on arable land ⁽¹⁾. The benefits of farming with trees are now recognised in the UK and Europe, with grants and other incentives available to support diversification.

There are different options available to introduce trees on farms. The UK Government Agroforestry Handbook splits them into two categories: “in-field” and “around field”. (See *Photo 1*)

This can be broken down further:

- **In field, silvo-arable** - Trees planted, usually in rows, between arable crops or in horticulture settings where trees and shrubs are planted alongside annuals.
- **In field, silvo-pasture** - Trees combined with livestock and or forage production.
- **In field, wood pasture and traditional orchards** - In wood pasture livestock graze woodland. The woodland can include veteran trees and protected species. Usually, these systems have lower management inputs to conserve habitats and enhance biodiversity.
- **Around Field-trees in hedges** - hedges and trees can be used as boundaries whilst storing carbon, acting as shelter and/or forage for livestock and providing habitats for birds, insects and mammals.
- **Around Field-trees in fields** - isolated trees in fields can provide shelter or shade, as well as habitats. A single tree may also act as community point of interest.
- **Around Field-windbreaks and shelter banks** – wind breaks are usually planted to reduce wind and soil erosion. They can also provide shelter or browsing feed for livestock and act as natural boundary. A Shelter bank is a larger scale windbreak, usually across a landscape which can also provide a wildlife corridor, enhancing biodiversity and/or providing amenity value for local communities. Thinning can potentially provide a medium-term income source.
- **Around Field-trees as riparian buffers** - trees can be planted as riparian buffers between agricultural land and a waterway to improve water quality. They can also provide shelter, shade or browsing feed for livestock and/or act as a natural boundary. Thinning can potentially provide a medium-term income source.

Practices can be combined on one farm and planting designs and tree selection be considered depending on the farm context and funding available.

EcoFarm, a 26 ha Climate Demo Farm, in Nottingham is managed by a Community Benefit Society aiming to connect people with the land, food and environment. Fruit and nut trees are grown, in two agroforestry systems. 740 trees are in two arable fields planted between 24m cropping alleys, within 4x230m strips of wildflower and grasses. Another 3,700 are planted in woodland with grazing sheep. Ecofarm has been farming trees for 10 years, during this time research with the University of Reading has demonstrated higher environmental gains from the alley system of planting than the broadacre system, also trialled. Soil health has also improved. Another non-cash benefit is community involvement; volunteers can plant and harvest trees and have a say on how produce is sold.⁽³⁾

Whitehall Farm, a Climate Demo Farm in Cambridgeshire established a Silvoarable orchard system in 2009. 4,500 apple trees were planted north to south across 52 hectares of arable land. Trees are spaced every 3m within an understorey of clovers, vetch and perennial wildflowers. The 27m cropping alley between each row, allows access to machinery for crops and trees. Tree row orientation reduces the impact of tree shading and helps reduce wind erosion, a common challenge in the Fens. The late ripening apple varieties selected enables cereal crops to be harvested late summer before apples are handpicked early autumn. With a farm tenancy of 15 years apples were the perfect trees to plant, providing a long enough cropping cycle to deliver an economic return on the capital invested in tree planting. The trees enabled diversification of crops and income sources. Other benefits were soil protection a reduction in pest and disease risks and enhanced biodiversity on the farm ⁽⁴⁾.

⁽¹⁾ Agroforestry Handbook- Agroforestry for the UK

⁽²⁾ UK Government Guide to agroforestry

⁽³⁾ <https://www.fwi.co.uk/arable/how-trees-helped-notts-farmer-broaden-arable-business>

⁽⁴⁾ <https://agroforestrynet.eu/afinet/whitehall-farm-an-innovative-silvoarable-orchard-system-in-the-uk>

ADDITIONAL INFORMATION

Tips for starting out

1. Consider your overall farm aims and what you want to achieve by introducing trees, this should guide your plans.
2. Look at what others have done; you could attend agroforestry weekend events or the UK agroforestry conference. Be curious, *“there’s no such thing as a silly question”*.

3. Set your business plan carefully; yields from tree planting can be medium to long-term. Combinations of trees and shrubs and/or silvoarable or silvopasture will bring in income streams at different times and earlier than forestry. This all needs to be factored into your business plan, alongside capital investment in machinery and new revenue requirements such as skill development and labour.
4. Regulatory and legal checks are important, check the definitions of trees and woodland to ensure you meet any planning permission or land use change requirements and at harvest you have any required licences for tree felling. If you are a tenant farmer, you may need your landlord's consent and will need to factor in the length of your tenancy into design and financial planning. Similarly, you may need to enter into new agreements, for example entering a contract or a license with a grazier to graze your orchard or woodland.
5. Tree and shrub selection is important to gain your set economic and environmental benefits. For example, trees can have an economic value and value to natural pollinators such as raspberry or blackberry bushes or other native tree species which can provide valuable habitats for insects, birds, and small mammals. Other trees may not have an economic value until mature but can save money on flood control, housing for livestock or pesticide use.

Guidance on getting started is included in the Agroforestry Handbook ⁽¹⁾, UK government funding options including a grant to establish an agroforestry plan are available at Gov.uk ⁽²⁾

Suggested areas for future practice abstracts or case studies

Silvo pasture with goats.

Stacked enterprises and agroforestry

PHOTOS

In field	Around Field
Silvo arable	Trees in hedges
Silvo pasture	Trees in field
Wood pasture	Wind and shelter breaks
Orchards	Riparian buffers

Photo 1: Two categories of introducing trees on farm - The UK Government Agroforestry

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description:

Farm Woodland Forum

The Farm Woodland Forum is a group of farmers, foresters, researchers and other interested bodies with a shared interest in farming with trees. The Forum facilitates knowledge exchange to promote agroforestry and improve agroforestry practices. Members meet annually to share developments, and the Forum hosts a website with agroforestry news and resources.

URL:

<https://www.agroforestry.ac.uk>

Title/Description:

THE AGROFORESTRY HANDBOOK- Agroforestry for the UK

The Agroforestry Handbook seeks to inspire farmers to plant trees. The handbook summarises the theory and benefits of agroforestry and provides practical guidance on management and design through to information on pricing and market access, in the UK. It was developed by Abacus Agri, Soil Association and Woodland Trust to support the Farm Woodland Forum, the UK's lead agroforestry body.

URL:

<https://www.soilassociation.org/media/19141/the-agroforestry-handbook.pdf>

Title/Description:

UK Government Guide to agroforestry

Sets out definitions and types of agroforestry as well links to grants available.

URL:

<https://www.gov.uk/guidance/a-guide-to-agroforestry>

Title/Description:

UK Funding for Agroforestry

The UK Government provides funding to develop an agroforestry plan and capital funding to establish an in-field agroforestry system. Revenue funding is also available through the SFI (Sustainable Farming Initiative) and Countryside Stewardship Schemes.

The Tree Species Guide for UK Agroforestry Systems

Provides details of the physical characteristics, environmental tolerances, silvicultural characteristics, and ecosystem services and disservices, for 33 species of trees or shrubs that could be planted in UK agroforestry systems.

URL:

<https://www.forestresearch.gov.uk/research/expanding-agroforestry-a-tree-species-guide-for-agroforestry-in-the-uk/>

Title/Description:**Definition of trees and woodland**

Provides the Forestry Commission's interpretation of "tree" and "woodland". This is important to help interpret whether your trees require a felling licence and definitions of afforestation, deforestation and other forestry related works.

URL:

<https://www.gov.uk/government/publications/definition-of-trees-and-woodland/definition-of-trees-and-woodland#woodland-management-scenarios-and-our-advice>

Title/Description:**1st UK Agroforestry Conference**

The first UK Agroforestry Conference was held in September 2023, organised by the Soil Association and Woodland Trust. It hosted over 1000 people. The two-day programme was captured on films and recordings.

The second UK Agroforestry Conference will be held on Woodoaks Farm, Hertfordshire on the 10th-11th September 2025.

URL:

<https://www.agroforestryshow.com>

Title/Description:**Agroforestry Weekend**

Agroforestry weekend is celebrated every May in the UK with farmers opening their gates to visitors. The event runs from the 16th-19th May 2025.

URL:

<https://agroforestryopenweekend.org>

PRACTICE ABSTRACT #95**SHORT TITLE IN NATIVE LANGUAGE**

Rohumaakanad: munakanade portsjonkarjatamine

SHORT TITLE IN ENGLISH

Pastured Poultry: Portion Herding for Laying Hens

COUNTRY AND CLIMATIC ZONE

Estonia, mixed forest sub-region of the Atlantic continental region of the temperate zone

CONTACT

Kelli Talving (kelli.talving@metk.agri.ee)

3 BENEFITS OF THE PRACTICE – KEYWORDS

1. Animal Welfare: Portion herding supports hens' ethological needs, enhancing well-being.
2. Farmer Benefits: Low-cost entry into agriculture, no need for expensive aviary infrastructure or large arable land, improves grassland quality.
3. Consumer Advantage: Pastured poultry eggs offer higher nutritional value than conventional eggs.

PRODUCTION SYSTEM

Poultry

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Rohumaal kanade karjatamine on alternatiivne pidamisviis, taastavas põllumajanduses peetakse selle termini all silmas kanade portsjonkarjatamist. Olenevalt kanade jooksuuala suuruselt on nad ühe koha peal 2-3 päeva. Selle ajaga nad söövad ära taimede kõige nooremad otsad, väetavad natukene ning õhutavad siblimisega mulda. Tegemist on väga efektiivse rohumaad tervistava meetodiga. Juba ühe-kahe karjatamise järel on taimestik märgatavalt lopsakam kui enne.

Kuna kanad on ühe koha peal kõigest paar päeva, on neil pidevalt puhas jalgealune ja värske roheline ninaesine. Nad saavad süüa toitaineid rohkem taimi, putukaid ja kanadele seedimiseks vajalikke pisikesi kive. Päike ja päevavalgus annab oma panuse immuunsüsteemile. Oma olemuselt väga uudishimulikud ja terased linnud saavad rohumaal elada nii liigiomast elu kui vähegi võimalik.

Talvisel ajal on kanad suures kütteta kasvuhoones. Kanad ei karda niivõrd madalaid temperatuure kui niiskust ja tuult, mille eest kasvuhoone neid ideaalselt kaitseb. Sügavallapanu annab oma panuse sooja jalgealuse hoidmisel.

Lühike seedetrakt tagab selle, et palju kanade väärtuslikust söögist ja heast elust jõuab ka muna sisse. Tänu rohu ja putukate söömisele on rohumaakanade munades oluliselt rohkem vitamiine ja mineraale.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Pastured poultry is an alternative method of keeping chickens. In regenerative agriculture, this term refers to chicken portion grazing. Depending on the size of the chickens' running area, they stay in one place for 2–3 days. During this time, they eat the youngest parts of plants, fertilize, and aerate the soil by scratching.

Chicken portion grazing mimics how animals move in nature. They eat the best and youngest parts of plants, contribute fertilizer through manure, and slightly mix and loosen the soil. This method is highly effective in improving grassland health. After just one or two grazing sessions, vegetation becomes noticeably lusher.

Since the chickens remain in one place for only a few days, they constantly have clean ground and fresh green feed. They can consume nutrient-rich plants, insects, and small stones necessary for digestion. Sunlight and daylight strengthen their immune system. Being naturally curious and sharp birds, they can live as natural a life as possible on the pasture.

In winter, the chickens stay in a large, unheated greenhouse. Chickens are more sensitive to wetness and wind than to low temperatures, and the greenhouse provides excellent protection. Deep bedding helps keep their feet warm.

A short digestive tract ensures that much of the chickens' valuable food and good living conditions contribute to the quality of their eggs. Thanks to their diet of grass and insects, pasture-raised chickens' eggs contain significantly more vitamins and minerals.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Rohumaakanad on Ameerikas ja mõnel pool Euroopas juba mõnda aega kanda kinnitanud. Toitainerikaste munade, rohumaade tervistamise ja mitmete teiste põhjuste tõttu võiksid nad ka Eestis olla palju levinumad olla.

Ahisilla taluaias on rohumaakanad kolm hooaega olnud. Esimesel aastal katsetas talu 150 munakanaga süsteemi läbi, 2023. aastal tõstsid nad kanade arvu 800 peale ja 2024. aastal sibilis Ahisilla taluaia rohumaadel juba 1400 kana.

Kanad elavad karjatusperioodil liigutatavates kanalates. Regulaatsioonide kohaselt on tegemist alternatiivse pidamisviisiga, taastavas põllumajanduses peetakse selle termini all silmas kanade portsjonkarjatamist.

Olenevalt kanade jooksuala suurusest on nad ühe koha peal 2-3 päeva. Selle ajaga nad söövad ära taimede kõige nooremad otsad, väetavad natukene ning õhutavad siblimisega mulda. Viimane on meie talu looduslikel rohumaadel väga oluline, sest taimede all kasvab tihe sammal, mida kanad siblides efektiivselt eemaldavad.

Kanade portsjonkarjatamine on sarnane sellele, kuidas loomad ka looduses liiguvad. Kanad söövad ühe koha pealt paremad palad ära, annavad oma väike väetisepanuse ning segavad-kobestavad veidi maapinda. Juba ühe-kahe karjatamise järel on taimestik märgatavalt lopsakam kui enne.

Kuna kanad on ühe koha peal kõigest paar päeva, on neil pidevalt puhas jalgealune ja värske roheline ninaesine. Nad saavad süüa toitainerohkeid taimi, putukaid ja kanadele seedimiseks vajalikke pisikesi kive. Päike ja

päevavalgus annab oma panuse immuunsüsteemile. Oma olemuselt väga uudishimulikud ja terased linnud saavad rohumaal elada nii liigiomast elu kui vähegi võimalik.

Talvisel ajal on kanad suures kütteta kasvuhoones. Kanad ei karda niivõrd madalaid temperatuure kui niiskust ja tuult, mille eest kasvuhoone neid ideaalselt kaitseb. Sügavallapanu hoiab neil kenasti varbad soojas.

Lühike seedetrakt tagab selle, et palju kanade väärtuslikust söögist ja heast elust jõuab ka muna sisse. Tänu rohu ja putukate söömisele on rohumakaanade munades oluliselt rohkem vitamiine ja mineraale. Penni osariigi (USA) põllumajandusteaduste ülikooli uuringu kohaselt sisaldavad tavaliste farmilindude munadega võrreldes rohumakaanade munad 39% rohkem A vitamiini ja kaks korda rohkem E vitamiini. Lisaks leiti neist ligi kolm korda rohkem Omega-3 rasvhappeid ja ligi seitse korda rohkem beetakaroteeni.

Kuna kanal on võimalik olla kogu päeva ka päikese käes siis sisaldavad munad ka suurel hulgal D vitamiini. Halle-Wittenbergi Martin Lutheri Ülikoolis läbi viidud uuringu tulemuste järgi on karjatatavate kanade munades keskmiselt 14.3 mikrogrammi Vitamiini D3 100g kohta. Võrdluseks siseruumides elavate kanade munades oli D3 vitamiini 100 gr kohta 3.8 mikrogrammi.

Väga suur vahe on rohumakaanamunade ja tavamunade võrdluses foolhappel. Mother Earth News magazine viis läbi uuringu kus võrreldi USA tavatootmise mune 12 erineva tootja rohumakaanamunadega ning vahe oli keskmiselt 21 korda rohumakaanamunade kasuks, sisaldades 1038 mikrogrammi foolhapet.

Tähelepanuta ei tasu jätta kanade karjatamise majanduslikku poolt. Põllumaa soetamine on Eestis kõrgete hindade ja suurtootjate kätte koondumise tõttu keeruline. Ühtlasi seavad maakasutuse määrad ranged piirangud sellele, kuidas maad rakendada tohib. Kanade karjatamine on hea võimalus, kuidas väikeste investeeringute ja püsikuludega põllumajandussektoris siseneda. Boonusena ei vaja kanade karjatamine palju maad.

Ahisilla taluaias on rohumakaanad üks lüli talu kohalikust ringmajandusest. Seal kasvatatakse lisaks kanadele ka köögivilju ja lõikelilli ja mitte midagi ei lähe raisku, sest kanad on suurepäraseid taimekasvatustajaid kompostrid. Kõik, mis taimekasvatusest üle jääb, saab munaks või läheb kanasõnnikuna taimerammuks tagasi.

LONGER DESCRIPTION – IN ENGLISH

Pastured poultry has established itself in America and some parts of Europe. Due to the nutrient-rich eggs, improvement of pasture health, and various other reasons, they could become much more common in Estonia as well.

At Ahisilla farm, pastured hens have been present for three seasons. In the first year, the farm tested the system with 150 laying hens. In 2023, they increased the number of chickens to 800, and by 2024, Ahisilla farm's pastures were home to 1,400 chickens.

The chickens live in mobile coops during the grazing period. According to regulations, this is considered an alternative housing method, and in regenerative agriculture, this term refers to the rotational grazing of chickens.

Depending on the size of their run, they stay in one place for 2–3 days. During this time, they eat the youngest parts of the plants, fertilize a bit, and aerate the soil with their scratching. This is especially important for our farm's natural pastures, as there is a thick layer of moss under the plants that the chickens effectively remove by scratching.

Rotational grazing of chickens mimics how animals move in nature. Chickens eat the best parts of the plants in one spot, contribute fertilizer, and mix and loosen the soil. After just one or two grazing periods, the vegetation becomes noticeably lusher.

Since the chickens remain in one place for only a few days, they always have clean ground under their feet and fresh greens to peck at. They consume nutrient-rich plants, insects, and small stones necessary for digestion. Sunlight and daylight strengthen their immune system. Being naturally curious and sharp-witted birds, they can live as species-appropriate a life as possible on the pasture.

During winter, the chickens are housed in a large, unheated greenhouse. They are not as sensitive to low temperatures as they are to wetness and wind, which the greenhouse protects them from perfectly. Deep bedding helps keep their toes warm in winter.

Their short digestive tract ensures that much of their valuable food and good living conditions transfer into the eggs. Thanks to eating grass and insects, free-range chickens' eggs contain significantly more vitamins and minerals.

According to a study by Pennsylvania State University (USA), compared to conventional farm birds' eggs, free-range chickens' eggs contain 39% more vitamin A and twice as much vitamin E. Additionally, they have nearly three

times more Omega-3 fatty acids and nearly seven times more beta-carotene.

Since the chickens spend all day in the sun, their eggs also contain a large amount of vitamin D. A study conducted by Martin Luther University of Halle-Wittenberg found that pasture-raised chickens' eggs contain an average of 14.3 micrograms of vitamin D3 per 100g, whereas indoor chickens' eggs contained only 3.8 micrograms per 100g.

There is also a significant difference in folic acid between free-range and conventional eggs. Mother Earth News magazine conducted a study comparing conventional eggs in the USA with free-range eggs from 12 different producers, finding that free-range eggs contained 1,038 micrograms of folic acid—21 times more than conventional eggs.

The economic aspect of grazing chickens should not be overlooked. Acquiring farmland in Estonia is challenging due to high prices and land consolidation by large producers. Additionally, land-use regulations impose strict limitations on how land can be utilized. Grazing chickens provide an affordable entry into the agricultural sector with low investments and fixed costs. A bonus is that permanent grasslands can be used, and large land areas are not required.

At Ahisilla farm, free-range chickens are part of the farm's local circular economy. In addition to chickens, they grow vegetables and cut flowers, ensuring nothing goes to waste. Chickens act as excellent composters of plant residues—everything leftover from vegetables either goes into an egg or returns to the soil as chicken manure.

ADDITIONAL INFORMATION

Ahisilla Taluaed first learned about pastured poultry practices through YouTube videos and later studied them in more depth in the Regenerative Agriculture Masterclass by Richard Perkins.

The main risks in pastured poultry farming are aerial predators, as terrestrial predators can be kept away using electric fencing powered by solar energy. Additionally, the risk of bird flu must be considered, and measures should be taken to minimize its impact.

Pastured poultry and its effects urgently need more research in Europe. The practice has proven successful, but farmers require scientific backing to gain recognition in legislation and policies. Without this support, innovation and sustainable practices will not spread as effectively as they could or should.

In the autumn of 2024, Ahisilla Taluaed faced a dispute with officials in Estonia while applying for an animal welfare subsidy. The subsidy was completely denied as the practice was unrecognized and unsupported by officials. In 2025, the animal welfare policy for laying hens is set to be reviewed, with the goal of supporting pastured poultry.

PHOTOS



Photo 1: Ahisilla farm



Photo 2: Ahisilla farm and farmer



Photo 3: Ahisilla farm, chicken coop

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Richard Perkins | Making Small Farms Work

URL:

<https://www.richardperkins.co/>

Title/Description

Research shows eggs from pastured chickens may be more nutritious

URL:

<https://www.psu.edu/news/agricultural-sciences/story/research-shows-eggs-pastured-chickens-may-be-more-nutritious>

Title/Description

Rohumaal kana pidamine tõstab linnu elu, muna ja põllu kvaliteeti

URL:

<https://www.pikk.ee/rohumaakana/>

Title/Description:

Free-range farming: a natural alternative to produce vitamin D-enriched eggs

URL:

<https://pubmed.ncbi.nlm.nih.gov/24607306/>

Title/Description:

Ahisilla taluaed – Facebook page

URL:

<https://www.facebook.com/ahisillataluaed>

Title/Description:

Ahisilla taluaed – Instagram page

URL:

https://www.instagram.com/ahisilla_taluaed/

4.3 “Rewarding Mechanisms”: A Collection of Practice Abstracts

This subchapter presents 7 Practice Abstracts developed within the project, focusing on rewarding mechanisms for sustainable agricultural and forestry practices. These abstracts provide an overall framework for Rewarding Mechanisms in Climate-Smart Farming, as well as innovative approaches, key challenges, and best practices identified across different regions.

PRACTICE ABSTRACT #9**SHORT TITLE IN ENGLISH**

Definitions and categorization of Rewarding Mechanisms for Climate Smart Farming

COUNTRY AND CLIMATIC ZONE

Pan-European Scope

CONTACT

Laurène Lebelt (laurene.lebelt@climate-kic.org), Stelios Dritsas (stelios.dritsas@climate-kic.org)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Knowledge Sharing
2. Awareness

THEMATIC AREA

Rewarding Mechanisms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Farmers need rewarding mechanisms in the pursuit of the green transition in agriculture. These rewarding mechanisms can be sourced from public or private entities, and can take the form of regulatory responsibilities, voluntary public money, R&D, voluntary carbon markets, and price premiums/labelling.

On EU agricultural land, there are various climate action systems, including emission reduction, carbon sequestration, and climate adaptation. There are **two types of rewarding sources: public and private**. Public rewarding

refers to financing from the international community, EU, State, or regional level, while private rewarding includes funding from companies, private groups, and consumers through carbon markets or price premiums.

There are several ways to reward land users and farmers for their environmental activity, with two main types: **result-based** and **action-based results**. Action-based rewarding provides farmers with compensation or incentives for carrying out specific agricultural methods, while result-based rewarding is linked to a confirmed outcome. The timing of rewarding can be either ex-ante, a financial prelude to climate action, or ex-post, following the farmer's climate action. Combinations of timing are also possible.

LONGER DESCRIPTION – IN ENGLISH

Farmers face numerous positive and negative effects on the climate and adaptiveness to climate change. Using two sorts of policy approaches—those of "carrots," or "sticks"—broadly speaking, legislators and the private sector can inspire farmers to adopt measures regarding climate change effects mitigation (i.e., lower emissions or enhance carbon removals) and adaptability to climate change. "Sticks" comprise taxes, regulatory restrictions or prohibitions, quotas or quantitative limitations, and taxes—all of which penalise or make it unlawful to carry out negative activities, therefore changing behaviour. On the other hand, legislators or the private sector might pay farmers for doing good deeds, therefore encouraging positive change - "carrots".

We focus on these so-called "carrots," which we see as rewarding mechanisms, in this Practice Abstract. Rewards for agricultural activities that lower or avoid emissions, remove carbon from the atmosphere, adapt to climate change are defined as mechanisms that reward farmers in return for implementing a desired action or delivering a desired outcome and can be sourced from public or private entity or even a mix of both. Aiming to promote a behavioural change, using positive incentives, and their voluntary character define rewarding systems. Among other things, these motivating systems can take the following format: regulatory responsibilities (that are rewarded), voluntary public money, R&D, voluntary carbon markets and price premiums/labelling.

Furthermore, on EU agricultural land, there is a wide spectrum of climate action on plot, field, and landscape level which are captured to different degrees in the several present or proposed rewarding systems. One can classify them as follows:

1. **emission reduction** which is mainly methane (CH₄) from enteric fermentation and N₂O emissions from managed agricultural soils, which together represent over 80% of agricultural emission in the EU.
2. **the removal of CO₂** from the atmosphere by converting between land cover types and managing the agricultural soils to increase carbon sequestration and
3. **the response to climate change** by increasing the adaptive capacity of the agricultural sector.

Moreover, two basic types define rewarding sources: public and private ones. While most of the current systems rely on monetary financing, both might entail both financial and non-financial benefits. With public rewarding we refer to financing or help from the international community, EU, State or regional level e.g. Common Agricultural Policy (CAP), R&D initiatives, etc. Any kind of funding from the private sector—companies, private groups, and consumers—through carbon markets or price premiums and labelling qualifies as private rewarding. Public/private funding sources include market-based strategies whereby the Government plays a major role either supplying or distributing the funds also exist.

There are several ways to reward land users and farmers for their environmental activity. They can be generally divided between the delivery of result-based or action-based results. Action-based rewarding gives the farmer in line with generally quite particular agricultural methods satisfying results. Independent of the outcome of those designated management activities, farmer or landowner gets a compensation or incentive for carrying out such activities. Result-based rewarding is linked to a confirmed outcome and calls for a direct, explicit relationship between the result delivered—e.g., emission decreased or avoided, carbon sequestered—and the incentive the farmer gets.

Lastly, there are several design choices about the timing of the rewarding, that is, when and how often the rewarding is occurring. Ex-ante rewarding is the (typically financial) prelude to climate action. While the real result of climate change might take years, long-term initiatives requiring significant upfront expenditures may find relevance for this payment mechanism. Ex-post rewarding is done following the farmer's generated climate action. Over the course of the project, the rewarding might be one-off or continuous, multi-year. Also, combinations of the timing of rewarding are feasible.

ADDITIONAL INFORMATION

By using these definitions and the scope presented here, specific factsheets per category of rewarding mechanism will be published in the next months, to help advisors and farmers to identify better what specific rewarding mechanism are, if it is beneficial to apply and what would be the requirements. Moreover, another aspect that the project will analyze is the needs of farmers and advisors regarding rewarding mechanisms and the first results are expected by the end of this year (2025).

This specific practice abstract works as an introductory material to the topic of rewarding mechanisms in agriculture regarding climate-related actions. Others will follow on analyzing more specific categories of rewarding mechanisms.

PRACTICE ABSTRACT #10**SHORT TITLE IN ENGLISH**

Farmers and Advisors' Needs from Rewarding Mechanisms

COUNTRY AND CLIMATIC ZONE

Pan-European Scope

CONTACT

Laurène Lebelt (laurene.lebelt@climate-kic.org), Stelios Dritsas (stelios.dritsas@climate-kic.org)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Needs identification
2. Needs understanding
3. Information exchange

THEMATIC AREA

Rewarding Mechanisms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Farmers and farm advisors play a crucial role in implementing climate-smart farming practices, but they often face challenges in accessing and benefiting from reward mechanisms. This practice abstract aims to identify the key needs of farmers and advisors to engage more effectively with these mechanisms.

Farmers need straightforward, organized, and easy-to-understand information about the available mechanisms, including policy contexts, eligibility criteria, benefits, and potential risks. Organizations like farmer groups are essential for sharing this information.

Easy-to-use carbon calculation tools should help farmers determine their potential earnings from carbon credits. Clear policies with consistent rules, less red tape, and proven methods are crucial for building farmers' trust in mechanisms. Reliable advisors can help farmers through application processes, compliance tracking, and economic feasibility evaluation. Offering fair and motivating prices for carbon credits and other sustainable production outputs is essential.

Advisors need ongoing training, especially on carbon market tools, updates on national and EU policies, and incentive programs. They need accessible tools to help farmers navigate the complexities of rewarding mechanisms, offering risk assessments and evaluations of long-term economic impacts. Access to trustworthy validation and certification schemes ensures that incentives offered to farmers are credible and financially sound.

To make the most of rewarding mechanisms, it is important to create a user-friendly information platform, strengthen advisory networks by training advisors in climate-smart agriculture and reward systems, equip them with decision-making tools, establish consistent rules, simplify processes, provide stable policies to motivate farmers' participation, boost market opportunities through fair pricing for carbon credits and sustainable products, and encourage knowledge sharing.

LONGER DESCRIPTION

Farmers and farm advisors are essential in putting climate-smart farming practices into action, but they encounter difficulties in accessing and benefitting from rewarding mechanisms. These mechanisms, like financial incentives and market-based carbon credits, can really help out, but their complexity often makes it tough to adopt them effectively. This practice abstract aims to understand and present the essential needs of farmers and advisors, helping them engage more effectively with rewarding mechanisms.

Farmers need straightforward, organised, and easy-to-understand information about the rewarding mechanisms available to them. This includes details on policy contexts, eligibility criteria, benefits, and potential risks. Organisations like farming groups are really important for sharing this information. They need guidance that is organised by farm type, country, and practices, so they can find the best mechanisms for their needs. Easy-to-use carbon calculation tools should help them figure out how much they could earn from carbon credits. Clear policies with consistent rules, less red tape, and proven methods are crucial for building farmers' trust in

mechanisms. Farmers really benefit from having reliable advisors by their side to help them through application processes, keep track of compliance, and evaluate economic feasibility. They want to be part of the design process instead of just joining in when it is time to implement. Additionally, it is really important to have fair and motivating prices for carbon credits and other sustainable production outputs. Offering financial incentives to help cover initial costs and manage productivity risks is also crucial. Visiting farms, sharing success stories, and creating spaces for knowledge exchange help farmers learn from one another's experiences, building trust and encouraging teamwork in solving problems.

Advisors need ongoing training, especially regarding carbon market tools, updates on national and EU policies, and incentive programs. Keeping up with regular updates and getting insights from experts will really boost their capacity to help farmers. Advisors need accessible frameworks and tools to help farmers navigate the complexities of rewarding mechanisms, offering risk assessments and evaluations of long-term economic impacts. Advisors really need to have access to trustworthy validation and certification schemes so they can ensure that the incentives being offered to farmers are credible and financially sound. They really help encourage farmers to get involved in rewarding programs. It's important to share practical examples, success stories, and clear connections between climate-smart farming and the benefits it brings in a way that resonates with everyone. They need materials like presentations and leaflets to share nationally, along with chances to involve farmers in group activities that can improve their chances of getting funding.

To make the most of rewarding mechanisms, here are some suggested actions. It is important to encourage sharing knowledge through farmer networks, workshops, and engaging digital platforms. Farmers and farm advisors have expressed the need for a user-friendly information platform that includes organised and up to date resources at the EU and national level, inspiring success stories, reliable methods, and a list of support organisations. It is also critical to strengthen advisory networks by training advisors in climate-smart agriculture and reward systems. By equipping them with decision-making tools, they can provide better support to farmers. Finally, creating the right conditions for climate-smart farming to be profitable is necessary. To achieve this, policymakers should focus on creating consistent rules, simplifying processes, and providing stable policies to motivate farmers to get involved. Policymakers and business stakeholders should also boost market opportunities by encouraging fair

pricing for carbon credits and sustainable products, while supporting financial models that don't depend just on subsidies.

This practice abstract is meant for farmers interested in exploring climate-smart farming rewarding mechanisms, along with the farm advisors who support them in this journey. Policymakers, agricultural organisations, and market participants can also gain from these insights to improve and encourage effective rewarding mechanisms.

ADDITIONAL INFORMATION

This practice abstract aims to identify and understand farmers and advisors' needs from rewarding mechanisms regarding climate smart farming. This work is based on literature and elements gained through webinars with farmers and advisors. An analysis of these needs and more specific recommendations will be provided in the coming months.

PRACTICE ABSTRACT #11**SHORT TITLE IN ENGLISH**

Rewarding Mechanisms – The example of Label-Bas Carbone

COUNTRY AND CLIMATIC ZONE

France

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Result-based rewards
2. Credible and Transparent Carbon Certification
3. Flexibility and Market Opportunities

THEMATIC AREA

Rewarding Mechanisms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Label Bas-Carbone is a voluntary climate certification framework established by the French government to support projects that contribute to greenhouse gas emission reductions and carbon sequestration in France. It provides a structured approach to monitoring, reporting, and verifying carbon reductions or removals, ensuring transparency and credibility in the national voluntary carbon market. Farmers, farm advisors, and other agricultural operators can utilize this mechanism to adopt sustainable practices while securing financial rewards from private, public, or mixed funding sources.

The Label Bas-Carbone framework operates on a result-based rewarding method, meaning that financial compensation is tied to measurable environmental outcomes. Farmers implementing low-carbon practices must conduct a carbon audit at the start of the project and another at the end to assess progress. These practices fall under six approved farming methodologies and include actions such as reducing mineral fertilizer use in field crops, optimizing herd management in livestock farming, decreasing reliance on imported soybean feed, using cover crops, and planting hedges. Project proposals must be approved by the French Ministry of Ecological Transition, and independent auditors assess progress throughout the project cycle. Once the certification is obtained, project developers and their partners can contract with financiers to pay for the change of practices. Contracts are negotiated over the counter, but it has been observed that funding for agricultural projects is around €40-60/tCO₂.

The governance of the Label Bas-Carbone is managed by the French Ministry of the Environment, which oversees the approval of methodologies, ensures compliance with regulatory standards, and supervises the work of third-party auditors. By leveraging this framework, farmers can contribute to climate mitigation efforts, enhance farm sustainability, and access new revenue streams within the carbon market.

LONGER DESCRIPTION – IN ENGLISH

The Label Bas-Carbone is a voluntary climate certification framework established by the French government to support projects that contribute to greenhouse gas emission reductions and carbon sequestration in France. It provides a structured approach to monitoring, reporting, and verifying carbon reductions or removals, ensuring transparency and credibility in the national voluntary carbon market. Farmers, farm advisors, and other agricultural operators can utilize this mechanism to adopt sustainable practices while securing financial rewards from private, public, or mixed funding sources.

The Label Bas-Carbone framework operates on a result-based rewarding method, meaning that financial compensation is tied to measurable environmental outcomes. Farmers implementing low-carbon practices must conduct a carbon audit at the start of the project and another at the end to assess progress. These practices fall under six approved farming methodologies and include actions such as reducing mineral fertilizer use in field crops, optimizing herd management in livestock farming,

decreasing reliance on imported soybean feed, using cover crops, and planting hedges. Project proposals must be approved by the French Ministry of Ecological Transition, and independent auditors assess progress throughout the project cycle.

The financial arrangements between farmers and funders are not regulated by the Label Bas-Carbone itself, allowing flexibility in contractual agreements. Typically, these initiatives are collective efforts involving multiple farmers and intermediaries, which enhances collaboration and improves project success rates.

The financial rewards under the Label Bas-Carbone system follow a multi-year payment structure, with contracts typically lasting five years, renewable upon review. Farmers can receive payments annually or at the end of the five-year period, depending on the agreed contract with funders and intermediaries. It has been observed that funding for agricultural projects is around €40-60/tCO₂. Importantly, project validation under the Label Bas-Carbone does not guarantee financing; once a project is approved, intermediaries must secure funding, predominantly from private entities seeking to contribute to climate mitigation efforts.

The governance of the Label Bas-Carbone is managed by the French Ministry of the Environment, which oversees the approval of methodologies, ensures compliance with regulatory standards, and supervises the work of third-party auditors. The financial resources for the projects primarily come from companies and institutions looking to fulfill sustainability commitments through voluntary carbon contribution. The Label Bas-Carbone initiative aligns with France's National Low-Carbon Strategy, reinforcing the country's commitment to achieving carbon neutrality and fostering sustainable agricultural transitions.

For farmers, the Label Bas-Carbone offers an opportunity to integrate climate-smart practices into their operations while securing financial incentives. However, challenges remain, including the complexity of administrative procedures, the need for initial financial investments, and the uncertainty of securing funding. Advisors play a crucial role in supporting farmers through these processes by providing guidance on methodologies, assisting with carbon audits, and facilitating connections with potential funders. By leveraging this framework, farmers can contribute to climate mitigation efforts, enhance farm sustainability, and access new revenue streams within the carbon market.

Overall, the Label Bas-Carbone serves as a promising model for voluntary carbon markets, offering a structured and credible approach to rewarding climate-positive agricultural practices. Its emphasis on transparency, third-party validation, and performance-based incentives makes it an effective tool for encouraging sustainable farming while addressing climate challenges. As the framework continues to evolve, improvements in accessibility, strengthening environmental integrity and increased financial guarantees could further enhance its impact and attractiveness to farmers and agricultural stakeholders.

ADDITIONAL INFORMATION

This Practice Abstract aims in presenting a well-known example of rewarding mechanism from France. It is worth noting that dealing with the Label Bas Carbone presents various difficulties for farmers, farm advisers, and intermediaries especially with relation to the difficulty of financing the projects. More than 3,000 farmers are involved in projects with ambitious targets of removals and emission reductions but only 20-30% of these projects found entities to buy the LBC certificates. The challenge is therefore to increase the volume of financing for agricultural projects by raising awareness of the standard among economic players, initiating public-private funds and increasing confidence in agricultural projects, which are sometimes complex for financiers to understand. Many, particularly smaller farms, might find it difficult to afford the large upfront expenses associated with switching to climate smart farming or generally to more sustainable practices. Knowledge gaps also occur, hence farm advisers might not have the skills or most recent data to properly help farmers through the label acquisition process. By means of improved training, financial assistance, and simpler measuring instruments, addressing these challenges might help the agriculture industry to make the process more accessible and successful. Moreover, the information presented here will be also available through a specific factsheet the Climate Farm Demo project will produce in the next months.

PRACTICE ABSTRACT #17**SHORT TITLE IN NATIVE LANGUAGE**

Agroforstsysteme: Einstieg und Fördermöglichkeiten in Deutschland

SHORT TITLE IN ENGLISH

Agroforestry Systems: Introduction and Funding Opportunities in Germany

COUNTRY AND CLIMATIC ZONE

Germany, warm-temperate mid-latitude climate zone

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Climate adaptation through CO₂ sequestration, erosion protection and yield stability
2. Financial support through funding programs at federal and state levels
3. Long-term improvement in soil quality and biodiversity

PRODUCTION SYSTEM

Organic farming

THEMATIC AREA

Agroforestry and relation to landscape

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Agroforstsysteme verbinden Landwirtschaft mit Gehölzen und bieten Landwirten sowohl ökologische als auch wirtschaftliche Vorteile. Sie tragen zur Klimaanpassung bei, indem sie Wetterextreme wie Trockenheit und Starkregen abfedern, CO₂ binden und die Bodenqualität durch Erosionsschutz, Humusbildung und bessere Wasserhaltefähigkeit verbessern.

Seit 2023 sind Agroforstsysteme in Deutschland offiziell förderfähig. Über die Gemeinsame Agrarpolitik (GAP) erhalten Landwirte 200 € pro Hektar Gehölzfläche. Zusätzlich bieten Bundesländer wie Bayern, Mecklenburg-Vorpommern, Niedersachsen und Sachsen Investitionsförderungen. Externe Programme wie SilvoCultura unterstützen zudem die Pflanzung von Frucht- und Wertholzbäumen mit bis zu 50 € pro Baum (bei mindestens 70 Bäumen).

Neben den finanziellen Anreizen sind Agroforstsysteme auch wirtschaftlich attraktiv. Sie ermöglichen zusätzliche Einnahmen durch die Produktion von Nüssen, Früchten, Energie- oder Wertholz und können landwirtschaftliche Produkte durch nachhaltige Anbaumethoden und Storytelling-Potenziale aufwerten.

Für eine erfolgreiche Etablierung ist eine gezielte Pflege entscheidend. Besonders in den ersten Jahren nach der Pflanzung sind Maßnahmen wie Beikrautregulierung durch Hacken oder Mulchen wichtig, um Konkurrenz durch Unkraut zu minimieren. Langsam wachsende Gehölze benötigen bis zu drei Jahre intensive Pflege, bevor sie stabil wachsen und langfristige Vorteile bieten.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Agroforestry systems combine agriculture with woody plants and offer farmers both ecological and economic benefits. They contribute to climate adaptation by cushioning weather extremes such as drought and heavy rainfall, binding CO₂ and improving soil quality through erosion protection, humus formation and better water retention capacity.

Agroforestry systems have been officially eligible for funding in Germany since 2023. Farmers receive €200 per hectare of woodland via the Common Agricultural Policy (CAP). In addition, federal states such as Bavaria, Mecklenburg-Western Pomerania, Lower Saxony and Saxony offer investment subsidies. External programs such as SilvoCultura also support

the planting of fruit and timber trees with up to €50 per tree (for at least 70 trees).

In addition to the financial incentives, agroforestry systems are also economically attractive. They generate additional income through the production of nuts, fruit, energy or timber and can add value to agricultural products through sustainable cultivation methods and storytelling potential.

Targeted care is crucial for successful establishment. Especially in the first few years after planting, measures such as weed control by hoeing or mulching are important to minimise competition from weeds. Slow-growing woody plants require up to three years of intensive care before they grow stably and offer long-term benefits.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Agroforstsysteme, eine Kombination aus Landwirtschaft und Gehölzen, eröffnen Landwirten zahlreiche ökologische und ökonomische Chancen. Diese Systeme bieten nicht nur eine nachhaltige Antwort auf den Klimawandel, sondern auch vielseitige Möglichkeiten zur Diversifizierung von Betrieben. Durch die Integration von Bäumen in landwirtschaftliche Flächen können Wetterextreme, wie Trockenphasen oder Starkregen, abgepuffert werden. Gleichzeitig wird die CO₂-Bindung gefördert, wodurch ein Beitrag zum Klimaschutz geleistet wird. Auch die Bodenqualität wird durch Agroforst verbessert: Bäume verhindern Erosion, fördern die Humusbildung und unterstützen die Wasserhaltefähigkeit des Bodens.

In Deutschland wurde Agroforst seit 2023 offiziell als förderfähige Praxis anerkannt. Durch die Gemeinsame Agrarpolitik (GAP) können Landwirte jährlich 200 € pro Hektar Gehölzfläche über die Öko-Regelungen erhalten. Zusätzlich bieten Bundesländer wie Bayern, Mecklenburg-Vorpommern, Niedersachsen und Sachsen spezifische Investitionsförderungen an, um Agroforstsysteme umzusetzen. Externe Programme wie SilvoCultura unterstützen zudem die Pflanzung von Frucht- oder Wertholzbäumen, wobei pro Baum bis zu 50 € gefördert werden (bei mindestens 70 gepflanzten Bäumen). Diese Förderinstrumente erleichtern den Einstieg und reduzieren finanzielle Hürden.

Neben der finanziellen Förderung sind Agroforstsysteme auch ökonomisch attraktiv. Baumstreifen bieten Einnahmemöglichkeiten durch Frucht- und Nussproduktion, Energieholz oder hochwertige Wertholzerträge. Gleichzeitig erhöhen sie die Attraktivität landwirtschaftlicher Produkte, da

sie Umweltleistungen und Storytelling-Potenziale mitbringen, die sich positiv auf die Vermarktung auswirken können.

Die langfristige Wirtschaftlichkeit hängt jedoch von einer gezielten Pflege ab. Besonders wichtig ist die Beikrautregulierung, um die Konkurrenz der Gehölze mit Unkräutern zu minimieren. Im ersten Jahr nach der Pflanzung sollte der Boden schwarz gehalten werden, um optimale Wachstumsbedingungen zu schaffen. Maschinelle Methoden wie das Hacken oder Mulchen erleichtern diese Pflege. Langsam wachsende Gehölze erfordern zudem bis zu drei Jahre intensive Pflege, bevor sie stabil wachsen und ihren vollen Nutzen entfalten können.

LONGER DESCRIPTION – IN ENGLISH

Agroforestry systems, a combination of agriculture and woody plants, open numerous ecological and economic opportunities for farmers. These systems not only offer a sustainable response to climate change, but also a wide range of opportunities for farm diversification. By integrating trees into agricultural areas, weather extremes such as dry spells or heavy rainfall can be buffered. At the same time, CO₂ sequestration is promoted, which contributes to climate protection. Agroforestry also improves soil quality: trees prevent erosion, promote humus formation and support the soil's ability to retain water.

In Germany, agroforestry has been officially recognized as an eligible practice since 2023. Through the Common Agricultural Policy (CAP), farmers can receive €200 per hectare of wood per year via the organic regulations. In addition, federal states such as Bavaria, Mecklenburg-Western Pomerania, Lower Saxony and Saxony offer specific investment subsidies to implement agroforestry systems. External programs such as SilvoCultura also support the planting of fruit or timber trees, with funding of up to €50 per tree (if at least 70 trees are planted). These funding instruments make it easier to get started and reduce financial hurdles.

In addition to financial support, agroforestry systems are also economically attractive. Tree strips offer income opportunities through fruit and nut production, energy wood or high-quality timber yields. At the same time, they increase the attractiveness of agricultural products as they provide environmental services and storytelling potential that can have a positive impact on marketing.

However, long-term profitability depends on targeted maintenance. Weed control is particularly important to minimize competition between the woody plants and weeds. In the first year after planting, the soil should be

kept black to create optimal growing conditions. Mechanical methods such as hoeing or mulching facilitate this care. Slow-growing woody plants also require up to three years of intensive care before they can grow stably and develop their full potential.

PHOTOS



Photo 1: Farm in Germany



Photo 2: Farm in Germany

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

Webinar CFD Agroforestry - Agroforstsysteme im Ackerbau und auf der Weide

URL:

<https://youtu.be/Z1ff5UB6LxQ>

Title/Description

Werragut

URL:

<https://www.werragut.de/agroforst/>

Title/Description

ReSoLa e.V.

URL:

<https://resola-ev.de/>

Title/Description

SilvoCultura

URL:

<https://www.silvocultura.ch/>

PRACTICE ABSTRACT #33**SHORT TITLE IN ENGLISH**

The Carbon Removals and Carbon Farming (CRCF) Regulation

COUNTRY AND CLIMATIC ZONE

Pan-European

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Cost-effective monitoring
2. Regulatory alignment
3. Market opportunities

PRODUCTION SYSTEM

N/A

THEMATIC AREA

Rewarding Mechanisms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Carbon Removals and Carbon Farming (CRCF) Regulation (EU/2024/3012) is a voluntary certification framework introduced by the EU to support climate efforts by offering farmers an additional income source. Aligned with the EU Commission's Vision for Sustainable Agriculture, CRCF

provides more incentives (carrots) and fewer rules (sticks). It enhances transparency and reduces greenwashing by establishing EU-wide quality criteria and monitoring processes. The regulation categorizes certificates into permanent carbon removals, carbon storage in products, carbon farming removals, and soil emission reductions, with standardized procedures for third-party verification, certification, and registration.

Carbon farming practices include agroforestry, peatland restoration, use of cover crops, reduced fertilizer use, and biodiversity-focused reforestation. Methodologies describing MRV (Monitoring, Reporting, Verification) will be drafted by the EU Commission and published via delegated acts. The certification process builds on the Renewable Energy Directive, enabling compliance through audits, registries, and standardized baselines. Copernicus satellite data and remote sensing will make monitoring cost-effective and ensure data accuracy.

The CRCF introduces group certification for small-scale farmers and foresters, enabling verified carbon credits through sustainable practices and innovation. It aims to reduce the admin burden by using group certification and bioenergy certification models. While it currently covers only soil-related emissions, methane reductions from livestock could be included from 2027.

Though use-cases are not specified, CRCF is expected to benefit farmers, foresters, agri-food businesses, policymakers, and advisors by incentivizing sustainable practices and shaping climate policy. It supports a scalable, transparent carbon removal market in the EU, rewarding nature-inclusive land management.

LONGER DESCRIPTION – IN ENGLISH

The Carbon Removals and Carbon Farming (CRCF) Regulation (EU/2024/3012) aims to support the European Union's efforts to tackle climate change by introducing a voluntary certification framework for carbon removals, carbon storage in products and carbon farming. Aligned with the EU's evolving Vision for Sustainable Agriculture, the Regulation reflects a shift towards prioritizing incentives ("carrots") over regulatory mandates ("sticks"), emphasizing economic opportunities as key drivers of sustainability. It tries to address challenges in carbon market credibility by setting out EU-wide quality criteria and monitoring processes that seek to enhance transparency and reduce the risks of greenwashing. The Regulation encourages investment in innovative carbon removal technologies and sustainable carbon farming, aiming to create economic

opportunities for farmers, foresters, and businesses while maintaining environmental integrity.

The CRCF Regulation attempts to organize carbon removals into distinct categories, including permanent carbon removals, carbon storage in products, carbon farming, and soil emission reductions. It proposes standardized procedures for third-party verification, certification, and registration to improve reliability and consistency across the EU. Some of the approaches it highlights include permanent carbon removals through technologies like Direct Air Carbon Capture with Storage (DACCS), Bioenergy with Carbon Capture and Storage (BECCS), and chemically binding CO₂ into products to secure long-term carbon storage. Carbon farming encompasses practices that seek to increase carbon sequestration in soil and forests or to cut emissions, such as agroforestry, peatland restoration, use of cover crops, reducing fertilizer application, and biodiversity-conscious reforestation. The certification process builds on the Renewable Energy Directive, looking to streamline compliance through audits, registries, and standardized baselines. Monitoring is expected to become more cost-effective with the use of Copernicus satellite technology and remote sensing, helping to lower reporting costs while ensuring data accuracy. The Regulation also introduces group certification to ease participation for small-scale farmers and foresters.

The CRCF Regulation seeks to create new financial opportunities for farmers, foresters, and businesses by allowing them to generate verified carbon credits through sustainable land management and technological innovations. Carbon farming has the potential to offer an additional income stream, while certification scheme owners involved in permanent carbon removals could attract sustainability-focused investors. The Regulation tries to reduce the administrative burden by enabling group certification and drawing on existing bioenergy certification models, making compliance more feasible for smaller landowners. Ensuring alignment with EU climate policies, the certification process aims to integrate smoothly with agricultural and environmental frameworks. Additionally, climate-friendly practices in the agri-food sector could enhance resilience and competitiveness. To build on these developments, the Directorate-General for Climate Action has commissioned a study to further assess policy options for encouraging climate action within the agri-food value chain, particularly with a view toward the post-2030 period.

The CRCF Regulation is expected to benefit farmers and foresters by providing financial incentives for adopting sustainable land management

and emission reduction techniques. Agri-food businesses may use market-based climate policies to reinforce sustainability across their supply chains. Investors and carbon market stakeholders could find a more credible framework for supporting certified carbon removal initiatives. Policymakers and advisory services may use the Regulation as a foundation for informed decision-making on climate and agricultural policy, e.g. nature credits. By working toward a transparent, science-based framework, the CRCF Regulation hopes to establish a reliable and scalable carbon removal market in Europe, contributing to the EU's broader climate goals while offering practical advantages to land managers and industry stakeholders.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Regulation (EU) 2024/3012 of the European Parliament and of the Council of 27 November 2024 establishing a Union certification framework for permanent carbon removals, carbon farming and carbon storage in products

URL:

<https://eur-lex.europa.eu/eli/reg/2024/3012/oj/eng>

PRACTICE ABSTRACT #55**SHORT TITLE IN NATIVE LANGUAGE**

AgroImpact, une association multi-acteurs permettant de valoriser et d'accompagner les efforts de décarbonation des agriculteurs suisses

SHORT TITLE IN ENGLISH

AgroImpact - a Multi-stakeholder Association to Promote and Support Decarbonization Efforts by Swiss Farmers

COUNTRY AND CLIMATIC ZONE

Switzerland, all zones

CONTACT

Pascal Python (pascal.python@agridea.ch)

3 BENEFITS OF THE PRACTICE

1. Market valuation and recognition of farmers' efforts
2. Inter-cantonal dynamics between public and private players
3. Pooling human and financial resources

PRODUCTION SYSTEM

For all systems: crops and animals

THEMATIC AREA

Rewarding mechanisms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

AgroImpact est une jeune association créée en décembre 2023 pour accélérer la transition climatique de l'agriculture. Elle propose une démarche visant à soutenir les agriculteurs dans l'adoption de pratiques résilientes face au changement climatique.

Les agriculteurs s'engagent sur une base volontaire dans le programme AgroImpact. Ils bénéficient, en fonction du canton, de soutien financier supplémentaire pour la réalisation d'un bilan carbone et l'adoption de mesures d'adaptation au changement climatique. La démarche AgroImpact permet des synergies avec d'autres projets régionaux en cours. L'agriculteur perçoit également une prime climatique versée par l'acheteur. Il est à préciser que la démarche AgroImpact ne génère pas de vente de certificats carbone.

La spécificité de l'association réside dans une gouvernance partagée regroupant des représentants d'organisations agricoles (producteurs, chambres d'agriculture, conseil), de la recherche, d'association (ONG), et des acheteurs (industriels, coopérative et distributeurs) de matières premières. Des collaborations multiples se mettent en place et se coordonnent entre public et privé.

Les agriculteurs s'engagent pour 6 ans dans le dispositif AgroImpact :

- Réalisation par un conseiller d'un bilan carbone complet de l'exploitation ;
- Adoption d'un plan d'action personnalisé pour réduire son empreinte climatique ;
- Mise en place de la démarche de certification ClimaCert qui comprend :
 - Mesure du bilan carbone de l'exploitation.
 - Identification de leviers d'amélioration spécifiques.
 - Obtention de l'attestation ClimaCert (les résultats de l'empreinte climatique de l'exploitation ainsi que son stockage carbone sont attestés).
 - Inscription sur un registre public.
- A l'issue du processus, l'agriculteur certifié peut percevoir annuellement des primes climatiques pour la production de matières premières bas carbone. Les primes sont octroyées par les acheteurs/industriels membres de l'association.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

AgroImpact is a young association created in December 2023 to accelerate the climate transition of agriculture. It proposes an approach aimed at supporting farmers in the adoption of resilient practices to climate change.

Farmers participate in the AgroImpact program on a voluntary basis. Depending on the canton, they receive additional financial support for the assessment of a carbon footprint and the adoption of adaptation and mitigation measures. The AgroImpact approach allows synergies with other ongoing regional projects. The farmer also receives a climate premium paid by the buyer. It should be noted that the AgroImpact approach does not generate any sales of carbon certificates.

The association is unique in that it has a shared governance structure involving representatives of agricultural organizations (producers, chambers of agriculture, advisory), research organizations, NGOs and buyers (industrialists, cooperatives and distributors) of raw materials. A wide range of collaborations in AgroImpact are being established and coordinated between the public and private sectors.

Farmers commit to the AgroImpact program for 6 years:

- An advisor carries out a full carbon assessment of the farm.
- A specific action plan is adopted to reduce the climate footprint.
- The ClimaCert certification process is implemented, which includes:
 - Measuring the farm's carbon footprint.
 - Identification of specific measures for improvement.
 - Obtaining the ClimaCert certificate (the results of the farm's climate footprint and its carbon storage are certified).
 - Registration in a public register.
- At the end of the process, the certified farmer can receive annual climate premiums to produce low carbon raw materials. The premiums are granted by buyers/industrialists who are members of the association.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

AgroImpact website page

URL:

<https://agroimpact.ch/>

Title/Description

AgroImpact : une association pour accompagner la transition climatique de l'agriculture suisse

URL:

<https://www.youtube.com/watch?v=YLaBz-tgmkA> (French)

PRACTICE ABSTRACT NUMBER #68**SHORT TITLE IN ENGLISH**

Rewarding Climate Action: Recognizing the Contributions of Organic Farmers

CONTACT

Lisa Sinnhuber (lisa.sinnhuber@organicseurope.bio)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. **Climate & Biodiversity Gains** - Organic farming cuts emissions, builds soil health, and protects biodiversity.
2. **Holistic Approach** - Supports whole-farm sustainability beyond just carbon.
3. **Rewarding Mechanisms Needed** - Organic farmers must be recognized and compensated for ongoing climate efforts.

PRODUCTION SYSTEM (IF RELEVANT)

Organic agriculture

THEMATIC AREA

Soil health and biodiversity, rewarding mechanisms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Organic farming offers a systemic approach for climate mitigation and adaptation while sustaining healthy soils and protecting biodiversity. Organic agriculture reduces greenhouse gas emissions by refraining from the use of synthetic fertilizer and pesticides and using less energy. Common organic practices like crop rotations including legumes, cover

crops or reduced tillage help to improve soil quality and fertility while also contributing to higher soil organic carbon stocks. These practices also support species protection and increase biodiversity as well as support ecosystem functions. Overall, the holistic approach of organic leads to more resilient farming systems.

However, organic farmers face some limitations under existing rewarding mechanisms for their climate action.

Carbon farming schemes typically only reward “additional” efforts. This is a barrier for first movers, like organic farmers, as they often have already built up soil organic carbon stocks. Their past efforts are not recognized and the maintenance of soil carbon is not incentivized.

In many cases, existing carbon farming schemes have a narrow approach. They do not take a whole farm approach and a carbon balance at farm level. Instead, they focus on efficiency and only on specific aspects like soil organic carbon. Externalities of the farming system, including biodiversity and ecosystem services, are often neglected.

Current rewarding mechanisms often do not remunerate farmers proportionally to the environmental benefits they provide. For example, in some EU Member States organic farmers have restricted access to environmental payments of the CAP due to the alleged issue of double funding.

To ensure organic farmers are rewarded appropriately, mechanisms should:

- take a systemic, whole farm approach to rewarding climate action.
- compensate proportionally for providing environmental benefits.
- recognize the efforts of first movers and support the maintenance of carbon soil.

4.4 “Living Labs”: A Collection of Practice Abstracts

This subchapter presents a series of six Practice Abstracts related to Living Labs, focusing on both overarching strategies for establishing and managing them, as well as concrete examples of existing Living Labs that showcase innovative practices, regional adaptations, and effective stakeholder involvement.

PRACTICE ABSTRACT #24

SHORT TITLE IN NATIVE LANGUAGE

Co-construire une démarche de conception pas-pas-pas dans un groupe multi compétence sur l'adaptation au changement climatique du secteur laitier du Nord de la Nouvelle-Aquitaine.

SHORT TITLE IN ENGLISH

Co-Constructing a Step-by-Step Design Approach in a Multi-Skill Group on Adapting to Climate Change in the Dairy Sector in the North of the Nouvelle-Aquitaine Region

COUNTRY AND CLIMATIC ZONE

France, Atlantic area (Atlantic region subject to summer drought)

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Step by step design
2. Reduced age at calving
3. Multi-stakeholder co-innovation

PRODUCTION SYSTEM

- Dairy cattle
 - Intensive milk cow farm, without grazing, maize based feeding, milking robot, OAP "Beurre Charentes-Poitou".

THEMATIC AREA

Forage production, crops management, herd management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Le Living Lab (LL) français travaille sur l'adaptation au changement climatique de la filière laitière du Nord de la Nouvelle-Aquitaine. Fin 2024, les participants ont souhaité orienter les travaux du LL sur une étude de cas. Nous avons donc initié une démarche de conception pas-à-pas. Le principe est de réaliser un diagnostic de l'un des élevages participant au LL, puis de proposer des leviers d'amélioration. L'éleveur choisit alors de mettre en place un ou plusieurs changements de pratique. Quelques mois plus tard, le groupe se réunit à nouveau pour un point d'étape et une analyse collective des résultats. Le groupe propose alors de nouveaux leviers d'amélioration.

L'un des éleveurs du groupe a accepté de se prêter au jeu. L'atelier s'est déroulé sur une journée. La matinée en salle a démarré par une présentation par l'éleveur de son exploitation, suivi d'un travail en trois sous-groupes, qui devaient compléter un "rapport d'étonnement" sur la situation présentée, puis lister des pistes d'adaptation. Suite à ces propositions, l'éleveur a identifié plusieurs leviers pertinents à creuser mais pour lesquels il rencontre des freins techniques : réduction du renouvellement, diminution de l'âge au 1^{er} vêlage, et l'intégration d'une plus grande diversité de fourrages. Nous avons donc choisi d'axer la visite d'exploitation organisée l'après-midi sur ces thèmes.

A la fin de la journée, nous avons débriefé de l'ensemble des observations. Les remarques du groupe ont amené l'éleveur à affiner sa stratégie, mais est apparu le besoin d'être accompagné et rassuré techniquement pour pouvoir mettre en place de nouvelles pratiques. Les partenaires techniques du LL se sont engagés à travailler ces points avec lui d'ici la prochaine réunion.

Lors du bilan, les participants ont exprimé une grande satisfaction sur le déroulement de l'atelier, et sont pressés de se revoir pour "le prochain épisode" pour continuer à accompagner cette réflexion dans la durée.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The French Living Lab (LL) is working on adapting to climate change in the dairy sector in the north of the Nouvelle-Aquitaine region. At the end of 2024, the participants wanted to focus the LL's activities on a case study. We therefore initiated a step-by-step design approach. The principle is to carry out a diagnosis of one of the farms taking part in the LL, and then to propose measures for improvement. The farmer then chooses to implement one or more changes in his practices. A few months later, the group meets again for a progress review and a collective analysis of the results. The group then suggests new measures for improvement.

One of the farmers in the group agreed to take part. The workshop took place over one day. The morning session began with a presentation by the farmer of his farm, followed by work in three sub-groups, who were asked to complete an 'astonishment report' on the situation presented, and then to list possible adaptations. Following these proposals, the farmer identified several relevant levers to be explored, but for which he was encountering technical obstacles: reducing turnover, reducing the age at first calving, and integrating a greater diversity of forages. We therefore chose to focus the afternoon farm visit on these themes.

At the end of the day, we debriefed all the observations. The group's comments led the farmer to refine his strategy, but the need for technical support and reassurance to be able to implement new practices became apparent. LL's technical partners undertook to work with him on these points between now and the next meeting.

At the end of the meeting, the participants expressed great satisfaction with the way the workshop had gone and were keen to meet up again for 'the next episode' to continue to support this process over the long term.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Dans le Living Lab France, nous réfléchissons à l'adaptation de la filière laitière du Nord de la Nouvelle-Aquitaine au changement climatique. Notre groupe rassemble tous les maillons de la filière : éleveurs (tous types de systèmes représentés, bio, herbagers, intensifs), conseillers techniques, chercheurs, responsables de l'aval.

Après deux réunions qui ont permis d'initier une dynamique de groupe, les participants ont souhaité orienter les travaux sur une étude de cas concret.

Nous avons donc initié une démarche de conception pas-à-pas.

Le principe est de choisir un membre du groupe volontaire, de réaliser ensemble un diagnostic en rapport avec une problématique préalablement

définie, puis de proposer des leviers d'amélioration. L'éleveur peut ensuite mettre en place un ou plusieurs changements de pratique. Quelques mois plus tard, le groupe se réunit à nouveau pour un point d'étape et une analyse collective des résultats : est-ce que le levier va dans le bon sens ? va trop loin ou pas assez ? Cela soulève-t-il d'autres problématiques qui n'étaient pas prévues ? Le groupe propose alors de nouvelles actions pour améliorer la pratique. C'est un processus d'innovation qui nécessite un temps long, compatible avec le projet Climate Farm Demo.

L'un des éleveurs du groupe a accepté de se prêter au jeu. Son exploitation concentre de nombreuses problématiques récurrentes, qui en font une exploitation assez représentative : problématique de main-d'œuvre tout d'abord avec un départ en retraite prochain de l'un des deux associés. Un système fourrager fortement soumis aux aléas climatiques avec un parcellaire compliqué (morcellé et argileux) sans irrigation. Un système animal intensif qui doit répondre à un impératif financier important. Enfin, une grande tension au niveau de la charge de travail, qui oblige à rationaliser les tâches au maximum. Beaucoup d'éleveurs peuvent donc se reconnaître dans au moins un de ses paramètres.

L'atelier s'est déroulé sur une journée, le matin en salle et l'après-midi sur l'exploitation. Un important travail préparatoire a été réalisé, comprenant un RDV chez l'éleveur pour bien définir ses attentes et la problématique, puis au bureau pour "prémacher" les éléments du diagnostic (assolement, parcellaire, système fourrager, rations...). Nous avons choisi d'axer la journée sur l'adaptation du système fourrager aux aléas climatiques.

La matinée en salle a démarré par une présentation par l'éleveur de son exploitation, avec l'appui des animateurs. Avant cela, nous avons pris soin de bien poser le cadre du fonctionnement du groupe, car le diagnostic par des pairs peut être déstabilisant pour l'éleveur hôte, il est donc essentiel que cela se déroule dans un climat d'écoute et de bienveillance. Nous avons veillé à ce que la présentation soit la plus factuelle possible de la part de l'éleveur, pour ne pas orienter les réflexions.

Ensuite nous avons réparti les participants en trois sous-groupes. Chaque groupe devait compléter un "rapport d'étonnement" sur la situation présentée, puis lister des idées de pistes d'adaptation.

Après la restitution et la synthèse des sous-groupes, l'éleveur a pu donner des informations complémentaires pour expliquer certains "étonnements" et écarter d'emblée certaines idées trop éloignées de la réalité actuelle de son exploitation.

Il a ensuite identifié plusieurs leviers qui lui semblent pertinents à creuser mais pour lesquels il rencontre des freins techniques : La réduction de l'âge au vêlage des génisses, et l'intégration d'une plus grande diversité de fourrages. Nous avons donc choisi d'axer la visite d'exploitation sur ces deux thèmes pour discuter de ces freins.

L'après-midi, une partie du groupe est parti faire un tour de parcelles pour visualiser les contraintes liées au parcellaire, qui limitent la diversification fourragère. L'autre groupe est resté sur le site du bâtiment des vaches laitières pour visualiser les contraintes liées au stockage des fourrages, et le troupeau en lien avec l'âge au vêlage.

A la fin de la journée, nous avons débriefé de l'ensemble des observations.

L'âge au vêlage semble incohérent car il est de plus de 30 mois dans un système intensif où les génisses ne sortent pas du tout au pâturage. De plus **le taux de renouvellement** est élevé. L'éleveur explique cela pour deux raisons. D'une part, il a une surface importante en prairie permanente donc du foin qui n'est pas valorisable dans la ration des vaches en lactation. Donc la phase d'élevage, même si elle est longue, n'est pas très onéreuse car elle permet de valoriser du fourrage qui serait sinon excédentaire. D'autre part, un vêlage tardif permet pour l'éleveur d'obtenir un gabarit suffisant pour les animaux. Il a en effet remarqué que des "petites vaches" avaient du mal à s'imposer au robot et que cela pénalisait la fréquentation, surtout dans le cas d'un robot très saturé. Quant au taux de renouvellement, il permet de sécuriser la production laitière en cas de problème sanitaire. L'élevage a en effet connu un épisode de maladie hémorragique gingival il y a quelques années et a pu maintenir le cheptel grâce aux nombreuses génisses présentes. L'éleveur souhaite donc maintenir cette sécurité.

De l'avis général, **la diversification fourragère** est compliquée à mettre en œuvre pour l'instant car l'éleveur n'a pas de plateforme de stockage d'ensilage avec des silos couloir. Il stocke tout son maïs en silo taupinière, ce qui prend beaucoup de place et empêche de stocker un autre type de fourrage. L'éleveur doit en préalable retrouver de la capacité financière pour mettre en place ce levier.

Les remarques du groupe ont amené l'éleveur à s'interroger sur la pertinence de sa stratégie de renouvellement (âge au vêlage et nombre de génisses). Il pense essayer de réduire l'âge au vêlage, mais a besoin d'un accompagnement technique pour ne pas dégrader le gabarit des animaux au vêlage.

L'éleveur s'est également interrogé sur le niveau élevé de sécurisation à tous les échelons de son système. Il craint qu'une baisse du niveau de sécurisation entraîne une baisse du produit, donc des difficultés financières. Il est proposé de réaliser avec lui d'ici la prochaine réunion une ou plusieurs simulations pour évaluer les impacts d'un changement de système plus profond (par exemple "est-ce que je peux réduire la production de mes vaches, quel est le seuil en deçà duquel la baisse du produit sera supérieure à la baisse des charges ?")

Lors du bilan, les participants ont exprimé une grande satisfaction sur le déroulement de l'atelier, et sont pressés d'avoir "le prochain épisode" pour continuer à accompagner cette réflexion dans la durée.

LONGER DESCRIPTION – IN ENGLISH

In the French Climate Farm Demo Living Lab, we are working on climate change adaptation of dairy sector in the North of Nouvelle-Aquitaine. Our LL represents all types of stakeholders in the dairy sector: farmers, advisors, researchers, dairy represents.

After two meeting dedicated to initiate the group's dynamic (with an agenda balanced between a technical focus, discussion about climate adaptation and the works to start in the living lab), the group decided to focus on a concrete case study.

So, we initiated a step-by-step design workshop. The principle is to choose a voluntary member in a group, and to carry out a joint diagnosis in relation to an issue, and then to propose some levers to improve. The farmer can then implement one or more changes in his practices. A few months later, another workshop is dedicated to analyse the changes in practice. Does the lever meet the issue or not? Does it create new problem(s)? The group can then suggest news changes in practice. The step-by-step design takes a long time (5 or 6 years), which makes it compatible with the Climate Farm Demo project.

A farmer of the LL has agreed to implement the process in his farm. This farm is representative of the farms in the area for several reasons. First, one of the two partners will be retiring in the next year or two. Secondly, the forage system is highly vulnerable to climatic hazards, with fragmented and very clayey land parcels and no irrigation. But the herd is managed very intensively to meet high financial expectations. Finally, the partners have a very heavy workload, and every task must be optimised.

The workshop took place over one day, in the morning in the meeting room and in the afternoon on the farm. A great deal of preparatory work was

carried out, including a meeting with the farmer to define his expectations and the problem, and then in the office to prepare the elements of the diagnosis (crop rotation, land parcels, forage system, rations, etc.). We chose to focus the day on adapting the forage system to climatic hazards.

The morning session began with the farmer presenting his farm, with the support of the facilitators. Before this, we took care to set out the framework for the group's operation, as diagnosis by peers can be destabilising for the host farmer, so it's essential that it takes place in an atmosphere of listening and caring. We made sure that the presentation was as factual as possible on the part of the farmer, so as not to lead the discussion.

We then divided the participants into three sub-groups. Each group had to complete an 'astonishment report' on the situation presented and then list ideas for adaptations.

After the sub-groups feed backs, the farmer was able to provide additional information to explain some of the 'astonishments' and to rule out some ideas that were too far removed from the current reality of his farm.

He then identified several measures that he felt should be explored, but for which he was encountering technical obstacles: reducing the age at calving of heifers and integrating a greater diversity of forages. We therefore chose to focus the farm visit on these two themes to discuss these obstacles.

In the afternoon, part of the group went on a tour of the plots to see the constraints linked to the plot structure, which limit forage diversification. The other group stayed at the dairy barn to look at the constraints linked to fodder storage, and the herd in relation to calving age.

At the end of the day, we debriefed all the observations.

The age at calving seems inconsistent as it is over 30 months in an intensive system where the heifers do not go out to pasture at all. In addition, the turnover rate is high. The farmer explained this for two reasons. Firstly, he has a large surface of permanent grassland, which means he has hay that cannot be used in the ration of lactating cows. So the rearing phase, even if it's a long one, isn't very costly because it allows him to make use of fodder that would otherwise be surplus. In addition, late calving allows the farmer to obtain sufficient size for the animals. He has noticed that 'small cows' find it difficult to get through the milking robot, and that this penalises attendance, especially in the case of a very saturated milking robot as his. As for the renewal rate, it helps to secure milk production in the event of health problems. The farm suffered from gingival haemorrhagic disease a few years

ago and was only able to maintain its herd thanks to the large number of heifers present. The farmer wants to maintain this security.

In the general opinion, forage diversification is complicated to implement now because the farmer does not have a silage storage platform with alley silos. The farmer needs to improve his financial capacity before implementing this lever.

The group's comments led the farmer to question the relevance of his renewal strategy (age at calving and number of heifers). He therefore is now thinking of trying to reduce the age at calving but needs technical support to ensure that the animals' size at calving does not deteriorate.

The farmer also questioned the high level of security at all levels of his system. He was afraid that a drop in the level of security would lead to a drop in production, and therefore financial difficulties. It was suggested that, between now and the next meeting, one or more simulations would be carried out to assess the impact of a more far-reaching system change (e.g. 'can I reduce the production of my cows, what is the threshold below which the fall in income will be greater than the fall in costs?')

At the end of the workshop, the participants expressed great satisfaction with the way the workshop had gone and were keen to participate in 'the next episode' so that they could continue to support this process over the long term.

PRACTICE ABSTRACT #41**SHORT TITLE IN ENGLISH**

Monitoring and Evaluation of Living Labs

COUNTRY AND CLIMATIC ZONE

N/A

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Gain transparency on the Living Lab process, objectives and impact
2. Stimulate reflexivity and collective learning
3. Support decision making in the Living Lab

THEMATIC AREA

N/A

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Within Climate Farm Demo, 10 Living Labs (LLs) are established. These LLs are creative multi-actor spaces for co-designing innovative climate-smart solutions in real-life settings. Multiple actors—such as farmers, researchers, advisors, suppliers, and policymakers—are involved in developing climate-smart solutions based on climate-related challenges in the region.

To strengthen the co-creation process in the LLs, a specifically designed Monitoring & Evaluation (M&E) approach has been developed. The objectives of M&E for the LLs are:

- to support transparency and facilitate peer-to-peer learning between LLs,
- to add reflexivity to strengthen the co-design process within the LL, and
- to improve LL responsiveness to changes and developments in and around the LL.

Literature provides many tools and approaches for M&E of LLs. Some tools focus on organizational aspects of the LL, others on the co-creation process or on the impact of the LL. Different indicators and approaches can be used, largely depending on the objective of M&E—there is no one-size-fits-all M&E framework for LLs.

In Climate Farm Demo, the M&E framework developed is based on a harmonized approach to allow for comparison between LLs. Monitoring of the LL includes continuously tracking activities by completing an LL diary. This is the responsibility of the LL monitor, a role specifically created in each LL. At regular intervals—twice a year—the LL monitor and facilitator evaluate the LL. The evaluation uses a template assessing the overall performance of the LL (efficiency, efficacy, and stakeholder engagement).

Additionally, the monitor and facilitator complete a self-assessment survey by scoring the LL on several Key Performance Indicators (KPIs). This helps them reflect on the resources, capabilities, collaborations, and innovations within the living lab. The list of KPIs was developed based on literature related to Living Labs.

PHOTOS



Photo 1: LL meeting of the French Living Lab on dairy cattle systems

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Methodological framework for supporting and running the 10 living labs in Climate Farm Demo.

URL:

https://climatefarmdemo.eu/wpcontent/uploads/2023/10/CFD_D4.1_Methodological_framework_for_supporting_and_running_the_10_Living_Labs_WR_26.09.2023.pdf

PRACTICE ABSTRACT #51**SHORT TITLE IN NATIVE LANGUAGE**

Living Lab - Methode voor het interactief genereren en prioriteren van ideeën

SHORT TITLE IN ENGLISH

Living Lab - Method for Interactive Generation and Prioritization of Ideas

COUNTRY AND CLIMATIC ZONE

All

CONTACT

Herman Schoorlemmer (herman.schoorlemmer@wur.nl)

3 BENEFITS OF THE PRACTICE

1. Collection of ideas of all participants
2. Everyone involved in prioritization
3. Energetic approach useful for large groups from 8-80 persons

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Je bent begeleider van een Living Lab en wilt ideeën brainstormen en prioriteren. Hoe doe je dit met alle deelnemers, maar zonder te vervallen in eindeloze discussies? Je hebt alleen een open ruimte nodig waarin mensen door elkaar kunnen lopen, een kaartje (A6 formaat) en een pen voor elke deelnemer. Volg de onderstaande stappen.

1. Stel een vraag aan de groep waarop je individuele antwoorden wilt. Bijvoorbeeld: wat is de meest interessante kans voor ons Living Lab? ..of.. wat we de volgende keer moeten bespreken is.. Schrijf deze vraag op een bord zodat iedereen het kan zien.



2. Geef iedereen 3 minuten om een antwoord te bedenken. Iedereen mag maar 1 idee geven. Vraag om dit in 3 tot 5 woorden op het kaartje te schrijven. Er mag maar op 1 kant van de kaart geschreven worden.
3. Vraag iedereen om op te staan met hun kaart en pen in de hand. Laat iedereen 1 minuut lang kriskras door elkaar lopen en laat ze continu de kaarten uitwisselen zonder naar de kaart te kijken. Moedig een hoog tempo aan.
4. Klap in je handen en vraag iedereen stil te staan. Iedereen heeft een willekeurige kaart in de hand. Vraag om duo's te vormen met de dichtstbijzijnde persoon en vraag om beide kaarten te bespreken en een oordeel te vellen. Verdeel per duo 7 punten over de 2 kaarten. Het beste idee krijgt 4 of meer punten. Het mindere idee 3 of minder. Schrijf deze score op de achterkant van de betreffende kaart.
5. De 2^{de} ronde begint weer met door elkaar lopen en gelijktijdig uitwisselen van de kaartjes. Na 1 minuut worden in duo's weer 7 punten verdeeld en opgeschreven op de achterkant van het kaartje. Idem voor ronde 3 en 4.
6. Vraag iedereen om de 4 scores op te tellen die op de achterkant staan van de kaart die ze in hun hand hebben. Het resultaat ligt tussen 0 en 28.
7. Plenair selecteer je antwoorden met de hoogste score, zoals bij een veiling: wie heeft 28 punten? Wie 27, 26 enz. Schrijf op de flip-over de 3-6 ideeën met de hoogste scores en dus met draagvlak van de deelnemers.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

You are a facilitator of a Living Lab and want to brainstorm and prioritize ideas. How do you do this with all the participants, but without falling into endless discussions? All you need is an open space where people can mingle, a card (A6 size) and a pen for each participant. Follow the steps below:

1. Ask a question of the group to which you want individual answers. For example: what is the most interesting opportunity for our Living Lab? or...what we should discuss next time is.... Write this question on a board for everyone to see.

2. Give everyone 3 minutes to come up with an answer. Everyone may only give 1 idea. Ask to write this in 3 to 5 words on the card. Only 1 side of the card may be written on.
3. Ask everyone to stand up with their card and pen in hand. Let everyone crisscross for 1 minute and have them continuously exchange cards without looking at the card. Encourage a fast pace.
4. Clap your hands and ask everyone to stand still. Everyone has a random card in their hand. Ask to form pairs with the nearest person and ask to discuss both cards and make a judgment. For each pair, divide 7 points between the 2 cards. The best idea gets 4 or more points. The inferior idea 3 or less. Write this score on the back of the corresponding card.
5. The 2nd round begins again with walking and exchanging cards simultaneously. After 1 minute, 7 points are again distributed in pairs and written on the back of the card. Ditto for rounds 3 and 4.
6. Ask everyone to add up the 4 scores written on the back of the card they have in their hand. The result is between 0 and 28.
7. Plenary select answers with the highest score, as in an auction: who has 28 points? Who has 27, 26, etc. Write on the flip chart the 3-6 ideas with the highest scores and therefore with a lot of commitment.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Je bent begeleider van een Living Lab met een grote groep boeren en belanghebbenden. Je wilt ideeën of knelpunten verzamelen of agendapunten voor de volgende bijeenkomst. Hoe doe je dit met alle deelnemers, maar zonder te vervallen in eindeloze discussies? Je hebt alleen een open ruimte nodig waarin mensen door elkaar kunnen lopen, een kaartje (A6-formaat) en een pen voor elke deelnemer. Volg de onderstaande stappen.

1. Stel een vraag aan de groep waarop je individuele antwoorden wilt. Bijvoorbeeld: de meest relevante uitdaging voor ons Living Lab is ... of... de meest interessante marktkans die ik zie is... of.. wat we de volgende keer moeten bespreken is... Schrijf deze vraag op een bord of flap zodat iedereen het kan zien.
2. Geef iedereen 3 minuten om zijn/haar antwoord te bedenken. Vraag naar hun beste idee. Benadruk dat iedereen maar 1 idee mag geven. Vraag hen om dit in 3 tot 5 woorden op het kaartje

- te schrijven. Er mag maar op 1 kant van de kaart geschreven worden.
3. Vervolgens nodig je iedereen uit om op te staan met hun kaart in de ene hand en hun pen in de andere. Laat iedereen 1 minuut lang kriskras door elkaar lopen en laat ze continu de kaarten uitwisselen zonder naar de kaart te kijken. Moedig een hoog tempo aan.
 4. Klap in je handen en vraag iedereen stil te staan. Iedereen heeft een willekeurige kaart in zijn/haar hand. Vraag om duo's te vormen met de dichtstbijzijnde persoon en vraag om beide kaarten te bespreken en een oordeel te vellen. Verdeel per duo 7 punten over de 2 kaarten. Het beste idee krijgt 4 of meer punten. Het mindere idee 3 of minder. Schrijf deze score op de achterkant van de betreffende kaart.
 5. De 2^{de} ronde begint door iedereen weer door elkaar te laten lopen en continu kaartjes te wisselen. Herhaal stap 4..
 6. Idem (ronde 3).
 7. Idem (ronde 4).
 8. Vraag iedereen om de 4 scores van de 4 rondes op te tellen. Die staan op de achterkant staan van de kaart die ze in hun hand hebben. Het resultaat ligt tussen 0 en 28.
 9. Plenair selecteer je antwoorden met de hoogste score, zoals bij een veiling: wie heeft 28 punten? Wie 27, 26 enz. Schrijf 3-6 ideeën met de hoogste scores op de flip-over.

Aandachtspunten: Het is handig om een even aantal deelnemers te hebben. Beslis of je zelf wel of niet meedoet. Bedenk dat het hier gaat om de eerste ideeën. In een later stadium kunnen ze verder worden uitgewerkt. Enthousiasmeer en stimuleer snelheid en snelle besluitvorming, anders verdwijnt de energie in de 3e en 4e ronde.

Een statisticus kan vragen hebben over de aanpak, maar de ideeën die ontstaan hebben een groot draagvlak van de hele groep.

LONGER DESCRIPTION – IN ENGLISH

You are the facilitator of a Living Lab with a large group of farmers and stakeholders. You want to collect ideas, opportunities, bottlenecks or agenda items for the next meeting. How do you do this with all the participants, but without falling into endless discussions? All you need is an open space where people can mingle, a card (A6 size) and a pen for each participant. Follow the steps below.

1. Ask a question of the group to which you want individual answers. For example: the most relevant challenge for our Living Lab is or ... the most interesting market opportunity I see is ... or ... what we should discuss next time is Write this question on a board or paper for everyone to see.
2. Give everyone 3 minutes to think of his/her answer. Ask for their best idea. Emphasize that everyone may only give 1 idea. Ask them to write it in 3 to 5 words on the card. Only 1 side of the card may be written on.
3. Then invite everyone to stand up with their card in one hand and their pen in the other. Let everyone crisscross for 1 minute and have them continuously exchange cards without looking at the card. Encourage a fast pace.
4. Clap your hands and ask everyone to stand still. Everyone has a random card in his/her hand. Ask to form pairs with the nearest person and ask to discuss both cards and make a judgment. For each pair, divide 7 points between the 2 cards. The best idea gets 4 or more points. The inferior idea 3 or less. Write this score on the back of the corresponding card.
5. The 2nd round begins by getting everyone mixed up again and continuously changing cards. Repeat step 4.
6. Ditto (round 3).
7. Ditto (round 4).
8. Ask everyone to add up the 4 scores shown on the back of the card they have in their hand. The result is between 0 and 28.
9. Plenary select answers with the highest score, as in an auction: who has 28 points? Who has 27, 26, etc. Write 3-6 ideas with the highest scores on the flip chart.

Points of attention: It is helpful to have an even number of participants. Decide whether to participate yourself. Remember that these are initial ideas which could be worked out in detail later. Enthuse and encourage speed and quick decision-making, otherwise the energy dissipates in the 3rd and 4th rounds.

A statistician may have questions about the approach, but the ideas that emerge have strong support from the whole group.

PHOTOS



Photo 1: Discussing and prioritising ideas from the whole group in pairs

PRACTICE ABSTRACT #60**SHORT TITLE IN NATIVE LANGUAGE**

Živé laboratórium zamerané na živú a zdravú pôdu, schopnú produkovať zdravé potraviny, ktoré pozitívne ovplyvňujú zdravie ľudí.

SHORT TITLE IN ENGLISH

Living Laboratory on Living and Healthy Soil, Capable of Producing Healthy Food that Positively Affects People's Health

COUNTRY AND CLIMATIC ZONE

Slovakia, mild continental climate

CONTACT

Robert Dohál - The board Director of Agricultural Cooperative Krakovany – Stráže, (robert.dohal@gmail.com)

3 BENEFITS OF THE PRACTICE

1. Improved Water Retention – reduces impact of rainfall fluctuations; water remains in porous soils.
2. Enhanced Nutrient Availability – balanced mineralization; organic nutrients more accessible to plants.
3. Stronger Plant Health & Quality – increased disease resistance; fewer harmful substances; higher nutritional value.

PRODUCTION SYSTEM (IF RELEVANT)

Crops production

THEMATIC AREA

Soil management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Zdravá štruktúrna aeróbna pôda musí mať správny pomer vody a vzduchu, ktorý umožňuje zadržiavanie a presakovanie vody tak, aby sa vzduch nevytláčal. Presakovanie vody, ponechávanie rastlinných zvyškov na povrchu, nenarúšanie jednotlivých pôdnych vrstiev a života v pôde, teda rešpektovanie prírodných princípov a prírodného mikrobiómu, je predpokladom zdravej pôdy; rastliny a huby si totiž dokážu preposielať živiny a vlahu na veľké vzdialenosti. Mechanické kyprenie, oranie pôdy, bolo preto na farme nahradené biologickým spracovaním pôdy, symbiózou koreňov zelených rastlín a hubami. Pôdne organické hmoty, včítane pôdnych húb tak dokážu zabezpečiť stabilizáciu pôdnych agregátov. Farma uplatňuje holistický prístup, neuplatňuje iba jeden vybraný parameter, ale využíva kombináciu viacerých, pričom jednotlivé kroky boli zavádzané postupne:

- Od roku 2011 začali s minimalizačnými technológiami a prestali s orbou,
- od roku 2013 zaradili krycie plodiny,
- v rokoch 2016 až 2018 postupne prešli úplne na bezorbové hospodárenie,
- od sezóny 2020/2021 úplne prestali používať fungicídy, insekticídy a umelé hnojivá.

V roku 2014 sa začal uplatňovať systém monitorovania: merania prínosu regeneračných postupov začali meraním organického uhlíka v pôde, v spolupráci so Slovenskou poľnohospodárskou univerzitou v Nitre. Od rokov 2020-2021, kedy prešla farma na hospodárenie bez hnojív, sa hodnotí minerálny dusík v pôde v rôznych fázach vegetácie. Od roku 2020 je sledovaná úroveň mikrobiálneho života v pôde s dôrazom na pôdne huby a baktérie. V roku 2023 začala spolupráca so Slovenskou akadémiou vied na hodnotení diverzity pôdnych húb v pôdnych vzorkách metódou DNA metabarcoding.

Okrem toho, prebiehajú druhý rok merania zhutnenia pôdy po prejazde kolies (rôzne kvalitné pneumatiky - flotácia) poľnohospodárskych strojov a porovnanie prejazdu po konvenčne obrábanej pôde (pri orbe) a prejazdu po pôde, ktorá bola 8-10 rokov v bezorbovom režime. Všetky merania a výskumy boli a sú realizované v rámci vedeckých (bakalárskych, diplomových, doktorandských, habilitačných) prác. Vrátane prác hodnotiacich ekonomický prínos zmeny hospodárenia z konvenčného na regeneračné.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

A healthy, structurally aerobic soil must maintain a proper water/air ratio to retain moisture without displacing air. Key to this is enabling water infiltration, leaving plant residues on the surface, and avoiding disturbance to soil layers and organisms—thus respecting natural principles and the soil microbiome. Plants and fungi play vital roles in nutrient and moisture transfer over long distances. On this farm, mechanical loosening and ploughing have been replaced by biological soil processing— a symbiosis of plant roots and fungi. Soil organic matter and fungi help stabilise soil aggregates.

The farm Agricultural Cooperative Krakovany – Stráže follows a holistic approach, implementing practices gradually:

- In 2011, minimisation technologies were introduced, and ploughing was stopped.
- From 2013, cover crops were used.
- Between 2016–2018, they transitioned to full no-till farming.
- From 2020/2021, they eliminated fungicides, insecticides, and artificial fertilisers.

Monitoring began in 2014, in partnership with the University of Agriculture, focusing on organic carbon soil. Since 2020/2021, mineral nitrogen is assessed during different crop stages. From 2020, microbial life, particularly soil fungi and bacteria—is also monitored. In 2023, collaboration with the Slovak Academy of Sciences began, using DNA metabarcoding to assess soil fungal diversity.

Additionally, soil compaction is being measured after machinery passes, comparing conventional fields to those under no-till for 8–10 years. These studies are part of various academic theses (bachelor, master's, PhD, and Habilitation), including assessments of the economic benefits of switching from conventional to regenerative practices.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Zdravá štruktúrna aeróbna pôda musí mať správny pomer vody a vzduchu, ktorý umožňuje zadržiavanie a presakovanie vody tak, aby sa vzduch nevytláčal. Presakovanie vody, ponechávanie rastlinných zvyškov na povrchu, nenarúšanie jednotlivých pôdnych vrstiev a života v pôde, teda rešpektovanie prírodných princípov a prírodného mikrobiómu, je

predpokladom zdravej pôdy; rastliny a huby si totiž dokážu preposielať živiny a vlahu na veľké vzdialenosti. Mechanické kyprenie, oranie pôdy, bolo preto na farme nahradené biologickým spracovaním pôdy, symbiózou koreňov zelených rastlín a hubami. Pôdne organické hmoty, včítane pôdných húb tak dokážu zabezpečiť stabilizáciu pôdných agregátov. Farma uplatňuje holistický prístup, neuplatňuje iba jeden vybraný parameter, ale využíva kombináciu viacerých, pričom jednotlivé kroky boli zavádzané postupne:

- Od roku 2011 začali s minimalizačnými technológiami a prestali s orbou,
- od roku 2013 zaradili krycie plodiny,
- v rokoch 2016 až 2018 postupne prešli úplne na bezorbové hospodárenie,
- od sezóny 2020/2021 úplne prestali používať fungicídy, insekticídy a umelé hnojivá.

V roku 2014 sa začal uplatňovať systém monitorovania: merania prínosu regeneračných postupov začali meraním organického uhlíka v pôde, v spolupráci so Slovenskou poľnohospodárskou univerzitou v Nitre. Od rokov 2020-2021, kedy prešla farma na hospodárenie bez hnojív, sa hodnotí minerálny dusík v pôde v rôznych fázach vegetácie. Od roku 2020 je sledovaná úroveň mikrobiálneho života v pôde s dôrazom na pôdne huby a baktérie. V roku 2023 začala spolupráca so Slovenskou akadémiou vied na hodnotení diverzity pôdných húb v pôdných vzorkách metódou DNA metabarcoding.

Okrem toho, prebiehajú druhý rok merania zhutnenia pôdy po prejazde kolies (rôzne kvalitné pneumatiky - flotácia) poľnohospodárskych strojov a porovnanie prejazdu po konvenčne obrábanej pôde (pri orbe) a prejazdu po pôde, ktorá bola 8-10 rokov v bezorbovom režime. Všetky merania a výskumy boli a sú realizované v rámci vedeckých (bakalárskych, diplomových, doktorandských, habilitačných) prác. Vrátane prác hodnotiacich ekonomický prínos zmeny hospodárenia z konvenčného na regeneračné

Na farme bol vypracovaný dokument, akýsi vnútorný predpis, včítane etického kódexu, ktorý vysvetľuje uplatňovanie 10 zásad, o ktoré sa snaží a propaguje s cieľom zjednotenia regeneračného hnutia v Európe:

1. Bezorebný systém
2. Trvalé pokrytie
3. Krycie plodiny
4. Žiadne chemikálie
5. Regeneračná pastva
6. Podpora biodiverzity

7. Šetrnosť k včelám
8. Žiadne GMO
9. Priamy predaj
10. Poctivý a férový prístup.

Hlavným dôvodom uvedených prístupov sú spotrebitelia. Ich je potrebné presvedčiť, že je životne dôležité obnoviť pôdu pre život budúcich generácií: len zdravá pôda produkuje zdravé, plnohodnotné a skutočné potraviny. Preto farma realizuje priamy predaj produkcie zákazníkom.

Krakovany Stráže je prvé poľnohospodárske družstvo na Slovensku, ktoré predáva kredity CO₂. Už 3. rok je v programe merania sekvestrácie CO₂ s českou certifikovanou spoločnosťou Carboneg. Takto získané prostriedky pomáhajú financovať vzdelávacie, výskumné a propagačné aktivity.

LONGER DESCRIPTION WEBSITE – IN ENGLISH

A healthy, structurally aerobic soil must have the correct water/air ratio to allow water to be retained and infiltrated so that air is not displaced. Water infiltration, leaving plant residues on the surface, and not disturbing the different soil layers and soil life—i.e., respecting natural principles and the natural microbiome—is a prerequisite for healthy soil, as plants and fungi are able to transfer nutrients and moisture over long distances. Mechanical loosening and ploughing have therefore been replaced on the farm by biological soil processing—a symbiosis of green plant roots and fungi. Soil organic matter, including soil fungi, can ensure the stabilisation of soil aggregates.

The farm Agricultural Cooperative Krakovany – Stráže adopts a holistic approach, not applying only one selected parameter, but using a combination of several, with the individual steps introduced gradually:

- Since 2011, they started with minimisation technologies and stopped ploughing.
- From 2013 onwards, cover crops were introduced.
- Between 2016 and 2018, they gradually switched completely to no-till farming.
- From the 2020/2021 season onwards, they completely stopped using fungicides, insecticides, and artificial fertilisers.

In 2014, a monitoring system was established: measurement of the benefits of regenerative practices began with the assessment of soil organic carbon, in cooperation with the University of Agriculture. From 2020–2021, when the farm switched to fertiliser-free management, mineral nitrogen in the soil

has been assessed at different vegetation stages. From 2020, the level of microbial life in the soil has been monitored, with an emphasis on soil fungi and bacteria. In 2023, collaboration with the Slovak Academy of Sciences began to assess the diversity of soil fungi in soil samples via DNA metabarcoding.

In addition, measurements of soil compaction after wheel passage of agricultural machinery, and comparisons between conventionally cultivated soil and soil in a no-till regime for 8–10 years, have been underway for the second year. All measurements and investigations have been and continue to be carried out as part of scientific (bachelor, diploma, doctoral, and habilitation) theses, including works evaluating the economic benefits of transitioning from conventional to regenerative management.

The farm has drawn up an internal regulation document, including a code of ethics, which explains the application of 10 principles it strives for and promotes to unify the regeneration movement in Europe:

1. No ploughing
2. Permanent coverage
3. Cover crops
4. No chemicals
5. Regenerative grazing
6. Biodiversity support
7. Bee friendliness
8. No GMOs
9. Direct sales
10. Honest and fair approach

Consumers are the main reason for adopting these approaches. They need to be convinced that restoring the soil is vital for the future of coming generations: only healthy soil produces healthy, wholesome, and real food. That is why the farm sells produce directly to customers.

Krakovany Stráže is the first agricultural cooperative in Slovakia to sell CO₂ credits. It is now in its third year in the CO₂ sequestration measurement program with the certified Czech company Carboneg. The funds raised through this help finance educational, research, and promotional activities.

ADDITIONAL INFORMATION

The farm Agricultural Cooperative Krakovany – Stráže systematically disseminates its many years of experience, which yield concrete results, to the professional and public. Since 2021, it has regularly organized various events and demonstrations on the farm, where not only farmers, but also

policy makers, researchers and students have been in attendance. The farm is open to the public every Wednesday; increasingly popular is the farm's flagship event, the Living Soil Day, held every September.

Practices, experiences and successes in increasing soil organic carbon and CO₂ sequestration are shared with other farmers not only on the farm, but also through collaboration within the Healthy Soil Task Force, which the farm has played an active role in establishing. Cooperation is being developed with experts from non-state forest owners' associations and state forests, applying the principles of nature-friendly management.

Increasingly, the farm is seeking to exchange knowledge at international level. A coalition of farmers from 6 countries is currently being formed to establish the International Regenerative Agriculture Association (IREAGA). The farm is also a recognized farm on the PREPSOIL map.

PHOTOS



Photo 1: Agricultural Cooperative Krakovany – Stráže farm - Living Soil Day 2024, a flagship event of the farm organised every September



Photo 2: Agricultural Cooperative Krakovany – Stráže farm - Living Soil Day 2024, a flagship event of the farm organised every September

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Short video from the Living Soil Day event (2024)

URL:

<https://www.youtube.com/watch?v=ZgqKSXpp27k>

Title/Description

Climate Farm Demo Living Labs

URL:

<https://climatefarmdemo.eu/living-labs/>

PRACTICE ABSTRACT #93**SHORT TITLE IN NATIVE LANGUAGE**

Põllumajandusmaastike rikastamine hekkide ja põõsasribadega

SHORT TITLE IN ENGLISH

Enriching Agricultural Landscapes with Hedges and Shrub Strips

COUNTRY AND CLIMATIC ZONE

Estonia, mixed forest sub-region of the Atlantic continental region of the temperate zone

CONTACT

Karme Petrutis (karme.petrutis@metk.agri.ee)

BENEFITS OF THE PRACTICE

1. Diverse Habitats: Supports various species, boosting biodiversity.
2. Enhanced Forage Base: Provides food for birds, animals, and insects, promoting pollination.
3. Natural Pest Management: Encourages ecological balance, reducing pests.
4. Carbon Storage: Increases carbon sequestration, mitigating climate change.
5. Microclimate Stability: Regulates temperature and moisture levels.
6. Wind Protection & Erosion Control: Shields crops, birds, and wildlife.
7. Aesthetic Value: Creates visually appealing agricultural landscape

PRODUCTION SYSTEM (IF RELEVANT)

Biodiversity- and climate friendly plant production

THEMATIC AREA

Soil health and biodiversity

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Tartu Ülikool katsetab koos talunikega põllumajandusmaastike rikastamist liigirikaste hekkidega. Climate Farm Demo projektis osalev OÜ Mäemõisa rajas oma põllule esimese katsena 130-meetrise, mitmesugustest hekitaimedeks sobivatest puudest ja põõsastest koosneva heki (tärnpuu, lodjapuu, magesõstar, mustsõstar, tikker, viirpuu, sarapuu, jalakas jmt). Järgnevatel aastatel on plaan rajada umbes 4 kilomeetrit erinevaid elurikkaid hekke. Esimese katseriba hekitaimede valikul sooviti lisada eelkõige kodumaiseid taimi, millest osad on ka söödavate viljadega. Järgmistes etappides luuakse eriilmelisi hekke/puuderibasid, milledest mõnede eesmärk on pakkuda ka saagiks sobivaid vilju, teised keskenduvad rohkem elurikkuse toetamisele ning mõnede puhul on oluline ka esteetiline mulje.

Hekitaimede istutusosalal katsetati erinevaid multše ja tüvekaitsemeetodeid. Tootja üheks hekkide rajamise põhjuseks oli soov luua rohekoridore, mis ühendaksid metsamassiive, mida eraldavad mitmed põllud. Heki osas tehakse projektis tähelepanekuid erinevate istutusvahendite ning -protsessi kohta, mis omakorda võiks aidata järgmiste hekkide istutamise puhul nii tootjaid endid kui ka teisi hekihuvilisi. Teadlased soovivad rajada nii pügamist vajavaid kui ka vabakujulisi hekke.

Asukoha valikul tuleks kindlasti arvestada kohalike olude, ootuste ja võimalustega. Mitmeliigilistel ja ümbruskonna looduslikest liikidest koosnevatel hekkidel on kahjustajaid vähem. Istutamiseks on hea valida erineva kõrgusega, aga ka erinevatel aegadel õitsevaid ja viljuvaid liike. Nutikas on rajada ka kohati laiemaid ribasid kohtadesse, kus on rohttaimestiku hooldus raskendatud. Hekid või põõsasribad rajatakse üldjuhul varakevadel või sügisel. Kõrgema kasvuga põõsad võiks paigutada väiksemate rühmadena põõsasriba keskele, väikesekasvulisemad suuremate rühmadena riba servadesse. Esimestel aastatel vajavad põõsasribad ja hekid rohkem hoolt, sh ka multšimist. Hekide ja põõsasribade ümber peaks olema niidetav rohumaariba, millesse võib külvata looduslikke seemnesegusid.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The University of Tartu is collaborating with farmers to enrich agricultural landscapes by planting diverse hedgerows. As part of the Climate Farm Demo project, OÜ Mäemõisa established the first trial, planting a 130-meter hedgerow with various trees and shrubs suitable for hedging, including buckthorn, viburnum, blackcurrant, gooseberry, hawthorn, hazel, and elm. Over the next few years, they plan to establish approximately 4 kilometers of hedgerows.

For the first trial, they focused mainly on native plants, some bearing edible fruits. In subsequent stages, they will create different types of hedgerows and tree lines—some designed for harvestable fruits, others to support biodiversity, and some for aesthetic appeal.

The planting area also includes experiments with different mulches and trunk protection methods. One key reason for establishing hedgerows was to create green corridors that connect forest masses separated by fields. The project also includes observations on planting tools and techniques, offering insights for both the farmers and other hedgerow enthusiasts.

Researchers recommend establishing both pruned and free-form hedgerows. The location choice should consider local conditions, expectations, and possibilities. Hedgerows with a mix of species, including natural ones from the surrounding area, are more likely to survive. It is advised to select species of different heights, with flowering and fruiting occurring at different times.

In areas where maintaining herbaceous vegetation is difficult, wider strips are recommended. Hedgerows and shrub strips are best established in early spring or autumn. Taller shrubs should be grouped toward the center, while smaller shrubs should be placed around them.

During the first few years, hedgerows require more care, including mulching. A 6-meter mown grass strip around the hedgerows is recommended, which can also be seeded with natural seed mixes to support biodiversity.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Eesti Tartu Ülikool katsetab projekti „Loodusrikas Eesti“ raames koos põllumeestega põllumajandusmaastike rikastamist liigirikaste hekkidega. Eesmärgiks on luua põllumajandusmaastikele elurikkust, aga rikastada ka piirkonna vaateid. Umbes 1000 ha suurune Climate Farm Demo demofarm OÜ Mäemõisa on samuti projektiga seotud. Tootja rajas põllule 130 meetrise, mitmesugustest hekitaimedeks sobivatest puudest ja põõsastest koosneva katseheki - lodjapuu, magesõstar, mustsõstar, tikker, türnpuu, viirpuu,

sarapuu, jalakas jmt. Kogu ala on hoolikalt disainitud ja taimede valik väga läbimõeldud.

Hekitaimede valikul sooviti lisada eelkõige söödavaid taimi, mis annaksid tulevikus saaki, aga mitmekesisust ka ümbruskonna maastikku ja pakusid silmailu. Istutusala kaeti erinevate multšide ja tüvekaitsemeetoditega. Konkreetsetel tootjal oli soov luua rohekoridore mis ühendavad, et metsamassiive, mis on omavahel mitmete põldudega eraldatud. Heki osas tehakse projektis tähelepanekuid erinevate istutusvahendite ning -protsessi kohta, mis omakorda võiks aidata järgmiste hekkide istutamise puhul nii tootjaid endid kui ka teisi hekihuvilisi.

Teadlased soovivad põllumajandus-tootjatel rajada nii pügamist vajavaid hekke kui ka vabakujulisi hekke ja põõsasribasid. Erinevate omadustega hekid ja põõsasribad (madalamaid ja kõrgemaid, hõredamaid ja tihedamaid, püगतud ja pügamata) pakuvad maastikul elupaika erinevatele liikidele. Asukoha valikul tuleks arvestada heki või põõsasriba sobivust maastikku. Kuna hekid ja põõsasribad on püsivad struktuurid, tasub neid rajada näiteks piirdeaedadena. Hekid ei tohiks piirata kauneid maastikuvaateid või vaateid veekogudele. Hekkide või põõsasribade rajamisel põldude keskele tuleb jälgida, et takistataks põllutöid.

Hekke on soovitatav rajada põhja-lõuna suunas, et need ei varjutaks põllukultuure. Kui hekid rajatakse põldude servadesse ja seetõttu on neid ka ida-lääne suunaliselt, siis tuleb arvestada hekkide kõrgusega. Mõningal juhul võib varju tekitamine olla ka soovitud – nt kariloomadele päikesevarjuks. Hekid ja põõsasribad toimivad hästi ka erosiooni takistajana, kui need paigutada risti vee eeldatava voolusuuna ja peamiste tuultega. Asukoha valimisel tuleb arvestada ka maaparandussüsteemidega. Heki või põõsasriba rajamisel on soovitatav luua mitmeliigilisi koosseise. Mitmeliigilistel hekkidel on ka bioloogilisi kahjustajaid vähem. Kasutada tuleks ümbruskonnas leiduvaid looduslikke liike, pigem lehtpõõsaid ja madalamaid lehtpuid, sekka ka pikaealisemaid puid. Istutamiseks on hea valida erinevatel aegadel õitsevaid ja viljuvaid liike, mis pakuvad toitu tolmeldajatele ning marju lindudele.

Suuremate teede äärde istutatavate hekkide puhul on oluline ka liikide vastupanuvõime keskkonna saastajatele (nt heitgaasid, tolm jne). Mõned liigid annavad rohkelt juurevõsusid, mistõttu tuleb nende ümbrust igal aastal niita. Erineva kõrgusega põõsaste ribad on tihedamad ja visuaalselt ilusamad. Ribad ei pea olema igalt poolt ühelaiused, st neid võib kohati laiendada seal piirkonnas, kus on rohttaimestiku hooldus raskendatud.

Hekkide või põõsasribade rajamise parim aeg on varakevadel või sügisel pärast lehtede langemist. Sügisene hekkide rajamine vajab vähem hoolt, kuna sügisel on vett mullas rohkem, kevaded kipuvad kuivad olema ja taimed võivad vajada lisakastmist. Põõsasriba planeerimist alustatakse suuremate puude paigutamisest u 25 m vahedega. Kui on tegemist mitmerealise hekiga, paigutatakse põõsasriba keskele kõrgemad ning servadesse madalamad ja valgusnõudlikumad liigid. Eri liiki, aga rühmiti paigutatud taimed takistavad kahjurite levikut heki piires. Kõrgema kasvuga põõsad võiks paigutada väiksemate rühmadena, väikesekasvulisemad suuremate rühmadena.

Esimestel aastatel pärast rajamist vajavad põõsasribad ja hekid rohkem hoolt, nt istikute ümbruse niitmist, põõsaste tagasilõikamist ja välja läinud taimede asendamist. Selleks, et rohttaimed ei lämmataks hekitaimi, tuleks hekialust piisavalt multšida. Põõsaste kevadine tagasilõikamine soodustab külgharude teket. Hekkide ja põõsasribade ümber peaks olema püsiva taimestikuga niidetav rohumaariba, mida ei künta, sinna ei külvata ega seal ei väetata. Sellise rohumaariba liigirikkuse toetamiseks võib sinna külvata looduslikke seemnesegusid. Tolmeldajatele meeldivad selliste seemnesegude õitsvad rohttaimed, liblikõielised taimed jt.

LONGER DESCRIPTION – IN ENGLISH

The University of Tartu is testing the enrichment of agricultural landscapes with species-rich hedgerows as part of the "Loodusrikas Eesti" project. The goal is to enhance biodiversity in agricultural landscapes while also improving the area's visual appeal. The 1,000-hectare Climate Farm Demo farm, OÜ Mäemõisa, is also involved in the project. The producer established a 130-meter trial hedgerow with various trees and shrubs suitable for hedging, including viburnum, blackcurrant, gooseberry, buckthorn, hawthorn, hazel, elm, and others. The area is carefully designed, and the plant selection is well thought out.

The hedgerow plant selection focused primarily on edible species, ensuring a future harvest, landscape diversification, and aesthetic value. The planting area was covered with different mulches and trunk protection methods. A key goal was to create green corridors connecting forest masses separated by fields. The project also includes observations on planting tools and processes, providing insights for both producers and other hedgerow enthusiasts.

Scientists recommend that agricultural producers establish both pruned and free-form hedgerows and shrub strips. Hedgerows with varying

characteristics (low and high, sparse and dense, pruned and unpruned) provide habitats for various species. When selecting a location, the suitability of the hedgerow or shrub strip to the landscape should be considered. Since hedgerows are permanent structures, they should be placed as boundary fences where possible, ensuring they do not obstruct scenic views or water bodies. If placed in the middle of fields, care must be taken not to hinder fieldwork.

Hedgerows should ideally be planted in a north-south direction to prevent shading crops. If placed along field edges in an east-west direction, their height should be considered. In some cases, shade may be beneficial, such as for livestock sun protection. Hedgerows and shrub strips also act as erosion barriers when placed perpendicular to water flow and prevailing winds. Drainage systems should also be considered.

When planting a hedgerow or shrub strip, it is recommended to use multi-species compositions, as they are more resistant to biological pests. Native species from the surrounding area should be preferred, particularly deciduous shrubs and lower deciduous trees, interspersed with longer-lived trees. Selecting species that flower and bear fruit at different times ensures food for pollinators and berries for birds.

For hedgerows along major roads, species should be resistant to environmental pollutants (e.g., exhaust gases, dust). Some species produce abundant root suckers, requiring annual mowing around them. Shrub strips with different heights create denser and more visually appealing landscapes. Their width can vary, allowing for expansion in areas where maintaining herbaceous vegetation is difficult.

The best time to plant hedgerows or shrub strips is early spring or autumn after leaves have fallen. Autumn planting requires less maintenance due to higher soil moisture, whereas spring planting may require additional watering.

Planning a shrub strip begins with placing larger trees approximately 25 meters apart. In multi-row hedgerows, taller and more light-demanding species should be planted in the center, while lower species should be positioned at the edges. Grouping different plant species together prevents pest spread. Taller shrubs should be placed in smaller groups, while shorter shrubs should be arranged in larger clusters.

Early Maintenance and Biodiversity Support

In the first few years, newly planted shrub strips and hedgerows require extra care, such as mowing around seedlings, pruning shrubs, and replacing

dead plants. To prevent herbaceous plants from smothering hedgerow plants, the area under the hedgerow should be adequately mulched. Spring pruning encourages the formation of lateral branches.

A mowable grass strip should surround hedgerows and shrub strips, with permanent vegetation that is not plowed, sown, or fertilized. To enhance biodiversity, these grass strips can be sown with natural seed mixes, providing food for pollinators like flowering plants, legumes, and other species.

ADDITIONAL INFORMATION

Today's national agricultural policy does not fully support measures to increase biodiversity on agricultural land, leaving the efforts of farmers undervalued. Financial support for such activities remains very limited.

There are no performance-based measures or impact monitoring for these initiatives. More research is needed to provide policymakers with data on the costs and benefits of establishing diverse hedgerows and shrub strips.

Currently, PRIA regulations prohibit planting hedges or shrub strips next to grassland, but from an ecological and agrotechnical perspective, a hedge cannot be properly established without an adjacent buffer zone. This is necessary to accommodate hedge expansion and allow for essential maintenance work.

PHOTOS



Photo 1: Hedgerow in OÜ Mäemõisa Pilot Demo Farm



Photo 2: Hedgerow in OÜ Mäemõisa Pilot Demo Farm



Photo 3: Hedgerow in OÜ Mäemõisa Pilot Demo Farm

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Tartu Ülikooli maastike elurikkuse töörühm (2023). Kuidas rajada elurikkaid hekke ja põõsasribasid. Juhend on koostatud LIFE-IP projekti „Loodusrikas Eesti“

URL:

<https://www.loodusrikaseesti.ee/sites/forest/files/2023-11/Kuidas-rajada-elurikkaid-hekke-ja-p66sasribasid-juhend-2023.pdf>

Title/Description

Tartu Ülikooli maastike elurikkuse töörühm (2025). Raja ja säilita hekke ja põõsaribasid. Avaldatud Tartu Ülikooli „Heapõld“ veebilehel.

URL:

<https://heapold.ee/tegevused/>

Title/Description

Loodusrikas Eesti meeskond (2024). Rajasime põllumaastikele esimesed hekid ja põõsasribad. Mäemõisa OÜ kogemus. Avaldatud projekti “Loodusrikas Eesti” Facebook lehel 25.10.2024

URL:

<https://www.facebook.com/LoodusrikasEesti>

Title/Description

Loodusrikas Eesti - Eesmärgid ja tegevused

URL:

<https://loodusrikaseesti.ee/et/eesmargid-ja-tegevused>

Title/Description

Mäemõisa lugu

URL:

<https://mullaelu.ee/about/>

PRACTICE ABSTRACT #94**SHORT TITLE IN NATIVE LANGUAGE**

Minimeeritud mulla harimine ning selle mõju muldade omadustele ja keskkonnaseisundile, sh mullaelustikule, erosiooni tõkestamisele, süsiniku sidumisele ning mulla toite- ja veerežiimile

SHORT TITLE IN ENGLISH**Impact of Minimized Tillage on Soil Properties, Biota, and Environmental Conditions**

Minimized soil tillage and its impact on soil properties and environmental conditions, including soil biota, erosion control, carbon sequestration, soil nutrient and water regime

COUNTRY AND CLIMATIC ZONE

Estonia, mixed forest sub-region of the Atlantic continental region of the temperate zone

CONTACT

Karme Petrutis (karme.petrutis@metk.agri.ee)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Lower carbon footprint
2. More profitable production
3. Longer/optimized sowing time
4. Higher organic carbon in upper soil layers
5. Increased microbiological activity
6. More individuals and species of earthworms

PRODUCTION SYSTEM

Cereals and oilseed production

THEMATIC AREA

Soil health and biodiversity

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Orgaanilise süsiniku sisaldus on otsekülvipõldudel vertikaalselt kihistunud. Ülemises 0-5 cm mullakihis on selle sisaldus suurenenud, alumistes vähenenud. Traditsiooniliselt kündes on aga Crog sisaldus mullaprofiilis ühtlane. Liikuva fosfori ja kaaliumi sisaldus on samuti otsekülvipõldudel vertikaalselt kihistunud. Otsekülvi põllud võivad hapestuda kiiremini ning vajada lupjamist. Muldade liigse tallamisega suuri probleeme ei esinenud. Mulla mikrobioloogiline aktiivsus olid kõrgemad otsekülviga põldudel. Vihmausside arvukus oli pigem suurem künnipõhistel põldudel, kuid vihmausside liikide arv oli suurem pigem otsekülviga põldudel. Taimekaitsevahendeid kasutavad otsekülvi rakendajad oluliselt rohkem kui künnipõhise tehnoloogia kasutajad. Otsekülvi põldude mullas ja multšis tuvastati rohkem taimekaitsevahendite jääke kui künnipõhistel põldudel. Otsekülvi praktiseerimisel on tootja eesmärk kaitsta minimaalsete kuludega maksimaalselt mulda, vähendada heitmeid ja tekitada suurem ajaaken optimaalseks külviajaks. Otsekülvi on katsetatud talinisu, herne, oa, odra, talirapsi, vahekultuuride, aga ka rohumaade rajamisel. Otsekülviga saab ta vähendada traktorite töötunde ja tööjõukulu, säästa mulda, kasvatada süsiniku hulka mullas ja vähendada oluliselt CO2 heidet. Künda tuleks tõesti ainult siis, kui see on hädavajalik (nt peale ulatuslikke maaparandustöid).

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The organic carbon content is vertically stratified in direct cropping fields. In the upper 0-5 cm soil layers, its content is increased, in the lower layers decreased. In traditionally ploughed soils the crop content is more uniform. Soluble phosphorus and potassium are also vertically stratified in direct cropped fields. Such fields may acidify more rapidly and require liming. There were no major problems with excessive trampling of soils. Soil microbiological activity was higher in direct seeding fields. Earthworm abundance tended to be higher in ploughed fields, but the number of earthworm species tended to be higher in direct-sown fields. The use of plant protection products of direct-sowed fields was significantly higher compared to the ploughed fields. More pesticide residues were detected in the soil and mulch of direct broadcast fields than in plough-based fields.

The aim of direct sowing is to maximize soil protection, reduce emissions and create a larger window for optimal sowing at minimum cost to the producer. Direct sowing has been tested for example in winter wheat, peas, beans, barley, winter oilseed rape, catch crops and grasslands in Estonia. With direct sowing, the tractor hours and labour costs can be reduced. We can also save soil, increase soil carbon and significantly reduce CO2 emissions. Indeed, ploughing should only be used when it is absolutely necessary (e.g. after extensive land preparation).

LONGER DESCRIPTION – IN NATIVE LANGUAGE

2022. aastal kolmel Lõuna-Eesti põllul läbi viidud otsekülvi uuringu tulemusel järeldati, et orgaanilise süsiniku sisaldus on otsekülvipõldudel vertikaalselt kihistunud. Aastate võrdluses on ülemises 0-5 cm kihis sisaldus suurenenud ja alumistes kihtides vähenenud. Traditsiooniliselt kündes on aga Crog sisaldus mullaprofiilis ühtlane. Liikuva fosfori ja kaaliumi sisaldus on samuti otsekülvipõldudel vertikaalselt kihistunud. Mulla reaktsioon ja mikroelementide sisaldus eri tehnoloogiaid kasutades aga ei erinenud. Osad otsekülvi põllud vajaksid lupjamist, kuna on muutunud ajas happelisemaks. Muldade tallatus on üldiselt vähene ja suuri probleeme ei esinenud. Mulla mikrobioloogiline aktiivsus (biomass ja hingamine) olid kõrgemad otsekülviga põldudel. Vihmausside arvukus oli pigem suurem künnipõhistel põldudel, kuid vihmausside liikide arv oli suurem pigem otsekülviga põldudel. Otsekülvipõldude 0-5 cm kihis on hoogahännaliste arvukus ja liikide arv kõrgem kui 5-10 cm kihis võrreldes künnipõhiste põldudega. Taimekaitsevahendeid kasutavad otsekülvi rakendajad oluliselt rohkem kui künnipõhise tehnoloogia kasutajad, sest otsekülvi puhul pole võimalik mehhaanilist umbrohutõrjet teha. Otsekülvi multšist leiti rohkem taimekaitsevahendite jääke kui mullast, sh peamiselt herbitsiidide ja fungitsiidide jääke. Otsekülvi põldudel tuvastati ka mullas rohkem jääke kui künnipõhistel põldudel.

Praktikas kastetati ka ribakülvi- ja ribaharimist, samuti ribaharimist koos vedelsõnniku paigaldusega töödeldavasse ribasse. Otsekülvi praktiseerimisel on tootja eesmärk kaitsta minimaalsete kuludega maksimaalselt mulda, vähendada heitmeid ja tekitada suurem ajaaken optimaalseks külviajaks. Tootja kasutab otsekülvi talinisu, herne, oa, odra ja vahekultuuride rajamisel. Katsetatakse ka talirapsi külvil ning rohumaade rajamisel. Reavaheks on 19cm ja 25cm. Otsekülvil on oluline põhu ühtlane laotus põllul ning võib olla vajalik ka mullapinna eeltöötlus. Tootja rõhutab, et otsekülviga saab ta vähendada traktorite töötunde ja tööjõukulu, säästa mulda, kasvatada süsiniku hulka mullas ja vähendada oluliselt CO2 heidet.

Samuti toonitatakse, et künd on viimane mullaharimise meede, mida maadel rakendatakse siis, kui teistmoodi ei ole võimalik. Küntakse üldjuhul pärast maaparandustöid, kui hiljem on vaja mulda tasandada.

LONGER DESCRIPTION – IN ENGLISH

A direct seeding survey conducted in 2022 on three fields in South Estonia found that organic carbon content in direct seeding fields is vertically stratified, with an increase in the upper 0–5 cm layer and a decrease in lower layers over the years. In traditionally ploughed soils, however, organic carbon content remains uniform. Soluble phosphorus and potassium concentrations are also vertically stratified in direct-cropped fields, while soil reaction and trace element content showed no significant differences between different technologies.

Some direct-drilled fields have become more acidic over time, requiring liming. Soil trampling was found to be generally low, and no major problems were encountered with direct seeding. Soil microbiological activity (biomass and respiration) was higher in direct-drilled fields. Earthworm abundance tended to be higher in ploughed fields, but species diversity was greater in direct-sown fields. In the 0–5 cm layer of direct-sown fields, earthworm abundance and species richness were higher compared to plough-based fields, particularly in comparison to the 5–10 cm layer.

However, herbicide use in direct-sown fields is significantly higher than in plough-based systems, as mechanical weed control is not possible with direct sowing. More pesticide residues were found in the mulch of direct-sown fields than in the soil, mainly herbicide and fungicide residues. Additionally, more residues were found in the soil of direct-sown fields compared to ploughed fields.

A demo-producer also experimented with strip-tillage and strip-tillage with liquid fertilizer application. In direct drilling, the producer aims to maximize soil protection at minimum cost, reduce emissions, and create a larger window for optimal sowing. The producer applies direct drilling for winter wheat, peas, beans, barley, and catch crops, as well as for winter oilseed rape and grassland establishment. Row widths of 19 cm and 25 cm are used.

In direct sowing, even straw spreading across the field is crucial, and pre-treatment of the soil surface may be necessary. The producer emphasizes that direct drilling can reduce tractor hours and labor, conserve soil, increase soil carbon, and significantly lower CO₂ emissions. He also stresses that ploughing should be the last resort when no other options are available.

Ploughing is generally used only after land melioration, when soil leveling is required.

ADDITIONAL INFORMATION

Need for well-suited machinery for minimized soil tillage, including direct drill, strip drill and simultaneous work operations etc. Far too much use of farmers own savings to carry out research on their own fields (too little cooperation with research institutions). Need for further research on optimal sowing time with direct drilling and new machinery. More impact research of minimized soil tillage to soil microbiome and other soil parameters, but also on carbon footprint, biodiversity etc. Solutions should be found to reduce the use of harmful pesticides and their residues.

PHOTOS



Photo 1: A farm machinery in a field



Photo 2: A cover crop field with visible rows of young brassica plants growing alongside a thick layer of straw mulch.



Photo 3: Early-stage cereal or grass cover crops emerging through the residue of a previous harvest.

Source: Sadala Agro

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

Maaelu Teadmuskeskus (2024). Minimeeritud harimise ja otsekülvi mõju muldade omadustele ja keskkonnaseisundile.

URL:

https://metk.agri.ee/sites/default/files/documents/2024-05/6_Minimeeritud%20harimise%20ja%20otsek%C3%BClvi%20m%C3%B5ju_2023.pdf

Title/Description

Pajuste, M. (2024). Sadala Agro: uus tehnoloogia toob märkimisväärse kokkuhoiu. Artikkel väljaandes: Eesti põllumees

URL:

<https://www.profieesti.ee/articles/725/sadala-agro-uus-tehnoloogia-toob-markimisvaarse-kokkuhoiu>

Title/Description

Mullastiku uuringud

URL:

<https://metk.agri.ee/mullastik/mullastiku-uuring#otsekulvi-minimeeri>

Title/Description

Sadala Agro: uus tehnoloogia toob märkimisväärse kokkuhoiu

URL:

<https://www.profieesti.ee/articles/725/sadala-agro-uus-tehnoloogia-toob-markimisvaarse-kokkuhoiu>

Title/Description

METKi katsed: kuidas mõjub otsekülv mullale

URL:

<https://metk.agri.ee/uudised/metki-katsed-kuidas-mojub-otsekulv-mullale>



4.5 “MRV Tools”: A Collection of Practice Abstracts

This subchapter presents three Practice Abstracts focused on Monitoring, Reporting, and Verification (MRV) tools: one explaining the overall methodology for validating GHG assessment tools, and two detailing specific tools tested in Hungary and Denmark.

PRACTICE ABSTRACT #38**SHORT TITLE IN NATIVE LANGUAGE**

ESGreen Tool – landbrugets digitale ESG-løsning

SHORT TITLE IN ENGLISH

ESGreenTool – A Digital Sustainability Solution for Danish Agriculture

COUNTRY AND CLIMATIC ZONE

Denmark, north temperate zone

CONTACT

Maria Alejandra Arias Escobar (mare@icoel.dk)

3 BENEFITS OF THE PRACTICE

1. Calculation of current carbon footprint (CO₂ equivalents) for entire farm, in all production systems
2. Farmers get a prompt overview of measures for reducing C emissions.
3. Calculation of C footprint at product level.

PRODUCTION SYSTEM(S)

Arable crops, beef cattle, dairy cattle, pigs and poultry in organic and conventional.

THEMATIC AREAS

Crops and grassland management, forage production, energy management, herd management, biogas production, rewarding mechanisms, manure storage and spreading.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

ESGreen Tool er en digital applikation, der er udviklet i Danmark til at hjælpe landmænd med at beregne og styre deres landbrugs CO2-fodaftryk. Det blev introduceret i 2022 og er landets første software, der er i stand til at vurdere en gårds udledning af drivhusgasser og udforske potentielle reduktionsstrategier. Beregningsmetoderne bag værktøjet er i overensstemmelse med retningslinjerne fra IPCC 2006 for den nationale opgørelsesrapport på bedriftsniveau og retningslinjerne fra PEF for beregningerne på produktniveau.

Vigtige funktioner:

- **Omfattende emissionsvurdering:** Værktøjet evaluerer udledninger fra forskellige landbrugsaktiviteter, herunder husdyrs fordøjelse, gødningshåndtering, nedbrydning af afgrøderester, energiforbrug og import af ressourcer som foder og dyr.
- **Scenarieanalyse:** Landmænd kan modellere forskellige scenarier for at forstå virkningen af potentielle ændringer i praksis, såsom justeringer i fodersammensætning, gødningsanvendelse eller indførelse af nye teknologier, på deres samlede udledninger.
- **Integration af data:** ESGreen Tool integreres med eksisterende landbrugsdatabaser, hvilket giver mulighed for automatisk dataoverførsel og reducerer manuelt input. Denne integration sikrer, at beregningerne er baseret på nøjagtige og opdaterede oplysninger om gården.
- **Fodaftryk på produktniveau:** I sin avancerede version, ESGreen Tool Climate 2, gør applikationen det muligt for landmænd at beregne klimapåvirkningen pr. produktenhed, f.eks. pr. kg æg, hvilket giver detaljeret indsigt i de udledninger, der er forbundet med specifikke output.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The ESGreen Tool is a digital application developed in Denmark to assist farmers in calculating and managing the carbon footprint of their agricultural operations. Introduced in 2022, it serves as the country's first software capable of assessing a farm's greenhouse gas emissions and exploring potential reduction strategies. The calculation methods behind the tool are aligned with the guidelines of IPCC 2006 as the national inventory report at farm level, and the guidelines of PEF for the calculations at product level.

Key Features:

- **Comprehensive emission assessment:** The tool evaluates emissions from various farm activities, including livestock digestion, manure management, crop residue decomposition, energy consumption, and the import of resources like feed and animals.
- **Scenario analysis:** Farmers can model different scenarios to understand the impact of potential changes in practices, such as adjustments in feed composition, fertilizer application, or the adoption of new technologies, on their overall emissions.
- **Data integration:** ESGreenTool integrates with existing agricultural databases, allowing for automatic data transfer and reducing manual input. This integration ensures that calculations are based on accurate and up-to-date information, specifically concerning the farm.
- **Product-level footprint:** In its advanced version, ESGreenTool Climate 2, the application enables farmers to calculate the climate impact per unit of product, such as per kilogram of eggs, providing detailed insights into the emissions associated with specific outputs.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

ESGreen Tool, der er udviklet af SEGES Innovation og Innovationscenter for økologisk landbrug, er en digital platform til beregning af emissionskilder som en del af ESG-rapporteringen (Environmental, Social and Governance). Værktøjet bruger gården som det system, der vurderes, og det beregner de tre vigtigste drivhusgasser for landbruget: **metan (CH₄)**, **lattergas (N₂O)** og **kuldioxid (CO₂)** i henhold til IPCC's retningslinjer (2006).

Resultaterne er angivet som udledning i **ton CO₂eq pr. år, pr. hektar og pr. kg produkt**. Desuden beregnes en relativ kulstofbalance, som viser, hvor meget kulstof der skønnes at være lagret på gårdens jord. En del af dataene indsamles direkte fra de obligatoriske landbrugsregistreringsdata til den danske regering.

Beregnete emissionskilder:

- Enterisk fermentering/fordøjelse
- Gødning i stald og lager
- Gødning distribueret til markerne
- Omsætning af afgrøderester
- Udvaskning af nitrat
- Energiforbrug og produktion af grøn energi
- Import af ressourcer som foder, halm og dyr
- Balance for kulstofbinding i jorden

ESGreenTool består af to produkter:

1. **ESGreenTool Climate**, som gør det muligt for landmænd at beregne klimapåvirkningen fra deres landbrugsvirksomhed (Climate 1) og det individuelle produktfodaftrek fra afgrøder og dyr ved hjælp af bedriftsspecifikke data (Climate 2). Det gør det muligt for landmænd at beregne, hvordan potentielle ændringer i f.eks. foder, gødningshåndtering eller ny teknologi vil påvirke gårdens CO₂-fodaftrek eller det specifikke produktfodaftrek for hver produceret enhed. På den måde støtter værktøjet landmanden i at udvikle en konkret plan for at reducere gårdens udledning af drivhusgasser. I øjeblikket er ESGreenTool et afgørende værktøj, da den danske regering har besluttet at reducere udledningen af drivhusgasser fra landbrugssektoren med 55-65 procent inden 2030.
2. **ESGreenTool-rapporten** giver landmænd mulighed for at dokumentere deres indsats inden for miljø, ledelse og sociale aspekter. Det er en skabelon, der er udviklet til landbruget, med datapunkter, der er relevante for en landbrugsvirksomhed. Det er nemt at vælge og tilpasse 100+ datapunkter baseret på relevante forhold for den enkelte gård (f.eks. udledning af drivhusgasser, arbejdsforhold, biodiversitet, ledelse, dyrevelfærd osv.) Når skabelonen er færdig, kan landmændene nemt dele ESG-data med deres finansielle partnere eller relevante virksomheder i deres værdikæde, og de kan tilpasse den endelige rapport efter deres behov for ESG-data. Outputtet er i pdf-format på gård- og produktniveau.

LONGER DESCRIPTION – IN ENGLISH

The ESGreenTool, developed by SEGES Innovation and Innovation center for organic farming, is a digital platform to calculate emission sources as part of the Environmental, Social and Governance (ESG) reporting. The tool uses the farm as the system being assessed and it calculates the three most important greenhouse gases for agriculture: **methane (CH₄)**, **nitrous oxide (N₂O)**, and **carbon dioxide (CO₂)**, according to the IPCC guidelines (2006).

The results are given as emissions in **tons CO₂eq per year, per hectare and per kilogram of product**. In addition, a relative carbon balance is calculated, which shows how much carbon is estimated to be stored on the farms land. Part of the data is collected directly from mandatory farm registration data to the Danish government.

Calculated emission sources:

- Enteric fermentation/digestion

- Manure in barn and stock
- Manure distributed to the fields
- Turnover of crop residues
- Nitrate leaching
- Energy consumption and production of green energy
- Import of resources such as feed, straw, animals
- Carbon sequestration balance in soil

ESGreenTool is made up of two products:

1. **ESGreenTool Climate**, which allows farmers to calculate the climate impact of their agricultural business (Climate 1) and the individual product footprint of the crops, and animals, using farm specific data (Climate 2). This enables farmers to calculate how potential changes in, for example, feed, fertilizer management, or new technology, will impact the farm's carbon footprint or the specific product footprint for each unit produced. In that way, the tool supports the farmer in developing a concrete plan to reduce the farm's greenhouse gas emissions. Currently, ESGreenTool is a crucial tool, since Danish government has decided to reduce greenhouse gas emissions from agricultural sector by 55-65 percent by 2030.
2. **ESGreenTool Report** provides a setting for farmers to document their efforts in the areas of environment, governance, and social aspects. It is a template developed for agriculture, with data points relevant to the farming business. It is easy to select and customize 100+ data points based on relevant matters for the individual farm (e.g., greenhouse gas emissions, working conditions, biodiversity, governance, animal welfare etc.). When the template is completed, farmers can easily share ESG data with their financial partners or relevant companies in their value chain, and they can customize the final report according to their demand for ESG data. The output is in pdf format at farm and product level.

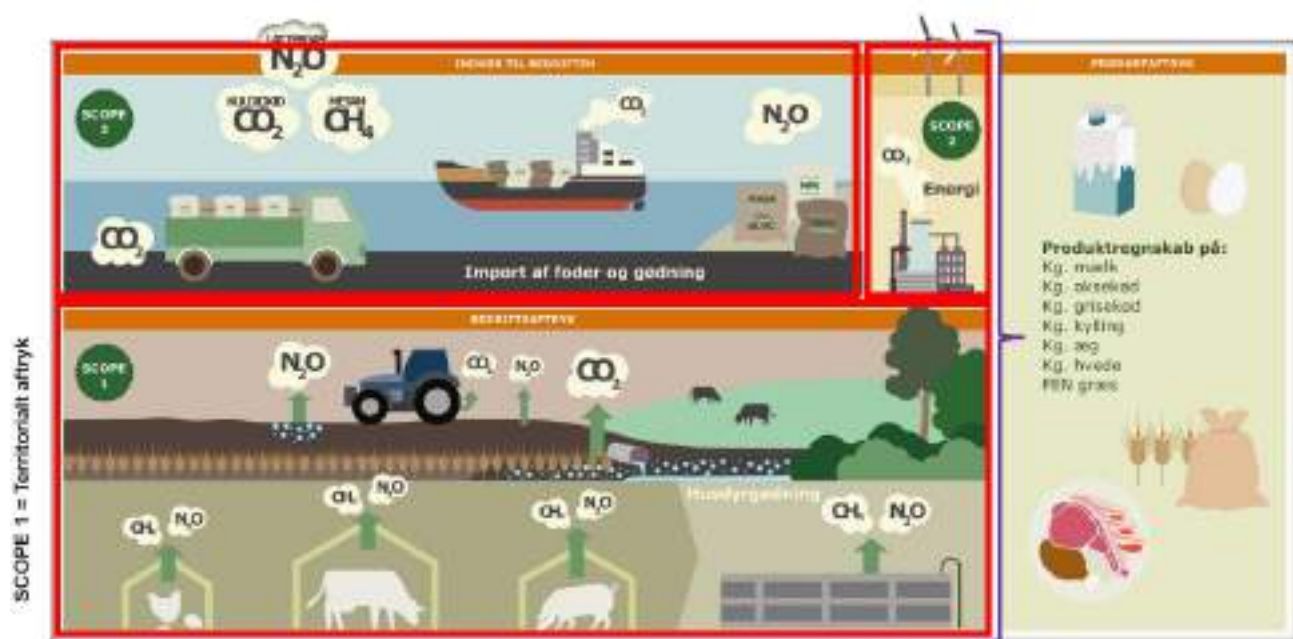
ADDITIONAL INFORMATION

While the ESGreenTool offers valuable insights into sustainability and climate impact on farms, there are some potential downsides:

1. Farmers need to input detailed information about their operations, which can be time-consuming and require a learning curve.
2. The tool integrates with Mark Online, which may limit flexibility for farms that do not already use SEGES systems.

3. The tool has a license fee and depending on the pricing model, smaller farms may find this a limiting factor.
4. If farm data is incomplete or incorrect, the tool's sustainability assessments and CO₂ calculations may not provide a fully accurate picture.
5. As it is developed in Denmark, some of its methodologies or assumptions may not be directly applicable to farms in other countries with different regulations or climatic regions.

PHOTOS



Picture 1: ESGreen Tool calculations - emissions of the three climate gases CO₂, CH₄ and N₂O

Picture 1 shows how ESGreen Tool calculations consider emissions of the three climate gases CO₂, CH₄ and N₂O on a Scope 1 (territorial footprint in relation to the farm emissions e.g., crops, soils, fertilizer usage, number of animals), Scope 2 (energy usage), and Scope 3 (Imports of fertilizer and feed). The application then calculates the climate impact per unit of product in Kg e.g., Kg milk, Kg eggs. (Developed by SEGES Innovation).

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

ESGreenTool® – the digital solution for environmental, social, and governance (ESG) reporting in agriculture.

URL:

Link [here](#).

Title/Description

Climate footprint at farm level: the importance of imports (Resource in Danish)

URL:

<https://icoel.dk/klima/klimaafttryk-paa-bedriftsniveau-betydningen-af-import/>

PRACTICE ABSTRACT #54**SHORT TITLE IN NATIVE LANGUAGE**

Talajvizsgálat gyorsan és pontosan a termékeny talaj megőrzésének szolgálatában

SHORT TITLE IN ENGLISH

Soil Fertility Management with Innovative Soil Scanner Technology

COUNTRY AND CLIMATIC ZONE

Hungary, continental

CONTACT

András Vér (ver.andras@sze.hu), Albert Kázmér

3 BENEFITS OF THE PRACTICE

1. Fast, affordable soil testing with practical results
2. Precision nutrient management via pH, organic matter, texture data
3. Optimized input use for sustainability and lower environmental impact

PRODUCTION SYSTEM

Arable farming, soil fertility management

THEMATIC AREA

Soil Health and Biodiversity, Grassland Management, Crops Management, Water Management, Manure storage and spreading, Energy management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

A Talajszkenner egy innovatív eszköz, amely fényvisszaverődés-alapú elemzéssel, „száraz” módszerrel elemzi a talaj kémiai és fizikai jellemzőit. Ez gyorsabb és kényelmesebb alternatívát kínál a hagyományos „nedves” laboratóriumi módszerekhez képest. A szkenner a talaj pH-értékét, szervesanyag-tartalmát (humusz), kötöttségét és fő makroelemek (N, P, K) szintjét méri.

- A talaj pH-ját (H₂O és KCl) a megfelelő kémhatás biztosítására osztályozza, segítve az optimális növénytermesztést.
- Az agyagtartalom %-os megadása alapján a talaj kötöttségére és vízmegtartó képességére vonatkozóan ad információt.
- A szerves C-tartalom mérése révén a humusztartalom pontos becslését teszi lehetővé.

Az eszköz különösen hasznos azoknak a gazdálkodóknak, akik gyorsan szeretnének döntéseket hozni a tápanyag-utánpótlásról és talajmenedzsmentről, minimalizálva a környezetterhelést. A talajszkenner gyakorlati használata több kulcsfontosságú lépést foglal magában. A gazdálkodó vagy a tanácsadó elvégzi a talajmérést, majd a tanácsadó értelmezi az eredményeket, és beépíti azokat a mezőgazdasági döntéshozatalba. A kutatók segíthetnek az adatok elemzésében a finomabb talajgazdálkodási ajánlások érdekében. Az adatok alapján idő- és helyspecifikus tápanyag-gazdálkodási tervet dolgoznak ki, és a gazdálkodó végrehajtja az ajánlott talajkezelési tervet.

A Széchenyi István Egyetemen 2024. november 21-én tartott CODECS éves workshopon 22 résztvevővel a minimális talajművelés, a precíziós gazdálkodás, a talajvizsgálat és az agrárdigitalizáció témakörét járták körül. A digitális talajszkennek legfontosabb előnyei közé tartozik a jobb gazdálkodás, a csökkentett inputköltségek, a jobb pénzügyi kiszámíthatóság, valamint a környezeti előnyök, például az alacsonyabb kibocsátás és a fokozott biológiai sokféleség. A kihívások közé tartoznak a magas beruházási költségek, a korlátozott tanácsadói támogatás, valamint a szakképzés és a fiatalok mezőgazdaságba való bevonásának szükségessége.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Soil Scanner is an innovative tool that uses light reflection-based analysis to analyze the soil's chemical and physical properties via a "dry"

method. This offers a faster and more convenient alternative to traditional "wet" laboratory techniques. The scanner measures soil pH, organic matter content (humus), soil texture (clay content), and major macronutrients (N, P, K).

- It categorizes soil pH (H₂O and KCl) to ensure optimal conditions for crop production.
- Provides clay content as a percentage, indicating soil texture and water retention capacity.
- Measures organic carbon content, allowing for precise estimation of humus levels.

This tool is especially useful for farmers needing rapid decisions on nutrient management and soil sustainability while reducing environmental impact. The practical use of the Soil Scanner involves several key steps. The farmer or advisor takes the soil measurement, and the advisor then interprets the results and integrates them into farm decision-making. Researchers may assist in data analysis for more refined soil management recommendations. Based on the data, a time- and location-specific nutrient management plan is developed, and the farmer implements the recommended soil treatment plan.

The CODECS annual workshop at Széchenyi István University on November 21, 2024, brought together 22 participants to explore minimum tillage, precision farming, soil testing, and agro-digitalization. Key benefits of digital soil scanners include improved farm management, reduced input costs, better financial predictability, and environmental gains like lower emissions and enhanced biodiversity. Challenges include high investment costs, limited advisor support, and a need for more vocational training and youth involvement in agriculture.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

A Talajszkenner egy olyan eszköz, amely a modern gazdálkodók és agrártanácsadók számára biztosít gyors és pontos talajvizsgálati eredményeket. Fényvisszaverődés-alapú elemzéssel (reflektancia spektroszkópiás elemzés) révén száraz módszerrel vizsgálja a talaj kémiai és fizikai jellemzőit, elkerülve a hagyományos laboratóriumi eljárások idő- és költségigényét.

A Talajszkenner gyakorlati használata több kulcsfontosságú lépésből áll. A gazdálkodó vagy agrártanácsadó elvégzi a talajmintavételt, majd a tanácsadó segít az eredmények értelmezésében és beépítésében a gazdasági döntésekbe. Kutatók is közreműködhetnek az adatelemzésben a

talajgazdálkodás pontosabb ajánlásainak kidolgozásához. Az adatok alapján időzített és helyspecifikus tápanyag-utánpótlási terv készül, amelyet a gazdálkodó végrehajt.

A talajvizsgálatok gyakorisága függ a termesztett növénytől, az évszaktól és a talaj típusától, de az adataalapú gazdálkodás szempontjából a rendszeres ellenőrzés elengedhetetlen. Átlagosan kéthetente a vegetációs időszakban és egyszer szezonon kívül ajánlott a mérések elvégzése.

A CODECS éves workshopját 2024. november 21-én tartották a Széchenyi István Egyetemen, Mosonmagyaróváron, ahol a minimális talajművelés, precíziós gazdálkodás, talajvizsgálat és agrár-digitalizáció témái kerültek fókuszba. Az eseményen 22 résztvevő vett részt, köztük gazdálkodók, tanácsadók és kutatók.

Workshop Eredmények

A résztvevők azonosították a digitális talajszkenner gazdasági, környezeti és gazdálkodási hatásait:

Gazdálkodási Eredmények:

- Hatékonyabb gazdálkodási döntések a pontosabb adatok miatt.
- Nagyobb nyitottság a digitális innovációkra.
- Kevesebb munkavégzés a földeken, mivel csökkenthető a művelési műveletek száma.

Gazdasági Eredmények:

- Csökkentett költségek az optimalizált tápanyag- és növényvédőszer használatával.
- Jobb pénzügyi tervezhetőség a gazdálkodásban.
- Befektetési kihívások, a beruházás megtérülésének bizonytalansága.

Környezeti Eredmények:

- Hatékonyabb inputhasználat, csökkent műtrágya- és növényvédőszer-felhasználás.
- Biodiverzitás megőrzése precíziós talajgazdálkodással.
- Kevesebb gépi üzemanyag-felhasználás, alacsonyabb karbonlábnyom.

Jóléti Eredmények:

- Kevesebb vegyszerrel való érintkezés a precíziós alkalmazásnak köszönhetően.

- Digitális eszközök segítségével kevesebb stressz és bizonytalanság a gazdálkodásban.

Gazdálkodói Kihívások és Megfontolások

- A digitális technológiák elfogadását nagymértékben befolyásolja a közösségi hatás, a szomszédos gazdák véleménye döntő lehet.
- Szakértői tanácsadás hiányában sok gazdálkodó nem tudja hatékonyan alkalmazni az új technológiákat.
- Hiányzó területek a digitális értékláncban: szakmai képzés és a következő generáció bevonása.

A workshop igazolta, hogy a digitális talajszkenner jelentősen hozzájárul a gazdaságok hatékonyságához, pénzügyi stabilitásához és környezetvédelmi céljaihoz. Míg a gazdasági előnyök azonnal érzékelhetőek, a környezeti hatások hosszabb távon jelentkeznek. Az agrártanácsadók szerepe kulcsfontosságú a gazdálkodók támogatásában az adatvezérelt döntéshozatal és a klímaváltozáshoz való alkalmazkodás terén.

LONGER SUMMARY FOR THE CLIMATE FARM DEMO WEBSITE – IN ENGLISH

The Soil Scanner offers farmers and agricultural advisors a fast and precise method for soil testing, providing key insights into soil health without relying on time-consuming and resource-intensive traditional laboratory techniques. By using reflectance spectroscopy and a dry analysis method, the scanner delivers instant data on soil pH, organic matter content, soil texture (clay content), and major macronutrient levels (N, P, K).

The practical use of the Soil Scanner involves several key steps. The farmer or advisor takes the soil measurement, and the advisor then interprets the results and integrates them into farm decision-making. Researchers may assist in data analysis for more refined soil management recommendations. Based on the data, a time- and location-specific nutrient management plan is developed, and the farmer implements the recommended soil treatment plan.

The frequency of soil scanning depends on the crop type, season, and soil condition, but regular monitoring is essential for data-driven farming. On average, measurements are taken every two weeks during the growing season and once during the off-season.

A CODECS annual workshop was held at Széchenyi István University in Mosonmagyaróvár on November 21, 2024, focusing on minimum tillage,

precision farming practices, soil testing, and agro-digitalization. The event gathered 22 participants, including farmers, advisors, and researchers, with diverse backgrounds and experiences.

Key Outcomes from the Workshop

Participants identified several economic, environmental, and farm management outcomes related to the adoption of digital soil scanners:

Farm Management Outcomes:

- Improved business management due to more measurable farming results.
- Increased readiness to adopt digital innovation.
- Reduced fieldwork time due to fewer cultivation passes.

Economic Outcomes:

- Reduced costs from optimized fertilizer and pesticide use.
- Improved financial predictability for farms.
- Challenges related to investment costs and uncertainty in return on investment.

Environmental Outcomes:

- Optimized farm input efficiency, leading to reduced fertilizer and pesticide use.
- Improved biodiversity due to precise soil nutrient management.
- Lower fuel use and machinery damage, contributing to sustainability goals.

Wellbeing Outcomes:

- Less chemical exposure for farmers due to precision application of inputs.
- Digital tools help in decision-making, reducing stress and uncertainty.

Challenges and Considerations for Farmers

- Adoption of digital tools depends on peer influence, as farmers are more likely to adopt innovations if their neighbors have a positive attitude towards digitalization.
- Farmers without specialist advisors may struggle to integrate new technologies effectively.
- The lack of vocational training and next-generation involvement was identified as a missing area in the value chain.

Conclusion

The workshop confirmed that digital soil scanners contribute significantly to farm efficiency, economic sustainability, and environmental conservation. While economic benefits are immediate (e.g., reduced input costs), environmental improvements occur gradually over time. The role of advisors is critical in guiding farmers towards data-driven decision-making, helping them adapt to climate variability and ensure long-term farm stability.

ADDITIONAL INFORMATION

Facilitating factors for implementation include the scanner's user-friendly interface, mobile connectivity, and compatibility with existing nutrient management systems. However, challenges such as initial investment costs and the need for regular calibration may arise. Future research could focus on expanding the database for local soil types and integrating additional soil health parameters.

Connection with Climate Farm Demo:

- The soil scanner technology empowers **real-time, on-site analysis of soil parameters**, supporting rapid decision-making.
- It enables farmers to **swiftly respond to climate-related soil challenges**, such as nutrient leaching caused by extreme or sudden rainfall.
- By identifying **microelement deficiencies** or imbalances on the spot, farmers can adjust fertilization plans immediately, improving resilience and sustainability.
- The tool contributes to **data-driven, site-specific nutrient management**, a core principle of climate-smart agriculture promoted by the CFD project.
- Its integration into advisory services and demonstration farms **facilitates knowledge transfer**, aligning with CFD's aim to bridge research, innovation, and practice.

PHOTOS

Photo 1: Soil Scanner in Use on Field: An advisor demonstrates the Soil Scanner during a field visit, supporting farmers in data-driven nutrient management.



Photo 2: Efficient Climate Response through Digital Soil Analysis: Real-time interpretation of soil parameters via mobile connectivity empowers on-site decision-making for sustainable farming.



Photo 3: From Soil to Sprout: Understanding your soil's nutrients is the first step to maximizing growth and fertility.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

ERASMUS+ WISEFARMER

URL:

<https://food.sze.hu/erasmus-wisefarmer>

Title/Description

SoilCares

URL:

<https://talajszken.com/>

Title/Description

Czernozjom

URL:

<https://www.csernozjom.com/>

Title/Description

CODECS - Innovative Soil Scanner Technology for Sustainable Agriculture

URL:

https://www.horizoncodecs.eu/living_lab/innovative-soil-scanner-technology-for-sustainable-agriculture/

PRACTICE ABSTRACT #57**SHORT TITLE IN ENGLISH**

Description of a Methodology for Validating GHG Assessment Tools at Farm Level

COUNTRY AND CLIMATIC ZONE

All countries and all climatic zones concerned

CONTACT

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3 BENEFITS OF THE PRACTICE

1. GHG diagnostic tools identification
2. Carbon tool usability assessment
3. Impact of practices on carbon sensitivity

PRODUCTION SYSTEM

All types of productions

THEMATIC AREA

All

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Le projet Climate Farm Demo (CFD) vise à créer un réseau européen d'agriculteurs pilotes. Son objectif global est d'accélérer l'adoption par les agriculteurs de pratiques face au changement climatique. Pour les soutenir

dans cette transition, il leur faut d'abord connaître les émissions de gaz à effet de serre et le stockage de carbone de leur exploitation afin d'élaborer des plans d'action d'atténuation du changement climatique et l'adaptation à ses effets.

De nombreux outils d'évaluation des GES à l'échelle de l'exploitation existent pour les différents systèmes agricoles. Les outils sélectionnés doivent être d'une qualité suffisante et répondre à certaines normes scientifiques. Pour évaluer les outils, nous avons utilisé une approche par étapes : 1) définition des critères d'évaluation, 2) collecte d'informations sur les outils, 3) réalisation de l'évaluation et 4) fourniture de fiches d'information sur les outils sélectionnés. Les informations suivantes ont été collectées pour évaluer les outils :

- Informations générales
 - Systèmes de production couverts
 - Langues disponibles
 - Périmètre de l'évaluation de l'outil
 - Coût d'utilisation
- Caractéristiques pour l'élaboration d'un plan d'action
 - Description de l'exploitation
 - Unités fonctionnelles émissions de GES et stockage
 - Comparaison des résultats des références
 - Autres impacts environnementaux
 - Liste de leviers d'atténuation
 - Lien avec les résultats économique
 - Possibilité de simuler les plans d'action
- Support aux conseillers
 - Modalités de formation
 - Documentation
 - Export / Import de données
- Sensibilité aux pratiques
 - Fermentation entérique
 - Gestion des effluents
 - Gestion de l'azote sur les surfaces
 - Consommation d'énergie
 - Facteurs d'émissions des engrais
 - Facteurs d'émissions des aliments
 - Stockage de carbone

Sur la base de cette évaluation, le projet a sélectionné 18 outils qui peuvent être utilisés par les agriculteurs et les conseillers dans le cadre du projet Climate Farm Demo, et qui couvrent les principaux systèmes de production

agricole. Ces outils sont compilés sur le site du projet : <https://climatefarmdemo.eu/cfd/en/#/resources>

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Climate Farm Demo project aims to create a unique pan-European network of Pilot Demo Farmers. Its overall objective is to accelerate the adoption of Climate Smart Farming practices and solutions by farmers. To support farmers in this transition, they first need insight into current GHG emissions and carbon removals on their farms to create action plans for climate change mitigation and adaptation.

Over the last decade, a range of farm-level GHG assessment tools have been developed for different farming systems. The main objective of these tools is to help farmers and advisors determine their baseline GHG emissions and assist in developing action plans. The selected tools should be of sufficient quality and comply with a certain scientific standard.

To evaluate the tools, we used a stepwise approach: 1) define evaluation criteria, 2) collect tool information, 3) perform assessment, and 4) provide information sheets on the selected tools.

The following information was collected to evaluate the tools:

General information

- Covered production systems
- Available languages
- Scope of the tool
- Cost of the tool

Features for development of an action plan

- Description of farms
- Type of GHG emissions and carbon storage included
- Benchmark possibility
- Other environmental impacts
- List of mitigation options
- Economic impact results
- Action plan simulation possibility

Support for advisors

- Training possibilities (cost, format, support)
- Documentation (user guide, methodology)
- Data handling

Sensitivity to mitigation practices

- Enteric fermentation
- Manure management
- Nitrogen management in the field
- Energy consumption
- Fertilizer emission factors (related to production emissions)
- Feed emission factors
- Carbon storage

Based on the assessment, the project selected 18 tools that can be used by farmers and advisors in the project, which cover the major agricultural production systems. These tools are compiled on the project website: <https://climatefarmdemo.eu/cfd/en/#/resources>.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Le projet Climate Farm Demo vise à créer un réseau européen d'agriculteurs pilotes. Son objectif est d'accélérer l'adoption par les agriculteurs de pratiques face au changement climatique en vue d'adapter les systèmes de production et de parvenir à un secteur agricole neutre en carbone d'ici à 2050. Pour soutenir les agriculteurs dans cette transition, il leur faut d'abord connaître les émissions de GES et le stockage de carbone de leurs exploitations afin de créer des plans d'action pour l'atténuation du changement climatique et l'adaptation à celui-ci.

Au cours de la dernière décennie, différents d'outils d'évaluation des GES à l'échelle de l'exploitation ont été mis au point pour différents systèmes agricoles. La plupart ont été développés pour calculer l'empreinte carbone des produits agricole. D'autres outils ont été développés au niveau de l'exploitation pour fournir des informations sur les flux d'éléments nutritifs et les émissions au sein du système.

L'objectif principal de l'utilisation de ces outils est d'aider les agriculteurs et les conseillers à déterminer leurs émissions de GES de référence et de contribuer à l'élaboration des plans d'action. La comparaison des performances des exploitations agricoles en matière d'émissions de gaz à effet de serre entre les pays n'est pas l'objectif du projet. Par conséquent, le projet a décidé de ne pas utiliser un seul outil pour toutes les exploitations, mais de permettre aux agriculteurs et aux conseillers de travailler avec les outils qu'ils utilisent déjà dans leur pays. Toutefois, les outils sélectionnés doivent être d'une qualité suffisante et répondre à certaines normes scientifiques. Voici les étapes suivies et les critères observés pour valider les outils.

Première sélection :

Seuls les outils répondant aux critères suivants peuvent être pris en compte pour la suite de l'évaluation :

1. Outil qui évalue les émissions de GES couvrant les scopes 1, 2 et 3 d'une exploitation agricole.
2. Outil dont le développement est suffisamment avancé pour pouvoir être utilisés directement par les agriculteurs/conseillers dans le cadre de l'élaboration des plans d'action.
3. Outil qui dispose d'une documentation suffisante pour réaliser l'évaluation (description de la méthodologie).

Voici ensuite les informations importantes à observer pour évaluer les outils. Informations sur les caractéristiques pertinentes pour l'élaboration d'un plan d'action pour les exploitations agricoles. Un aspect important est de savoir dans quelle mesure les outils sont sensibles à certaines pratiques d'atténuation, étant donné que les pratiques qui seront mises en œuvre dans ces exploitations devraient idéalement être reflétées dans l'évaluation suivante des GES.

Vous trouverez ci-dessous la liste complète des sujets à prendre en considération :

- Informations générales
 - Systèmes de production couverts
 - Langues disponibles
 - Périmètre de l'évaluation de l'outil
 - Coût d'utilisation
- Caractéristiques pour l'élaboration d'un plan d'action
 - Description de l'exploitation
 - Unités fonctionnelles émissions de GES et stockage
 - Comparaison des résultats des références
 - Autres impacts environnementaux
 - Liste de leviers d'atténuation
 - Lien avec les résultats économique
 - Possibilité de simuler les plans d'action
- Support aux conseillers
 - Modalités de formation (coût, format, support après formation)
 - Documentation (guide utilisateur, méthodologie)
 - Export / Import de données
- Sensibilité aux pratiques
 - Fermentation entérique
 - Gestion des effluents
 - Gestion de l'azote sur les surfaces

- Consommation d'énergie
- Facteurs d'émissions des engrais
- Facteurs d'émissions des aliments
- Stockage de carbone

Sur la base de cette évaluation, le projet a sélectionné 18 outils qui peuvent être utilisés par les agriculteurs et les conseillers dans le cadre du projet Climate Farm Demo, et qui couvrent les principaux systèmes de production agricole. Voici la liste des outils sélectionnés : Agnav, Agrecalc, Agrösfar, Biocode, Bovid CO2, CAP'2ER, Carbon F&L, Convis, Cool Farm Tool, DECiDE, ES Green Tool, Farm Carbon Calculator, Geep, GES&VIT, Klimrek, KLIR, Kringloopwijzer (ANCA), TEKla.

LONGER DESCRIPTION – IN ENGLISH

The Climate Farm Demo (CFD) project aims to create a unique pan-European network of Pilot Demo Farmers covering 27 countries and all pedo-climatic areas. Its overall objective is to accelerate the adoption of Climate Smart Farming practices and solutions by farmers with a view to adapting agricultural production systems to climate change and to achieving a carbon neutral agricultural sector by 2050. To support farmers in this transition they first need insight in the current GHG emissions and carbon removals on their farms in order to create action plans for climate change mitigation and adaptation.

Over the last decade a range of farm level GHG assessment tools have been developed for different farming systems. Most tools were developed to calculate the carbon footprint of crops or livestock products, which is increasingly being demanded by the food industry. Other tools were developed as farm level tools to provide insights in nutrient flows and emissions on the farm. Some tools are more appropriate as monitoring tools, whereas others have possibilities to also perform simulations with alternative management, which can be used for creating action plans.

Also, geographically there is a large variation, where countries in Western Europe have multiple tools available, while in Central-eastern European countries often no tools are yet developed.

The main objective for the use of these tools is to help farmers and advisors to determine their baseline GHG emissions and to assist in the development of the action plans. A comparison of the GHG performance of farms among countries is not the focus of the project. Therefore, the project decided not to use only a single tool for all farms but instead allow farmers and advisors to work with the tools they already might use in their country. However, the

selected tools should be of sufficient quality and comply with to a certain scientific standard. Here are the steps followed, and the criteria observed to validate the tools.

First screening:

Only tools meeting the following criteria can be considered for further evaluation:

1. Tool that assesses a farm's GHG emissions covering scopes 1, 2 and 3
2. Sufficiently advanced in their development so that the tool can be used directly by farmers/advisors for the development of the action plans and
3. Sufficient documentation material should be available to perform the evaluation.

Next, here is the important information to observe to evaluate the tools: Information on features that are relevant for the development of an action plan for the farms. An important aspect is to what extent the tools are sensitive to certain mitigation practices, as the practices that will be implemented on those farms should ideally be reflected in the following GHG assessment. Below the full list of topics to be considered:

- General information
 - Covered production systems
 - Available languages
 - Scope of the tool
 - Cost of the tool
- Features for development of an action plan
 - Description of farm
 - Type of GHG emissions and carbon storage included
 - Benchmark possibility
 - Other environmental impacts
 - List of mitigation options
 - Economic impact results
 - Action plan simulation possibility
- Support for advisors
 - Training possibilities (cost, format, support)
 - Documentation (user guide, methodology documentation)
 - Data handling
- Sensitivity to mitigation practices
 - Enteric fermentation
 - Manure management

- Nitrogen management in the field
- Energy consumption
- Fertilizer emission factors (related to production emission)
- Feed emission factors
- Carbon storage

Based on the assessment, the project selected 18 tools that can be used by farmers and advisors in the Climate Farm Demo project, which cover the major agricultural production systems. Here is the list of selected tools: Agnav, Agrecalc, Agrösfar, Biocode, Bovid CO2, CAP'2ER, Carbon F&L, Convis, Cool Farm Tool, DECiDE, ES Green Tool, Farm Carbon Calculator, Geep, GES&VIT, Klimrek, KLIR, Kringloopwijzer (ANCA), TEKla.

PHOTOS

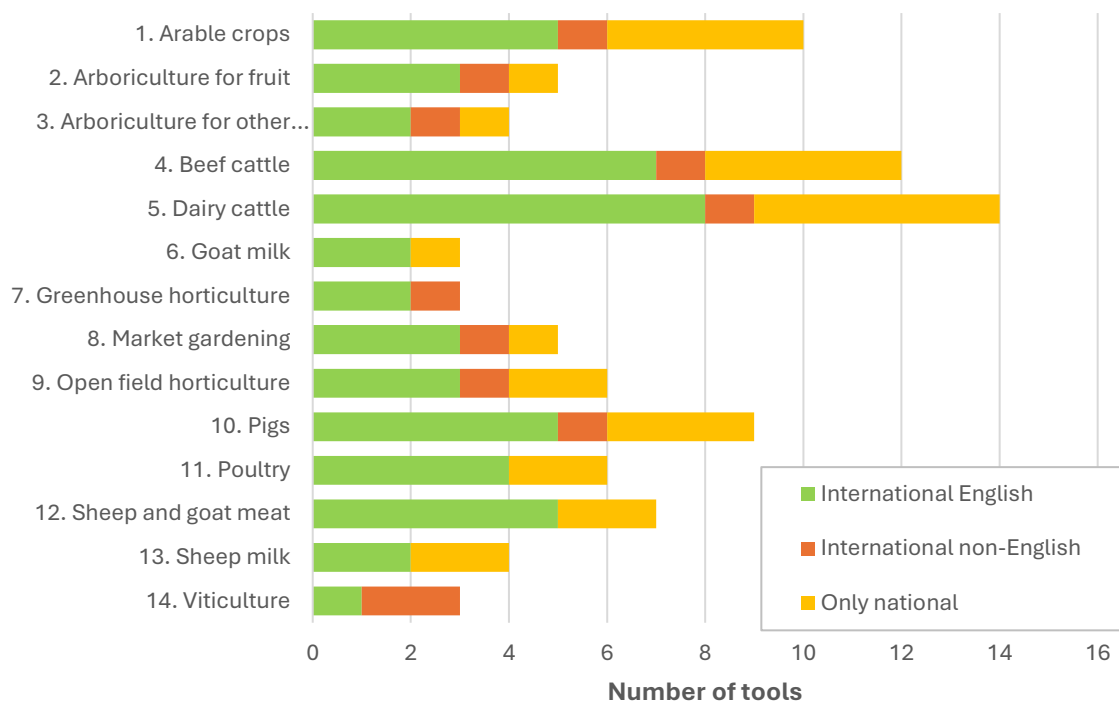


Figure 1: GHG Assessment and number of tools

4.6 “Adaptation and Mitigation Measures”: A Collection of Practice Abstracts

The following subchapter presents 44 Practice Abstracts that explore various aspects of adaptation and mitigation measures in agriculture across multiple regions. These abstracts cover a wide range of strategies, technologies, and innovative approaches aimed at enhancing climate resilience and reducing the environmental impact of farming practices.

PRACTICE ABSTRACT NUMBER #2**SHORT TITLE IN NATIVE LANGUAGE**

Zwiększanie materii organicznej przez międzyplony

SHORT TITLE IN ENGLISH

Increasing Organic Matter by Intercrops

COUNTRY AND CLIMATIC ZONE

Poland Cool Temperate Dry

CONTACT

Paweł Górecki (pawel.gorecki@kpodr.pl)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Prevention of soil erosion, increasing organic matter
2. Carbon sequestration
3. Weed control

PRODUCTION SYSTEM (IF RELEVANT)

Conventional/organic

THEMATIC AREA

Crops management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Zastosowanie międzyplonów uległo zmianom na przestrzeni lat, wcześniejszą ich funkcją w polskich gospodarstwach była produkcja paszy

dla zwierząt. Obecnie ich podstawową funkcją jest zapewnienie ochrony przed erozją wietrzną oraz wodną, jak również wzbogacanie gleby w materię organiczną.

Prawidłowo skomponowana mieszanka międzyplonowa powinna składać się z roślin, których system korzeniowy jest wiązkowy lub palowy, ma to wpływ na strukturę gleby: odpowiednio rośliny z systemem wiązkowym zwiększają wzrost mikroporowatości gleby natomiast palowy rozluźnia zbite warstwy gleby.

Rośliny międzyplonowe utrudniają ucieczkę pewnych pierwiastków do otoczenia poprzez spływ, wymywanie lub ułatwianie się, jak również utrzymują wilgotność i zatrzymują śnieg. Międzyplony są również uprawiane na zielony nawóz. O nawozie zielonym mówimy wówczas, gdy rośliny okrywowe dobierane są precyzyjnie w celu spulchnienia gleby lub nawożenia kolejnej rośliny uprawnej. Na ogół z przeznaczeniem na zielony nawóz uprawia się rośliny strączkowe wiążące azot atmosferyczny, po zniszczeniu zasilają one glebę w azot.

Szata roślinna przyczynia się również do żyzności gleby poprzez magazynowanie węgla atmosferycznego dzięki fotosyntetycznemu działaniu. Później, gdy resztki roślinne zostaną przynajmniej częściowo rozłożone, stanowią źródło materii organicznej i pozwalają na zwiększenie zawartości próchnicy w glebie.

W mniejszym stopniu rolnicy wykorzystują międzyplony do redukcji zachwaszczenia pól uprawnych. Wprowadzenie gatunków szybko rosnących pozwala na silną konkurencję z rozwojem chwastów w okresie, gdy pole uprawne jest najbardziej wrażliwe na zachwaszczenie. Konkurencja o zasoby: światło, wodę i składniki odżywcze w glebie pomaga zmniejszyć biomasę chwastów i produkcję nasion co pozwala uniknąć zasilania glebowego banku nasion i przyszłych wschodów. Niektóre gatunki ograniczają także wschody chwastów dzięki działaniu allelopatycznemu np.: żyto, gryka.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The use of intercrops has changed over the years; their earlier function on Polish farms was to produce fodder for animals. Today, their primary function is to provide protection against wind and water erosion, as well as to enrich the soil with organic matter.

A properly composed intercrop mixture should consist of plants whose root system is either bundled or stilt, which influences soil structure: respectively, plants with a bundled system increase soil microporosity, while stilt loosens compacted soil layers.

Intercrops impede the escape of certain elements into the environment through runoff, leaching or volatilisation, as well as conserving moisture and retaining snow. Intercrops are also grown for green manure, which is the case when cover crops are selected precisely to loosen up the soil or to fertilise another crop. In general, atmospheric nitrogen-fixing legumes are grown for use as green manure and once destroyed, supply the soil with nitrogen.

The vegetation cover also contributes to soil fertility by storing atmospheric carbon through photosynthetic action. Later, when plant residues are at least partially decomposed, they provide a source of organic matter and allow the humus content of the soil to increase.

To a lesser extent, farmers use catch crops to reduce the weed infestation on arable fields. The introduction of fast-growing species allows strong competition with weed growth at a time when arable fields are most vulnerable to weed infestation. Competition for resources (light, water and nutrients in the soil) helps reduce weed biomass and seed production which avoids feeding the soil seed bank and future weed emergence. Some species also reduce weed emergence through allelopathic effects e.g.: rye, buckwheat.

LONGER DESCRIPTION

Zastosowanie międzyplonów uległo zmianom na przestrzeni lat, wcześniej ich funkcją w polskich gospodarstwach była produkcja paszy dla zwierząt. Obecnie ich podstawową funkcją jest zapewnienie ochrony przed erozją wietrzną oraz wodną, jak również wzbogacanie gleby w materię organiczną.

Prawidłowo skomponowana mieszanka międzyplonowa powinna składać się z wielu roślin różniących się między sobą cechami morfologicznymi. Najważniejszą różnicą jest system korzeniowy może on być wiązkowy lub palowy, ma to duży wpływ na strukturę gleby: odpowiednio rośliny z systemem wiązkowym zwiększają wzrost mikroporowatości gleby natomiast palowy rozluźnia zbite warstwy gleby bardzo dobrym przykładem takiej rośliny może być rzodkiew japońska. Może ona z powodzeniem może zastąpić maszyny, które głęboko spulchniają glebę. Wiązkowy system

korzeniowy pozwala utrwalić odpowiednią strukturę gleby utworzoną przez maszyny uprawowe.

Międzyplony wspomagają bioróżnorodność. Stanowią schronienie oraz źródło pożywienia dla populacji wielu gatunków zwierząt oraz mikroorganizmów. Dżdżownice są bardzo dobrym wskaźnikiem żyzności gleby, a uprawa roślin okrywowych w dużym stopniu przyczynia się do zwiększenia ich populacji na polu uprawnym. Szata roślinna przyczynia się również do żyzności gleby poprzez magazynowanie węgla atmosferycznego dzięki fotosyntetycznemu działaniu. Później, gdy resztki roślinne zostaną przynajmniej częściowo rozłożone, stanowią źródło materii organicznej i pozwalają na zwiększenie zawartości próchnicy w glebie. Materią organiczną żywią się także dżdżownice co również wpływa na ich populację. Korzenie roślin międzyplonowych, ich różnorodność pod względem wielkości oraz głębokości mają pozytywne działanie na populację dżdżownic. Korzenie i dżdżownice oddziałują na siebie w taki sposób, że korzenie rosną w tunelach dżdżownic, a dżdżownice wykorzystują stare kanały korzeniowe, gdy poruszają się w profilu glebowym.

Rośliny międzyplonowe utrudniają ucieczkę pewnych pierwiastków do otoczenia poprzez spływ, wymywanie lub ulatnianie się, jak również utrzymują wilgotność i zatrzymują śnieg. Rośliny te również często mają możliwość pobierania składników niedostępnych dla innych roślin uprawnych np. facelia, gryka, słonecznik pobierają fosfor, który jest niedostępny dla zbóż. Na ogół z przeznaczeniem na zielony nawóz uprawia się rośliny strączkowe wiążące azot atmosferyczny, po zniszczeniu zasilają one glebę w azot.

W mniejszym stopniu rolnicy wykorzystują międzyplony do redukcji zachwaszczenia pól uprawnych. Wprowadzenie gatunków szybko rosnących pozwala na silną konkurencję z rozwojem chwastów w okresie, gdy pole uprawne jest najbardziej wrażliwe na zachwaszczenie są to najczęściej rośliny należące do rodziny kapustowatych. Natomiast najmniej konkurencyjne są rośliny bobowate nie są one przydatne do redukcji zachwaszczenia. Konkurencja o zasoby: światło, wodę i składniki odżywcze w glebie pomaga zmniejszyć biomasę chwastów i produkcję nasion co pozwala uniknąć zasilania glebowego banku nasion i przyszłych wschodów. Niektóre gatunki ograniczają także wschody chwastów dzięki działaniu allelopatycznemu np.: żyto, gryka. Duża biomasa wytwarzana przez niektóre gatunki o wolnym rozkładzie resztek np. owies szorstki, żyto, sorgo przyczyniają się do redukcji zachwaszczenia tworząc na powierzchni warstwę mulczu utrudniającą wschody chwastów. Jest to praktyka

szczególnie zalecana w przypadku siewu roślin w szerokich rzędach np. burak cukrowy, kukurydza pozwala ona na redukcję zachwaszczenia w międzyrzędziach.

Międzyplony pełnią wiele różnych funkcji pozytywnie wpływających na żyzność gleby, niektóre z nich można ze sobą łączyć poprzez odpowiedni dobór roślin, odpowiedni moment zniszczenia okrywy roślinnej. Uprawa roślin okrywowych pozwala dostosowywać się do zmian klimatu oraz łagodzić ich negatywne skutki.

LONGER DESCRIPTION – IN ENGLISH

The use of intercrops has changed over the years; their earlier function on Polish farms was to produce fodder for animals. Today, their primary function is to provide protection against wind and water erosion, as well as to enrich the soil with organic matter.

A properly composed intercrop mixture should consist of many plants differing in their morphological characteristics. The most important difference is the root system, which can be either bunching or taproot, which has a great influence on soil structure: respectively, plants with a bunching system increase the microporosity of the soil, while a taproot system loosens compacted soil layers; Japanese radish is a very good example of such a plant. It can successfully replace machinery that deeply loosens the soil. The tiered root system helps to consolidate the soil structure created by tillage machines.

Intercrops support biodiversity. They provide shelter and a food source for populations of many animal species and micro-organisms. Earthworms are a very good indicator of soil fertility, and the cultivation of cover crops contributes greatly to their populations in arable fields. Cover crops also contribute to soil fertility by storing atmospheric carbon through photosynthetic action. Later, when plant residues are at least partially decomposed, they provide a source of organic matter and allow the humus content of the soil to increase. Organic matter is also fed on by earthworms, which also influences their population. The roots of intercrops, their diversity in size and depth have a positive effect on earthworm populations. The roots and earthworms interact in such a way that the roots grow in the earthworm tunnels and the earthworms use the old root channels as they move through the soil profile.

Mollusc plants impede the escape of certain elements into the environment through runoff, leaching or volatilisation as well as maintaining moisture and retaining snow. These plants also often can take up elements that are

not available to other crops, e.g. phacelia, buckwheat and sunflower take up phosphorus, which is not available to cereals. In general, atmospheric nitrogen-fixing legumes are grown for use as green manure; once destroyed, they supply the soil with nitrogen.

To a lesser extent, farmers use catch crops to reduce the weed infestation on arable fields. The introduction of fast-growing species allows strong competition with weed growth at a time when the arable field is most susceptible to weed infestation. These are usually plants belonging to the cabbage family. On the other hand, the least competitive are broad bean plants that are not useful for weed reduction. Competition for resources (light, water and nutrients in the soil) helps to reduce weed biomass and seed production, which avoids feeding the soil seed bank and future weed emergence. Some species also reduce weed emergence through allelopathic effects (capacity to produce toxic compounds that are released into the soil when plant tissue is incorporated) e.g.: rye, buckwheat. The large biomass produced by some species with slow residue decomposition e.g. rough oats, rye, sorghum, contributes to weed reduction by forming a mulch layer on the surface that hinders weed emergence. This practice is particularly recommended if the crops are sown in wide rows, e.g. sugar beet, maize, and it reduces the weed infestation between rows.

Intercropping has many different functions with a positive effect on soil fertility, some of which can be combined through the right choice of plants, the right timing of the destruction of the cover crop. By growing cover crops, it is possible to adapt to climate change and mitigate its negative effects.

The flowchart is divided into three main sections: **Tillage**, **Direct sowing**, and a **Final recommendation** box.

Tillage Section:

- Plowing:**
 - Intercrop height above the knee: YES (leads to **Reduced or AGM****), NO (leads to **Plowing**).
- No-tillage:**
 - Intercrop height above the knee: YES (leads to **Grooves share above 20%**), NO (leads to **Grooves share above 20%**).
 - Grooves share above 20%:** YES (leads to **Reduced or AGM****), NO (leads to **Cultivation**).

Direct sowing Section:

- Grooves share above 20%:** YES (leads to **Intercrop height above the knee**), NO (leads to **Intercrop height above the knee**).
- Intercrop height above the knee:** YES (leads to **Reduced or AGM rate**), NO (leads to **Plow rate**).

Final recommendation box:

- Reduced or AGM rate:** Plowing, Cultivation and sowing, Cultivation and sowing.
- Plow rate:** Plowing, Cultivation and sowing, Cultivation and sowing.
- Cultivation:** Cultivation and sowing, Cultivation and sowing, Cultivation and sowing.
- Cultivation and sowing:** Cultivation and sowing, Cultivation and sowing, Cultivation and sowing.
- Reduced or AGM rate (Direct sowing):** Direct sowing, Direct sowing, Direct sowing.

Legend:

- 1 seed/1.2 plants
- ** seed 2 seeds

Source: Chamber of Agriculture of the Pyrénées-Atlantiques



Photo 2: A field of flowering mustard cover crop in full bloom



Photo 3: A freshly harvested tillage radish (Daikon radish) being held above a lush green cover crop field.



Photo 4: A tillage radish (Daikon radish) growing in a snow-covered field during winter.



Photo 5: A thriving cover crop mix growing in a field, showcasing a diverse blend of plant species including tillage radish, legumes, and leafy greens.



Photo 6: A cover crop mix in a winter.

PRACTICE ABSTRACT #8**SHORT TITLE IN NATIVE LANGUAGE**

Turvemaiden ilmastoviisas viljely Suomessa

SHORT TITLE IN ENGLISH

Climate Smart Farming of Finnish Peatlands

COUNTRY AND CLIMATIC ZONE

Finland Nordic Climate

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Peatland adaptation and mitigation
2. Water management
3. Peatland cover crops

PRODUCTION SYSTEM (IF RELEVANT)

Crop production

THEMATIC AREA

Crops management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Koko Suomen maatalosmaan hiilidioksidipäästöistä turvemaiden osuus on merkittävä noin 80% ja siksi eri tiloille sopivia hiilidioksidin päästövähennysratkaisuja on haettu jo useita vuosia turvemaiden osalta.

Turvemaiden osuus Suomen peltopinta-alasta eri mittausmenetelmistä riippuen on noin 4-7 % . Turvemaat määritellään paksuturpeisiksi, jos niiden turvepeite on yli 40 cm. Suurin osa turvemaista sijaitsee Suomen keskiosasta pohjoiseen karjatalousvaltaisilla viljelyalueilla.

Turvemaat pystyvät sitomaan vettä kivennäismaita paremmin, joten satotuotto on suurempi kuivana kasvukautena kuin kivennäismaalla.

Turvepeltojen ilmastoviisaaseen viljelyyn on haettu erilaisia ratkaisuja hiilidioksidipäästöjen vähentämiseksi. Päästövähennysratkaisuja on useita erilaisiariippuen siitä, kuinka paljon viljelijän tilalla on turvepeltoja. Yksinkertaisin keino on kartoittaa turvepeltojen sadontuottokyky eli keskittyä hyvätuottoisiin peltolohkoihin ja jättää heikkotuottoiset, pinta-alaltaan pienet ja muodoltaan haastavat lohkot kasvipeitteiseksi tai mahdollisesti jopa ennallistaa nämä pellot. Viljelijä itse on paras asiantuntija määrittämään omien turvepeltojensa sadontuottokyvyn

Suomessa viljellyillä turvepelloilla ilmastoviisaita viljelyratkaisuja turpeen hajoamisen hidastamiseksi ovat mm. Seuraavat toimenpiteet.

- Pellon vedenpinnan korkeuden ylläpitäminen ja säätely sekä säätösalaojitus
- Monivuotisten kasvien viljely
- Talviaikainen kasvipeitteisyys
- Suorakylvö tai kevennetty muokkaus
- Sadon käyttö ja viljely bioenergiaksi, kuten energiapaju
- Kyntömuokkauksen tai syvämuokkauksen välttäminen
- Heikkotuottoisten pienten peltolohkojen pitäminen luonnonhoitonurmena tai muuttaminen kosteikoksi

Suurin osa Suomen turvepelloista sijaitsee karjatalousalueilla, joten kasvipeitteisyys kohdentuu näin ollen automaattisesti suurelle osalle turvepelloista. Viljelijät ja tutkijat ovat kokeilleet ja kokeilevat edelleen uusia käytännönläheisiä viljelykeinoja turvemaiden hajoamisen hidastamiseksi.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Peatlands account for a significant 80% of the carbon dioxide emissions of the entire Finnish agricultural area, which is why Finland has been seeking carbon dioxide emission reduction solutions for farms for decades.

Peatlands cover about 4–7% of Finland's arable land, depending on the measurement method. They are defined as thick peats if the peat cover exceeds 40 cm. Most peatlands are located from the central to northern part of Finland, in areas dominated by livestock farming.

Peatlands are better able to bind water than mineral soils, so yield is higher during the dry growing season than on mineral soils.

Various solutions have been sought for climate-smart cultivation of peat fields to reduce carbon dioxide emissions. There are **several different emission reduction solutions depending on how many peat fields there are on the farmer's farm**. The simplest way is to map the yield capacity of peat fields, i.e. to focus on high-yielding parcels and leave low-yielding, small-scale parcels with challenging shapes covered with vegetation or possibly even restore these fields. The farmer himself is the best expert in determining the yield capacity of his own peat fields

In peat fields cultivated in Finland, climate-smart cultivation solutions to slow down the decomposition of peat include the following measures:

- Maintaining and regulating the water level in fields and regulating drainage
- Cultivation of perennial crops
- Winter plant cover
- Direct seeding or lightened tillage
- Use and cultivation of crops for bioenergy, such as energy willow
- Avoid plowing or deep tillage
- Keeping low yielding small parcels of arable land as grassland or converse them into wetlands

Most of Finland's peat fields are in livestock farming areas, so plant cover is thus automatically allocated to a large part of peat fields. Farmers and researchers have tried and continue to experiment with new practical farming methods to slow down the degradation of peatlands.

PHOTOS



Photo 1: Perennial, high-yielding grassland helps reduce peatland emissions by minimizing soil disturbance—only requiring re-establishment every five years, while keeping the field covered year-round



Photo 2: Peat soils provide reliable grass yields and are crucial for livestock feed during dry years. Their natural nitrogen release also reduces fertilizer needs by around 40% compared to mineral soils.



Photo 3: Peatlands are best suited for forage production and are essential, especially in regions with significant cattle farming and a high proportion of peat soils

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Peatland farming guide in Finnish

URL:

<https://www.proagria.fi/www/nettilehdet/turvepelto-opas/#/article/1/page/1>

PRACTICE ABSTRACT #18**SHORT TITLE IN NATIVE LANGUAGE**

Probiotechnologia w produkcji rolniczej

SHORT TITLE IN ENGLISH

“Probiotechnology” - Probiotics technology in agricultural production

COUNTRY AND CLIMATIC ZONE

Poland – warm – transition - temperate climate zone

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Eliminate the unpleasant smell of manure and slurry.
2. Improve the health and efficiency of farm animals.
3. Improve soil fertility by increasing organic carbon and humus content.

PRODUCTION SYSTEM

All: organic and conventional farming, plant production and animal husbandry.

THEMATIC AREA

Soil health and biodiversity, Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Probiotyki mają bardzo szeroki zakres użytkowania, w rolnictwie są dozwolone do stosowania w produkcji konwencjonalnej, jak i ekologicznej. Mają zastosowanie w produkcji roślinnej oraz zwierzęcej.

Efekty stosowania probiotyków w produkcji roślinnej:

- przyspieszenie procesu rozkładu resztek poźniwnych, słomy, poplonów, obornika, czyli tworzenia się próchnicy glebowej,
- wysoki poziom próchnicy glebowej to:
 - więcej dżdżownic, czyli produkcja naturalnego nawozu oraz spulchnianie podłoża;
 - większa możliwości magazynowania wody w glebie = roślina lepiej sobie radzi w okresach suszy.
- uruchamiają niedostępne dla roślin składniki mineralne już zawarte;
- w glebie = więcej mikro i makroelementów bez stosowania nawozów;
- rozkładanie toksyn, np. pozostałości po środkach ochrony roślin czy chorobach, dzięki czemu nie są przenoszone choroby roślin uprawnych pomiędzy kolejnymi sezonami wegetacyjnymi;
- można ograniczyć ilość stosowanych nawozów, a tym samym zaoszczędzić pieniądze oraz czas;
- probiotyki usprawniają proces kompostowania.

Efekty stosowania kompozycji pożytecznych mikroorganizmów w produkcji zwierzęcej:

- poprawiają proces trawienia;
- łagodzą przebieg zatruć pokarmowych;
- zmniejszenie częstości występowania biegunek;
- przyspieszają gojenie otarć i zranień;
- poprawiają kondycję fizyczną i funkcje fizjologiczne;
- likwidują odory produktów odzwierzęcych, np. obornik, gnojowica;
- redukują populację insektów, szczególnie much, meszek i komarów;
- w przypadku stosowania preparatów wewnątrz budynków inwentarskich, np. na ściany, podłogę, sufity, ściółkę itp., ogranicza się możliwość rozprzestrzeniania chorobotwórczych patogenów;
- poprawa jakości i wartości odżywczej kiszzonek. Proces kiszenia przebiega sprawniej i efektywniej. Kiszonki są bogatsze w łatwo przyswajalne składniki odżywcze, przez co zwierzęta karmione tak przygotowaną paszą mają lepsze wyniki produkcyjne;
- rewitalizacja wody.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Probiotics have a very wide range of uses. In agriculture, they are allowed for use in both conventional and organic production. They are used in crops and animal production.

Effects of using probiotics in crop production:

- accelerate the decomposition of post-harvest residues, straw, catch crops, manure, which leads to the formation of soil humus.
- A high level of soil humus means:
 - more earthworms, which means natural fertilizer production and soil loosening
 - greater water storage capacity in the soil = plants cope better during drought periods
- activate unavailable mineral components already present in the soil = more micro and macro elements without the use of fertilizers
- break down toxins, such as residues from plant protection products or diseases, so that crop diseases are not transmitted between successive growing seasons
- reduce the number of fertilizers used, thereby saving money and time
- probiotics improve the composting process.

Effects of using compositions of beneficial microorganisms in animal production:

- improve the digestion process
- alleviate the course of food poisoning
- reduce the incidence of diarrhea
- accelerate the healing of abrasions and wounds
- improve physical condition and physiological functions
- eliminate odors from animal products, such as manure and slurry
- reduce the population of insects, especially flies, midges and mosquitoes
- when using preparations inside livestock buildings, such as on walls, floors, ceilings, litter, etc., the possibility of spreading pathogenic pathogens is reduced
- improve the quality and nutritional value of silage. The ensiling process is more efficient and effective. Silage is richer in easily digestible nutrients, so animals fed with such prepared feed have better production results
- water revitalization.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Probiotechnologia w rolnictwie, czyli stosownie preparatów zawierających pożyteczne mikroorganizmy, m.in. bakterie, grzyby, pierwotniaki i wirusy. Dzięki różnorodności mikroorganizmów zwiększa się efekt działania preparatów. Odpowiednio dobrane grupy drobnoustrojów współpracują ze sobą, a nie rywalizują. Potrafią korzystać z produktów metabolizmu innych grup.

Probiotyki mają bardzo szeroki zakres użytkowania, w rolnictwie są dozwolone do stosowania w produkcji konwencjonalnej, jak i ekologicznej. Mają zastosowanie w produkcji roślinnej oraz zwierzęcej.

Główną pracą pożytecznych mikroorganizmów jest produkcja zdrowej gleby.

Mikroorganizmy „opiekują się” roślinami, są dla nich:

- **Kucharzem** – przetwarzają materię organiczną w próchnicę, a następnie związki przyswajalne dla roślin.
- **Kelnerem** – dostarczają substancje odżywcze z gleby do rośliny.
- **Ochroniarzem** – wypierają szkodliwe bakterie, grzyby, szkodniki tworząc dla nich niekorzystne warunki bytowania.

Efekty stosowania probiotyków w produkcji roślinnej:

- przyspieszenie procesu rozkładu resztek poźniwnych, słomy, poplonów, obornika, czyli tworzenia się próchnicy glebowej,

wysoki poziom próchnicy glebowej to:

- więcej dżdżownic, czyli produkcja naturalnego nawozu oraz spulchnianie podłoża;
- większe możliwości kumulacji węgla - C w glebie;
- większe możliwości magazynowania wody w glebie = roślina lepiej sobie radzi w okresach braku opadów atmosferycznych;
- poprawa struktury gleby, dzięki czemu m.in. intensywniej rozwija się system korzeniowy roślin;

Próchnica jest silnikiem gleby, głównym źródłem węgla C, a tym samym magazynem CO₂ (dwutlenku węgla).

1% próchnicy w glebie to:

17 t węgla organicznego

1700 kg azotu organicznego

300 kg fosforu

90-150 t wody

- uruchamiają niedostępne dla roślin składniki mineralne już zawarte w glebie = więcej mikro i makroelementów bez stosowania nawozów;
- rozkładanie toksyn, np. pozostałości po środkach ochrony roślin czy chorobach, dzięki czemu nie są przenoszone choroby roślin uprawnych pomiędzy kolejnymi sezonami wegetacyjnymi;
- lepsze przyswajanie stosowanych nawozów;
- można ograniczyć ilość stosowanych nawozów, a tym samym zaoszczędzić pieniądze oraz czas;
- probiotyki usprawniają proces kompostowania.

Efektem końcowym jest lepsza kondycja i zdrowie roślin uprawnych, są bardziej odporne na choroby, szkodniki, niekorzystne warunki atmosferyczne oraz dają większy plon.

Efekty stosowania kompozycji pożytecznych mikroorganizmów w produkcji zwierzęcej:

- probiotyki zasiedlają układ pokarmowy zwierząt, odtwarzając naturalną równowagę mikrobiologiczną. Stymulują układ immunologiczny zwierząt, zwiększając ich odporność na choroby;
- poprawiają proces trawienia;
- łagodzą przebieg zatruc pokarmowych;
- zmniejszenie częstości występowania biegunk;
- przyspieszają gojenie otarć i zranień;
- poprawiają kondycję fizyczną i funkcje fizjologiczne;
- likwidują odory produktów odzwierzęcych, np. obornik, gnojowica;
- redukują populację insektów, szczególnie much, meszek i komarów;
- w przypadku stosowania preparatów wewnątrz budynków inwentarskich, np. na ściany, podłogę, sufity, ściółkę itp., ogranicza się możliwość rozprzestrzeniania chorobotwórczych patogenów;
- poprawa jakości i wartości odżywczej kiszzonek. Proces kiszenia przebiega sprawniej i efektywniej. Kiszonki są bogatsze w łatwo przyswajalne składniki odżywcze, przez co zwierzęta karmione tak przygotowaną paszą mają lepsze wyniki produkcyjne.
- rewitalizacja wody.

Preparaty probiotyczne można dodawać do paszy, wody, oraz do zamgławiania budynków inwentarskich. Poprawa dobrostanu zwierząt hodowlanych przełoży się na większą ich wydajność (mleczną, mięsną czy

nieśną) oraz obniży koszty produkcji (większa przeżywalność zwierząt, mniejsze nakłady finansowe na preparaty weterynaryjne). Likwidacja odorów poprawi komfort pracy rolnika oraz zmniejszy niezadowolenie okolicznych mieszkańców.

LONGER DESCRIPTION – IN ENGLISH

Probiotechnology in agriculture means the use of preparations containing beneficial microorganisms, including bacteria, fungi, protozoa and viruses. The diversity of microorganisms increases the effectiveness of the preparations. Properly selected groups of microorganisms cooperate with each other and do not compete. They can take advantage of the metabolic products of other groups.

Probiotics have a very wide range of uses. In agriculture they are allowed for use in conventional and organic production. They are used in plant and animal production.

The main work of beneficial microorganisms is the production of healthy soil.

Microorganisms "take care" of plants, they are for them:

- **Cook** - they process organic matter into humus, and then into compounds that are assimilable for plants.
- **Waiter** - they deliver nutrients from the soil to the plant.
- **Security guard** - they displace harmful bacteria, fungi, pests, creating unfavorable living conditions for them.

Effects of using probiotics in plant production:

- acceleration of the decomposition process of post-harvest residues, straw, catch crops, manure, i.e. the formation of soil humus,

a high level of soil humus means:

- more earthworms, i.e. the production of natural fertilizer and loosening of the soil
- greater possibilities of carbon - C accumulation in the soil
- greater possibilities of water storage in the soil = the plant copes better with periods without rainfall
- improvement of soil structure, thanks to which, among others, the root system of plants develops more intensively

Humus is the engine of the soil, the main source of carbon C, and thus a storehouse of CO₂ (carbon dioxide).

1% of humus in the soil means:

17 t of organic carbon
1700 kg of organic nitrogen
300 kg of phosphorus
90-150 t of water

- they activate mineral components already present in the soil that are unavailable to plants = more micro and macro elements without the use of fertilizers
- decomposition of toxins, e.g. residues of plant protection products or diseases, thanks to which diseases of cultivated plants are not transmitted between successive growing seasons
- better assimilation of used fertilizers
- it is possible to reduce the number of fertilizers used, and thus save money and time
- probiotics improve the composting process.

The end result is a better condition and health of cultivated plants. They are more resistant to diseases, pests, unfavorable weather conditions and give a greater yield.

Effects of using compositions of beneficial microorganisms in animal production:

- Probiotics colonize the animal's digestive system, restoring the natural microbiological balance. They stimulate the animal's immune system, increasing their resistance to diseases
- improve the digestion process
- alleviate the course of food poisoning
- reduce the frequency of diarrhea
- accelerate the healing of abrasions and wounds
- improve physical condition and physiological functions
- eliminate odors of animal products, e.g. manure, slurry
- reduce the population of insects, especially flies, midges and mosquitoes
- in the case of using preparations inside livestock buildings, e.g. on walls, floor, ceilings, litter, etc., the possibility of spreading pathogenic pathogens is limited
- improve the quality and nutritional value of silage. The ensiling process is more efficient and effective. Silage is richer in easily

digestible nutrients, thanks to which animals fed with such prepared feed have better production results

- water revitalization.

Probiotic preparations can be added to feed, water, and for fogging livestock buildings. Improving the welfare of farm animals will translate into their greater efficiency (milk, meat or egg production) and reduce production costs (higher animal survival, lower financial outlays on veterinary preparations). The elimination of odors will improve the farmer's comfort at work and reduce the dissatisfaction of residents.

ADDITIONAL INFORMATION

Elementy ułatwiające wdrażanie probiotechnologii:

Factors Facilitating the Implementation of Probiotechnology:

- Rosnąca świadomość ekologiczna - coraz więcej rolników i konsumentów jest świadomych negatywnego wpływu konwencjonalnych metod produkcji na środowisko. Probiotechnologia oferuje alternatywne, bardziej zrównoważone podejście.
Growing ecological awareness - more and more farmers and consumers are aware of the negative impact of conventional production methods on the environment. Probiotechnology offers an alternative, more sustainable approach.
- Badania naukowe - coraz więcej badań potwierdza skuteczność probiotechnologii w różnych aspektach produkcji rolniczej. Scientific research - an increasing number of studies confirm the effectiveness of probiotechnology in various aspects of agricultural production.
- Dostępność produktów - na rynku dostępnych jest coraz więcej preparatów probiotycznych, dostosowanych do różnych potrzeb i upraw.
Product availability - there is a growing number of probiotic products available on the market, tailored to different needs and crops.
- Wsparcie rządowe - w niektórych krajach istnieją programy wspierające wdrażanie probiotechnologii w rolnictwie.
Government support - some countries have programs supporting the implementation of probiotechnology in agriculture.

Przeszkody we wdrażaniu probiotechnologii:

Obstacles to the Implementation of Probiotechnology:

- Brak wiedzy i doświadczenia - wielu rolników nie jest jeszcze świadomych korzyści płynących z probiotechnologii lub nie wie, jak je skutecznie stosować.
Lack of knowledge and experience - many farmers are not yet aware of the benefits of probiotechnology or do not know how to use it effectively.
- Koszty - niektóre preparaty probiotyczne mogą być drogie, co może stanowić barierę dla mniejszych gospodarstw.
Costs - some probiotic preparations can be expensive, which can be a barrier for smaller farms.
- Brak regulacji - w niektórych krajach brak jest jasnych regulacji dotyczących produkcji i stosowania probiotyków w rolnictwie.
Lack of regulation - in some countries, there is a lack of clear regulations regarding the production and use of probiotics in agriculture.
- Oporność na zmiany - niektórzy rolnicy mogą być oporni na zmiany i preferować tradycyjne metody produkcji.
Resistance to change - some farmers may be resistant to change and prefer traditional production methods.

Przyszłe działania:

Future Actions:

- Edukacja i szkolenia - konieczne jest prowadzenie szkoleń i warsztatów dla rolników, aby zwiększyć ich świadomość na temat probiotechnologii i nauczyć ich, jak ją skutecznie stosować.
Education and training - it is necessary to conduct training and workshops for farmers to raise their awareness of probiotechnology and teach them how to use it effectively.
- Badania nad nowymi produktami - potrzebne są dalsze badania nad nowymi, bardziej skutecznymi i tańszymi preparatami probiotycznymi.
Research on new products - further research is needed on new, more effective, and cheaper probiotic preparations.
- Regulacje prawne - konieczne jest stworzenie jasnych i spójnych regulacji dotyczących produkcji i stosowania probiotyków w rolnictwie.
Legal regulations - it is necessary to create clear and coherent regulations regarding the production and use of probiotics in agriculture.
- Promocja probiotechnologii - należy promować probiotechnologię jako zrównoważone i skuteczne podejście do produkcji rolniczej.

Promotion of probiotechnology - probiotechnology should be promoted as a sustainable and effective approach to agricultural production.

Probiotechnologia to innowacyjne podejście do produkcji rolniczej, które może przynieść wiele korzyści zarówno rolnikom, jak i konsumentom. Wybierając produkty pochodzące z upraw, w których stosowano probiotechnologię, wspieramy zrównoważone rolnictwo i dbamy o nasze zdrowie i środowisko.

Probiotechnology is an innovative approach to agricultural production that can bring many benefits to both farmers and consumers. By choosing products from crops where probiotechnology was used, we support sustainable agriculture and take care of our health and the environment.

PRACTICE ABSTRACT #19**SHORT TITLE IN NATIVE LANGUAGE**

Jak zatrzymać azot w gnojowicy poprzez zakwaszanie?

SHORT TITLE IN ENGLISH

How to Keep Nitrogen in Slurry by Acidification?

CONTACT

Justyna Fila (j.fila@cdr.gov.pl)

3 BENEFITS OF THE PRACTICE

1. Reducing ammonia emissions from slurry
2. Improving animal welfare
3. Reducing odors

PRODUCTION SYSTEM (IF RELEVANT)

Conventional

THEMATIC AREA

Manure storage and spreading

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

- Wysokie pH gnojowicy to główny powód bardzo szybkiego ulatniania się amoniaku w czasie jej aplikacji na polu. Podczas przechowywania gnojowicy w zbiornikach także dochodzi do znacznych strat azotu. Straty te można ograniczyć poprzez zadaszkowanie zbiorników, ochładzanie gnojowicy w celu spowolnienia procesów w niej zachodzących lub zakwaszanie.

- Obecnie w Danii 20% gnojowicy jest zakwaszane. Poza granicami tego kraju istnieje tylko kilka pilotażowych instalacji. Zainteresowanie tą techniką ze strony innych krajów rośnie, a obecny dokument BAT (Best Available Techniques) wskazuje zakwaszanie gnojowicy jako najlepszą dostępną technikę obowiązkową we wszystkich krajach UE.

W ramach projektu Climate Farm Demo chcemy osiągnąć 30% redukcji emisji gazów cieplarnianych w trakcie trwania projektu poprzez upowszechnianie praktyk łagodzących zmiany klimatu. Produkcja zwierzęca jest odpowiedzialna za znaczne emisje gazów cieplarnianych dlatego ważne jest aby promować praktyki, które wpływają na ich obniżenie.

- **Praktyczne rekomendacje:** Istnieją 3 metody zakwaszania “w budynku”, “na polu” i “w zbiorniku”. Bardzo ważne w każdym systemie jest zachowanie zasad bezpieczeństwa. Szczególnie należy zwrócić uwagę na środki ochrony osobistej tj. gogle do ochrony oczu, maskę pochłaniającą toksyczne opary, rękawice i buty kwasoodporne oraz kombinezon z kapturem. Koszt zakupu kwasu siarkowego jest niski ok 60 zł za litr i jest on łatwo dostępny. Pierwszy system zakwaszania gnojowicy pojawił się na rynku w 1999 roku i był to system zakwaszania w budynku. Następnie wprowadzono ok. 2009 roku system zakwaszania na polu. Ostatni na rynku pojawił się system zakwaszania gnojowicy w zbiorniku jako prostszy i tańszy od systemu zakwaszania gnojowicy na polu.
- **Grupa docelowa:** rolnicy

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

High pH of slurry is the main reason for very rapid evaporation of ammonia during its application to the field. During storage of slurry in tanks, significant nitrogen losses also occur. These losses can be reduced by covering tanks, cooling the slurry to slow down the processes occurring in it, or acidifying it.

Currently, in Denmark 20% of slurry is acidified. There are only a few pilot plants outside Denmark. Interest in this technique is growing in other countries, and the current BAT (Best Available Techniques) document indicates slurry acidification as a mandatory best available technique in all EU countries. **Practical implications/recommendations:** There are 3 methods of slurry acidification: “in house”, “in field” and “in storage”. It is very important to follow safety rules in each system. Particular attention should

be paid to personal protective equipment, such as eye protection goggles, a mask absorbing toxic fumes, acid-resistant gloves and shoes, and a hooded suit. The cost of purchasing sulphuric acid is low, around 15 EUR per litre, and it is easily available. Main cost is equipment. The first slurry acidification system appeared on the market in 1999 in Denmark and it was a system of acidification in house. Then around 2009 a system of acidification in the field was introduced. The last one on the market appeared a system of acidification of slurry in storage.

- **Target Audience:** farmers

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Wysokie pH gnojowicy to główny powód bardzo szybkiego ulatniania się amoniaku w czasie jej aplikacji na polu. Podczas przechowywania gnojowicy w zbiornikach także dochodzi do znacznych strat azotu. W Danii od 20 lat stosowana jest metoda zakwaszania gnojowicy w celu obniżenia emisji amoniaku. Do zakwaszania gnojowicy używamy stężonego kwasu siarkowego 96%. Kwas siarkowy jest substancją silnie toksyczną i drażniącą dlatego należy zwrócić uwagę na środki ochrony osobistej tj. gogle do ochrony oczu, maskę pochłaniającą toksyczne opary, rękawice i buty kwasoodporne oraz kombinezon z kapturem. Wyróżniamy 3 metody zakwaszania gnojowicy

1. „in house” czyli w budynku
2. „in storage” czyli w zbiorniku
3. „in field” czyli na polu.

W skład systemu „**w budynku**” wchodzi: zbiornik główny na gnojowicę, zbiornik procesowy wyposażony w mieszadło, zbiornik na kwas siarkowy oraz komputer z jednostką sterującą. Zasada działania systemu polega na przepompowaniu gnojowicy zalegającej w kanałach gnojowicowych znajdujących się w budynku do zbiornika procesowego. Tu następuje dozowanie kwasu siarkowego przy ciągłym mieszaniu z gnojowicą aż ta osiągnie pH 5,5. Za pomocą czujnika przepływu gnojowica przepompowywana jest z powrotem do kanałów znajdujących się w budynku inwentarskim i krąży do momentu osiągnięcia odpowiedniej wartości pH.

Aby utrzymać stały poziom pH gnojowicy cały proces przepompowywania gnojowicy z kanałów gnojowicowych powtarzany jest raz dziennie. Zakwaszanie gnojowicy „**w zbiorniku**” w którym jest przechowywana jest

możliwe dzięki systemowi, który zamontowany jest na ciągniku rolniczym. W skład systemu wchodzi: mieszadło na końcu którego umieszczone są dysza do dozowania kwasu, pompa do gnojowicy oraz cały system orurowania wraz z zaworem zwrotnym i pompą do dozowania kwasu. Kwas zmagazynowany jest w pojemniku, który znajduje się bezpośrednio przy zbiorniku z gnojowicą. Kwas jest dozowany i miksowany z gnojowicą bezpośrednio w zbiorniku w którym gnojowica była magazynowana. Podczas dodawania kwasu będzie wytwarzać się duża ilość piany dlatego należy zwrócić uwagę aby zbiornik w którym magazynowana jest gnojowica był wypełniony maksymalnie w 2/3 swojej objętości. Gdyby piany było za dużo należy przerwać dodawanie kwasu i poczekać aż piana opadnie.

Trzeci system „na polu” wydaje się najbezpieczniejszy z punktu widzenia dozowanego kwasu. W skład systemu wchodzi: wóz asenizacyjny wyposażony w pompę oraz zestaw węży wleczonych, pH metr, a także ciągnik, który jest integralną częścią całego systemu. Dozowanie kwasu siarkowego realizowane jest za pomocą nierdzewnej pompy. Dawka kwasu sterowana jest elektronicznie. Przed rozpoczęciem zakwaszania gnojowicy komputer sprawdza poziom pH gnojowicy znajdującej się w wozie asenizacyjnym. Następnie należy wprowadzić do komputera wartość pH jaką ostatecznie chcemy otrzymać. Czujnik pH umieszczony jest na wysięgniku jednego z przewodów do nawożenia. Bardzo istotny jest sposób wymieszania kwasu siarkowego z gnojowicą ponieważ powstająca piana może zatkać przewody i uniemożliwić aplikację zakwaszonej gnojowicy na pole. Aby tego uniknąć, wymieszanie kwasu i gnojowicy odbywa się bardzo szybko, a wtrysk kwasu następuje jak najbliżej dystrybutora, co powoduje swobodny wypływ zakwaszonej gnojowicy poprzez węże wleczone.

Wieloletnie doświadczenia w Danii mówią, że zakwaszanie gnojowicy ma szereg zalet: od zmniejszenia emisji amoniaku nawet o 40%, poprzez dostarczenie siarki do gleby i poprawę stanu zdrowotnego zwierząt (jeśli stosujemy system zakwaszania w budynku) do wzrostu plonu włącznie. Podczas aplikacji gnojowicy na pole niezależnie jakim systemem ją zakwaszaliśmy odory zredukowane są do minimum. Ponadto wieloletnie badania SEGES w Danii wskazują na wzrost sekwestracji węgla w glebie przy stosowaniu zakwaszonej gnojowicy na polu. Koszt zakupu kwasu siarkowego jest niski ok 60 zł za litr i jest on łatwo dostępny.

LONGER DESCRIPTION – IN ENGLISH

The high pH of slurry is the primary reason for the rapid evaporation of ammonia during field application. Significant nitrogen losses also occur during slurry storage in tanks. In Denmark, slurry acidification has been practiced for over 20 years. The process uses concentrated 96% sulfuric acid, which is highly toxic and irritating. Therefore, appropriate personal protective equipment (PPE) is essential, including protective goggles, a mask for toxic fumes, acid-resistant gloves and footwear, and a hooded suit.

There are three main methods of slurry acidification:

- 1. In-House** **Acidification**
 This system includes a main slurry tank, a process tank with a mixer, a sulfuric acid tank, and a computer-controlled unit. Slurry is pumped from channels in the livestock building to the process tank. Sulfuric acid is added and mixed until the slurry reaches a pH of 5.5. A flow sensor ensures the slurry circulates back into the building until the desired pH is maintained. To stabilize pH, this process is repeated daily.
- 2. In-Tank** **Acidification**
 This method uses a tractor-mounted system comprising a mixer with an acid dosing nozzle, a slurry pump, a piping system with a non-return valve, and an acid dosing pump. The sulfuric acid is stored in a container beside the slurry tank and added directly into the stored slurry. Since acidification generates foam, the slurry tank should be filled to no more than two-thirds capacity. If excessive foam forms, pause acid addition until it subsides.
- 3. In-Field** **Acidification**
 Considered the safest method for handling sulfuric acid, this system consists of a slurry tanker with a pump and trailing hoses, a pH meter, and a tractor. Acid is dosed using a stainless steel pump with electronic control. The system measures the initial pH of the slurry and adjusts it to the target pH entered in the computer. A pH sensor placed near the distribution boom ensures accurate application. To prevent clogging from foam, acid and slurry are mixed quickly, and the acid is injected as close to the distributor as possible.

Benefits of Slurry Acidification

Decades of Danish experience confirm multiple benefits of acidifying slurry:

- **Ammonia emission reduction** by up to 40%
- **Sulfur supplementation** to the soil
- **Improved animal health**, particularly with in-house systems

- **Higher crop yields**
- **Minimal odor** during field application
- **Increased carbon sequestration**, according to long-term SEGES studies

Additionally, sulfuric acid is widely available and relatively inexpensive, costing around €15 per liter.

PHOTOS



Photo 1. Adding acid to slurry produces a large amount of foam (Torkild Birkmose, SEGES).



Photo 2. Personal protective equipment when working with acid.



Photo 3. Slurry tanker with equipment for acidifying slurry "in the field" (Henning Foged, enAgro)

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Slurry acidification technologies (in Polish)

URL:

<https://www.youtube.com/watch?v=caHdkPxvkQU>

Title/Description

Treating slurry to reduce emissions

URL:

<https://www.youtube.com/watch?v=5bfGVKVC0hc>

PRACTICE ABSTRACT #20**SHORT TITLE IN NATIVE LANGUAGE**

Compléments alimentaires pour réduire les émissions de méthane entérique des bovins

SHORT TITLE IN ENGLISH

Additives for Reducing Enteric Methane Emissions from Cattle

COUNTRY AND CLIMATIC ZONE

All zones

CONTACT

Benoît Rouillé, (benoit.rouille@idele.fr)

3 BENEFITS OF THE PRACTICE

1. Reduction of methane emissions
2. Improvement of feed efficiency
3. Contribution to decrease carbon footprint of bovine production

PRODUCTION SYSTEM

Beef and dairy cattle

THEMATIC AREA

Additives for reducing enteric methane emissions from cattle

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

L'utilisation de compléments alimentaires permet de réduire significativement les émissions de méthane chez les bovins (voir le replay du webinaire organisé par CFD pour les références bibliographiques). Il en existe une grande diversité : tanins, huiles essentielles, nitrates, composés issus de la chimie. Ces additifs agissent en modifiant la fermentation ruminale, ce qui limite la production de méthane tout en maintenant les performances zootechniques des animaux la plupart du temps. Dans le cadre du projet Climate Farm Demo, l'ambition est de partager des connaissances scientifiques à jour, des essais en cours permettant d'améliorer la connaissance, de témoigner avec des acteurs des filières lait et viande sur la mise en œuvre pratique de ces solutions en ferme. Les résultats espérés sont une réduction des émissions pouvant atteindre 20 %, avec un impact économique limité pour les éleveurs ou pris en charge par un autre acteur. Ces solutions représentent une opportunité intéressante pour améliorer la durabilité de la production bovine en Europe.

L'intégration de compléments alimentaires dans l'alimentation des bovins est une approche innovante pour réduire les émissions de méthane. Des travaux scientifiques ont montré que la majorité de ces compléments permettent de réduire la production de méthane de 10 à 20 %. Ils influencent la digestion des animaux en modifiant le processus de fermentation ruminale, sans compromettre leurs performances productives la plupart du temps. (voir le replay du webinaire organisé par CFD pour les références bibliographiques)

L'utilisation de ces compléments constitue une opportunité pour les éleveurs souhaitant réduire leur empreinte environnementale tout en maintenant une rentabilité économique. L'intérêt de ces solutions réside également dans leur compatibilité avec les systèmes d'élevage existants et leur potentiel à être intégrées sans nécessiter de modifications majeures des pratiques alimentaires actuelles.

Cependant, plusieurs défis demeurent quant à leur adoption à grande échelle. Tout d'abord, la disponibilité et le coût de ces additifs varient selon les régions et les filières d'approvisionnement. Leur efficacité peut également dépendre du type de ration et des conditions d'élevage spécifiques. Il est donc essentiel d'adapter les recommandations d'utilisation en fonction des contextes locaux.

Par ailleurs, bien que certains compléments bénéficient déjà d'une reconnaissance réglementaire et d'une commercialisation à l'échelle européenne, d'autres nécessitent encore des études complémentaires pour garantir leur innocuité et leur efficacité sur le long terme. Le soutien

de la recherche et des politiques publiques sera déterminant pour favoriser leur adoption généralisée.

Des initiatives de sensibilisation et de formation des éleveurs sont également indispensables pour accélérer l'adoption de ces solutions. En complément, le partage d'expériences entre agriculteurs et la démonstration de résultats concrets sur le terrain contribueront à lever les freins à leur mise en œuvre.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The use of dietary supplements can significantly reduce methane emissions in cattle (see the CFD webinar for scientific references, included in additional dissemination material). There is a wide variety of supplements: tannins, essential oils, nitrates, and other chemical compounds. These additives act by modifying ruminal fermentation, limiting methane production while generally maintaining animal performance. Within the Climate Farm Demo project, the goal is to share current scientific knowledge, ongoing trials, and testimonies from the milk and meat sectors on practical implementation. Expected results show up to 20% reduction in emissions, with limited economic impact for farmers, often supported by other actors. These solutions offer an opportunity to improve the sustainability of European beef production.

Integrating feed additives into cattle diets is an innovative way to reduce methane emissions. Farm trials show that some additives, especially condensed tannins and seaweed extracts, can cut methane production by 10–20%. They improve digestion by altering ruminal fermentation without affecting performance.

These additives offer farmers a way to reduce their environmental footprint while maintaining profitability. They are compatible with current systems and can be integrated without major feeding changes.

However, several challenges limit large-scale adoption. Availability and costs vary by region and supply chain. Effectiveness depends on feed rations and farm conditions, requiring tailored advice. While some additives are approved and sold in Europe, others need more research to confirm long-term safety and impact.

Support from research and policy will be key. Awareness campaigns, training, and real-farm demonstrations are essential to encourage adoption and share best practices.

ADDITIONAL INFORMATION

The adoption of feed additives for methane reduction could be facilitated by economic incentives and better dissemination of knowledge about their effectiveness. Research must continue to explore new solutions and improve the formulation of existing additives. Increased collaboration between breeders, researchers and the feed industry are essential to ensure a successful transition to more sustainable beef production.

PHOTOS



GreenFeed: a tool for measuring enteric methane emissions at individual level

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Joint CFD-CSA webinar about methane emissions.

URL:

<https://www.youtube.com/watch?v=E-62yGC-ovw&t=49s>

PRACTICE ABSTRACT #21**SHORT TITLE IN NATIVE LANGUAGE**

De voordelen van koolstof boeren

SHORT TITLE IN ENGLISH

The Benefits of Carbon Farming

COUNTRY AND CLIMATIC ZONE

All countries and climatic zones in Europe.

Measures and results are in Dutch context

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Soil health
2. Climate mitigation
3. Water adaptation

PRODUCTION SYSTEM

Land-based sectors

THEMATIC AREA

Soil health and biodiversity

Effectieve maatregelen voor koolstofvastlegging:

Om de hoeveelheid organische stof in de bodem te verhogen, zijn er twee opties:

- Meer organische stof aanvoeren: Bijvoorbeeld door het gebruik van groenbemesters, compost en vaste mest.
- Afbraak van organische stof remmen: Bijvoorbeeld door gewasresten achter te laten op het land.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Carbon Sequestration in Agriculture

Benefits of Carbon Sequestration:

- **Improvement of Soil Health:** Carbon sequestration enhances soil health by improving soil structure, water retention, and nutrient availability.
- **Reduction of Carbon Footprint:** By sequestering carbon, the agricultural sector can contribute to the reduction of overall CO₂ emissions.
- **Financial Benefits:** Farmers can financially benefit from carbon sequestration by participating in carbon farming projects and selling carbon credits.
- **Support for Sustainable Agricultural Practices:** Carbon sequestration promotes the use of sustainable agricultural practices such as cover crops, compost, and organic fertilizers.

Ways Carbon Can Be Sequestered in Agriculture:

- **In the Soil:** Through crop residues, roots, and animal manure, organic material enters the soil, where soil organisms partially break it down. Some of the carbon forms stable organic matter that remains in the soil for a long time.
- **In Living Plants (Trees):** For example, through agroforestry, where carbon is sequestered in the biomass of trees as long as the trees remain standing.
- **In Processed Biomass:** Such as building materials made from hemp, which sequester carbon for a long time.

Factors Affecting Carbon Sequestration:

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Koolstofvastlegging in de landbouw

Voordelen koolstofvastlegging:

- Verbetering van de bodemgezondheid:
Koolstofvastlegging verhoogt de gezondheid van de bodem door verbetering van de bodemstructuur, waterretentie en beschikbaarheid van voedingsstoffen
- Verlaging van de koolstofvoetafdruk:
Door koolstof vast te leggen, kan de landbouwsector bijdragen aan de vermindering van de totale CO₂-uitstoot
- Financiële voordelen:
Boeren kunnen financieel profiteren van koolstofvastlegging door deel te nemen aan carbon farming projecten en het verkopen van koolstofcertificaten
- Ondersteuning van duurzame landbouwpraktijken:
Koolstofvastlegging stimuleert het gebruik van duurzame landbouwpraktijken zoals groenbemesters, compost en organische meststoffen

Koolstof kan op verschillende manieren worden vastgelegd in de landbouw:

- In de bodem: Via gewasresten, wortels en dierlijke mest komt organisch materiaal in de bodem, waar het bodemleven het gedeeltelijk afbreekt. Een deel van de koolstof vormt stabiele organische stof die langdurig in de bodem blijft.
- In levende planten (bomen): Bijvoorbeeld via agroforestry, waarbij koolstof in de biomassa van bomen wordt vastgelegd zolang de bomen blijven staan.
- In verwerkte biomassa: Zoals bouwmaterialen van hennep, die langdurig koolstof vastleggen.

Factoren die koolstofvastlegging beïnvloeden:

- De effectiviteit van koolstofvastlegging in de bodem hangt af van factoren zoals vochtbeschikbaarheid, temperatuur, kleigehalte, bodemstructuur, zuurgraad en bodemleven. Kleibodems kunnen over het algemeen meer koolstof vasthouden dan zandbodems.

- The effectiveness of carbon sequestration in the soil depends on factors such as moisture availability, temperature, clay content, soil structure, pH, and soil life. Clay soils generally have a higher carbon sequestration capacity than sandy soils.

Effective Measures for Carbon Sequestration: To increase the amount of organic matter in the soil, there are two options:

- **Increase Organic Matter Input:** For example, by using cover crops, compost, and solid manure.
- **Reduce Organic Matter Decomposition:** For example, by leaving crop residues on the land.

PHOTOS



Photos 1 and 2: Sandy and clay soils

Measures	Max. CO2 Sequestration T CO2/year	Certainty of CO2 Sequestration	Estimated N2O Emission T CO2/year
More permanent grassland	211	High	-31 to 125
Increase grassland age	n.b.	High	n.b.
Crop rotation maize-clover	96	Reasonable	-17 to 67
Adjust crop rotation	59	Reasonable	-25 to 25
Cover crops/catch crops	39	High	10 to 19
Extra solid manure	35	High	-5 to 5
Extra compost	24	High	1 to 2
Leave crop residues	19	High	1 to 7
Agroforestry	46	High	-3 to 8
Bird fields	4	Reasonable	0
Field margins	3	Low	-2 to -1
Non-inversion tillage	0	High	12 to 40
Herb-rich grassland	n.b.	Low	-27 to -5

Photo 3: Effect on Dutch Sandy Soils

Measures	Max. CO2 Sequestration T CO2/year	Certainty of CO2 Sequestration	Estimated N2O Emission T CO2/year
More permanent grassland	90	High	-19 to 75
Increase grassland age	n.b.	Very High	n.b.
Crop rotation maize-clover	37	Reasonable	-8 to 33
Adjust crop rotation	61	Reasonable	-25 to 25
Cover crops/catch crops	133	High	40 to 81
Extra solid manure	42	High	-5 to 5
Extra compost	35	Very High	1 to 3
Leave crop residues	79	High	1 to 15
Agroforestry	46	High	-2 to 7
Bird fields	5	Reasonable	-1 to 1
Field margins	6	Reasonable	-3 to -1
Non-inversion tillage	0	High	18 to 60
Herb-rich grassland	n.b.	Low	-23 to -5

Photo 4: Effect on Dutch Clay Soils

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Brochure: Koolstofvastlegging in bodem, bomen en bouwmaterialaai

URL:

[koostofvastlegging-bodem-bomen-en-bouwmaterialen.pdf](#)

PRACTICE ABSTRACT #26**SHORT TITLE IN NATIVE LANGUAGE**

S'adapter à une perte de 20 à 30% de production herbagère en Bretagne : les leviers mis en place par la SCEA de l'Ellé

SHORT TITLE IN ENGLISH

Adapting to a Loss of 20 to 30% of Grassland Production in Brittany: The Levers Put in Place by "SCEA de l'Ellé"

COUNTRY AND CLIMATIC ZONE

Bretagne, Morbihan, France, Atlantic area

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Feed self-sufficiency
2. Climate resilience
3. Optimising the dairy system

PRODUCTION SYSTEM (IF RELEVANT)

Dairy cattle

THEMATIC AREA

Forage production, herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Face aux défis du changement climatique, la SCEA de l'Ellé a mis en place plusieurs leviers d'adaptation. Grâce à l'outil [ClimAléas-Diag](#), issu des projets [Fermadapt](#) et [Climatveg](#), un diagnostic de vulnérabilité a été réalisé, révélant une baisse de production herbagère de 31 % en cas d'année sèche. Pour sécuriser l'alimentation du troupeau, l'exploitation s'est engagée dans des modifications conséquentes de son système : augmentation des surfaces de prairies temporaires et de cultures fourragères, diversification de ses ressources (maïs ensilage, méteil, betteraves), et optimisation de la gestion des stocks fourragers. À court terme, l'installation d'un boviduc permettra d'agrandir très significativement les surfaces de pâturage de 24 à 40 hectares.

Malgré des freins à l'adoption de ces pratiques importants : (1) de nouveaux coûts énergétiques et économiques liés à la hausse des charges de mécanisation ; (2) des investissements dans des infrastructures (boviduc, stockage des fourrages) et (3) la nécessité de tester les stratégies d'adaptation dans les conditions spécifiques de son exploitation, les bénéfices attendus sont une plus grande résilience face aux aléas climatiques, une amélioration de l'autonomie alimentaire, et une réduction de la dépendance aux intrants extérieurs. Cette analyse « coûts / bénéfices » a motivé l'éleveur à se lancer !

La SCEA de l'Ellé, située en Bretagne, fait face à des conditions climatiques de plus en plus variables, impactant directement la production de fourrage et la gestion du troupeau laitier. Afin de limiter les risques liés aux sécheresses estivales et aux printemps peu poussants, un diagnostic a été réalisé avec l'outil ClimAléas-Diag (programmes Fermadapt et Climatveg). Les résultats ont montré un déficit fourrager potentiel de 236 tonnes de matière sèche, soit 20 % des besoins annuels. Pour y faire face, plusieurs stratégies ont été mises en œuvre :

- Diversification des ressources fourragères : introduction de méteil, betteraves et légumineuses (luzerne).
- Amélioration de l'autonomie alimentaire : augmentation des surfaces de pâturage et cultures fourragères.
- Optimisation du troupeau : baisse du taux de renouvellement, vêlages groupés en automne, et sortie prolongée des génisses au pâturage.
- Gestion des stocks : ensilage et enrubannage prioritaires pour garantir une alimentation suffisante toute l'année.

À moyen terme, l'implantation accrue de légumineuses et une meilleure gestion des effectifs permettront de sécuriser davantage le système face aux aléas climatiques.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

To address climate change challenges, SCEA de l'Ellé has implemented several adaptation measures. Using the [ClimAléas-Diag](#) tool, created in both [Fermadapt](#) and [Climatveg](#) programs, a vulnerability diagnosis showed 31% reduction in grass production in dry years. To secure livestock feed, the farm has made changes to its system, increasing temporary grassland areas and forage crops, diversifying its resources (silage maize, mixed cereals, beet), and optimising the management of fodder stocks. In the short term, a cattle underpass will significantly increase the grazing area from 24 to 40 hectares.

Despite notable challenges in adopting these practices—such as:

1. Increased energy and economic costs due to higher mechanization expenses.
2. Investments in infrastructure, including cattle underpasses and additional fodder storage.
3. The necessity to test adaptation strategies tailored to the farm's specific conditions.

The anticipated benefits—enhanced resilience to climatic hazards, improved food self-sufficiency, and reduced reliance on external inputs—have motivated the farmer to proceed.

SCEA de l'Ellé in Brittany faces increasingly variable climatic conditions, impacting forage production and dairy herd management. To mitigate risks from dry summers and slow-growing springs, they conducted a diagnosis using the ClimAléas-Diag tool, revealing a potential forage deficit of 236 tonnes of dry matter—20% of annual needs. In response, they implemented several strategies:

- Diversifying forage resources: Introducing mixed cereals, beets, and legumes like alfalfa.
- Enhancing feed autonomy: Expanding grazing and forage crop areas.
- Optimizing the herd: Reducing the replacement rate, grouping autumn calvings, and extending grazing periods for heifers.
- Managing stocks: Prioritizing silage and wrapped forage to ensure year-round feed availability.

In the medium term, increasing legume cultivation and improving herd management will further secure the system against climate variability.

ADDITIONAL INFORMATION

The main obstacles to adopting these practices are:

- **Energy and economic costs:** increase in mechanisation costs (on average +€12/1000L) and fodder inputs (on average +€8.5/1000L). Source: Godoc et al. 2024.
- **Gradual implementation:** adaptation requires investment in infrastructure (boviduc, fodder storage).
- **Need for local references:** adaptation strategies need to be tested and validated according to the specific conditions of each farm.

However, the expected benefits are greater resilience to climatic hazards, improved food self-sufficiency and reduced dependence on external inputs.

PHOTOS



Photo 1: Conférence au Salon de l'Herbe de Nouvoitou May, 2024



Photo 2: Journées innovation

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Article « Sur la SCEA de l'Ellé, une réflexion sur l'adaptation au climat » (Paysan Breton, sept. 2024).

URL:

<https://www.paysan-breton.fr/2024/09/reflexion-en-cours-sur-ladaptation-au-climat/>

Title/Description

Godoc et al. 2024 – Conséquences énergétiques, économiques et environnementales de l'adaptation au changement climatique des systèmes fourragers bovins lait du Grand Ouest.

URL:

<https://afpf-asso.fr/acte/consequences-energetiques-economiques-et-environnementales-de-l-adaptation-au-changement-climatique>

PRACTICE ABSTRACT #27**SHORT TITLE IN NATIVE LANGUAGE**

Energieeffizienz in der Landwirtschaft - Ein Wegweiser zur Senkung der Energiekosten im Betrieb

SHORT TITLE IN ENGLISH

Energy Efficiency in Agriculture - A guide to Reducing Energy Costs on the Farm

COUNTRY AND CLIMATIC ZONE

Austria

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Reducing emissions
2. Energy saving
3. Energy independence

THEMATIC AREA

Energy Management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Die österreichische Land- und Forstwirtschaft gibt in mehrfacher Hinsicht die richtigen Antworten auf die drängenden Klimaprobleme unserer Zeit. Sie steht für eine sichere Lebensmittelproduktion, kurze Transportwege sowie die Bereitstellung von erneuerbaren Energien. Seit mehr als drei Jahrzehnten tüfteln die Landwirtinnen und Landwirte an innovativen Energielösungen. Unzählige Prototypen sind auf den landwirtschaftlichen Höfen zu international marktfähigen Energietechnologien weiterentwickelt worden.

Mit ausdauernder Begeisterung und echter Handarbeit entstanden in den Anfangsjahren der 1980er die ersten selbstgebauten Solaranlagen, die noch heute kostenlose Wärme erzeugen. Ein weiterer Meilenstein in der regionalen Wärmeversorgung war die technische Entwicklung der Biomasse-Hackgutanlagen. Durch so manchen landwirtschaftlichen Pioniergeist wurden Öl, Gas und Kohle über die Jahre durch klimafreundliches und heimisches Waldhackgut ersetzt.

Die Nutzung regionaler Ressourcen sowie der effiziente Energieeinsatz sind heute wie damals wichtige Erfolgsfaktoren für die Land- und Forstwirtschaft. Österreichs Landwirtschaft benötigt jährlich mehr als sechs Milliarden Kilowattstunden an Energie. Die Kosten für die Energieversorgung liegen bei rund 550 Millionen Euro. Allein durch die Umsetzung von einfachen Maßnahmen lassen sich über 100 Millionen Euro pro Jahr einsparen.

Mit zunehmender Elektrifizierung und Digitalisierung kommt dem Produktionsfaktor Energie eine neue Bedeutung zu. Heute finden wir auf den land- und forstwirtschaftlichen Betrieben völlig neue Technologien zur Senkung der Energiekosten, wie Photovoltaikanlagen, Elektrofahrzeuge, Wärmepumpen, Stromspeicher sowie von Satelliten gesteuerte Fahrassistenten. Die Technologien sind digital vernetzt und kommunizieren ständig miteinander, mit dem Ziel, eine möglichst effiziente Eigenenergieversorgung sicherzustellen.

Durch die Umsetzung von Effizienzmaßnahmen auf Ihrem Betrieb setzten Sie einen Schritt in Richtung Energieunabhängigkeit, Klimaschutz und lebenswerten Bauernhof.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

In many aspects, Austrian agriculture and forestry provide the right answers to the pressing climate problems of our time. It stands for safe food production, short transport routes and the provision of renewable energy. For more than three decades, farmers have been working on innovative energy solutions. Countless prototypes have been developed on farms into internationally marketable energy technologies.

With persistent enthusiasm and genuine manual labour, the first self-built solar systems were created in the early 1980s, which still generate free heat today. Another milestone in the regional heat supply was the technical development of biomass chipping plants. Thanks to many a pioneering agricultural spirit, oil, gas and coal have been replaced over the years by climate-friendly and local wood chips.

The utilisation of regional resources and the efficient use of energy are as important success factors for agriculture and forestry today as they were then. Austria's agricultural sector requires more than six billion kilowatt hours of energy every year. The cost of energy supply is around 550 million euros. The implementation of simple measures alone can save over 100 million euros per year.

With increasing electrification and digitalisation, energy as a production factor is taking on a new significance. Today, agricultural and forestry operations are using completely new technologies to reduce energy costs, such as photovoltaic systems, electric vehicles, heat pumps, energy storage systems and satellite-controlled driving assistants. The technologies are digitally networked and constantly communicate with each other with the aim of ensuring the most efficient energy supply possible.

By implementing efficiency measures on your farm, you are taking a step towards energy independence, climate protection and a farm worth living on.

PHOTOS

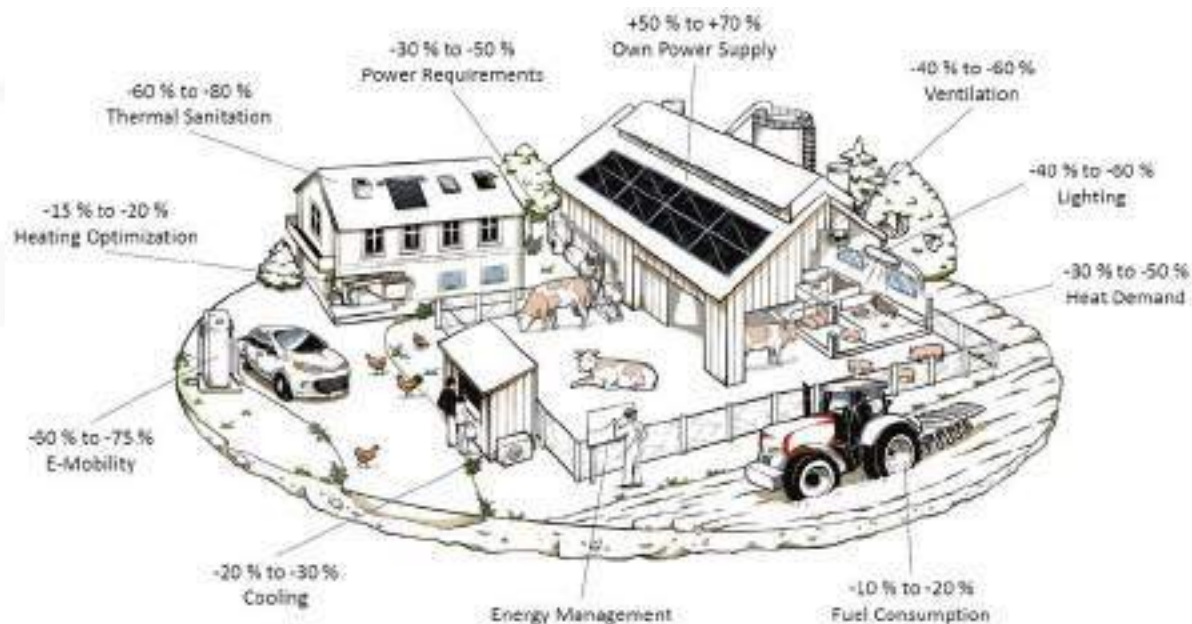


Photo 1: Energy efficiency on farm – English

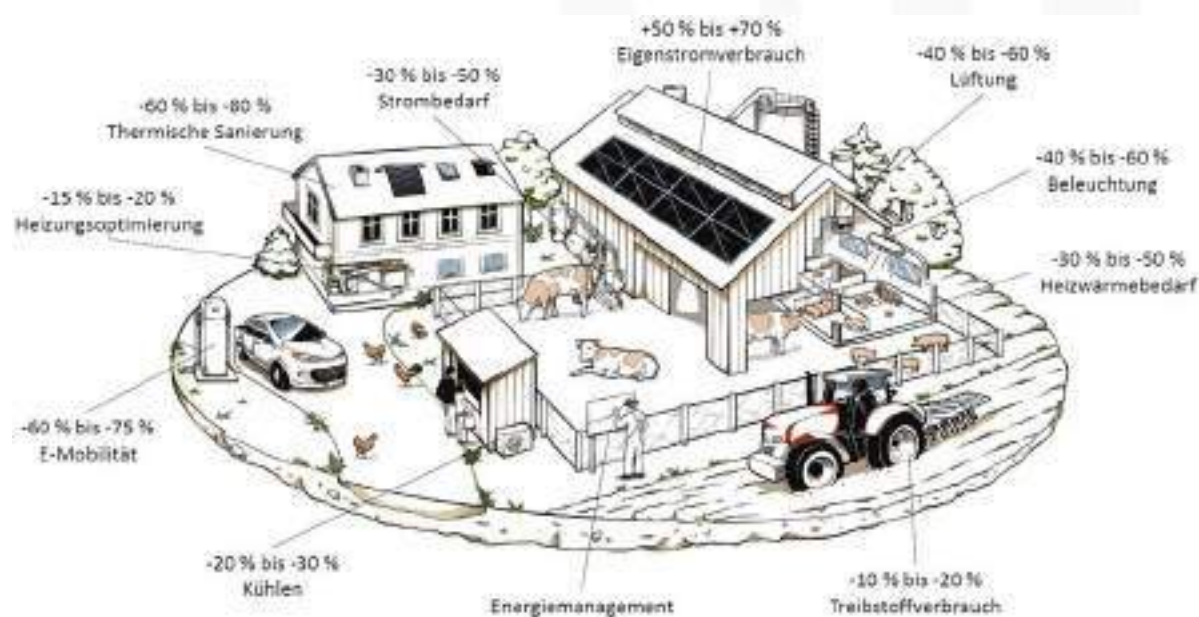


Photo 2: Energy efficiency on farm – German

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Energieeffiziente Landwirtschaft

URL:

<https://youtube.com/playlist?list=PLW73qoCLEueRRdNQcgBATbbRtsBnvtNAe&si=S2uUYdUWewZbrJ43>

PRACTICE ABSTRACT #28**SHORT TITLE IN NATIVE LANGUAGE**

Treibstoffsparen in der Landwirtschaft - Wie viel Einsparungspotential steckt in Ihrem Hof?

SHORT TITLE IN ENGLISH

Saving Fuel in Agriculture - How much Savings Potential is in your Farm?

COUNTRY AND CLIMATIC ZONE

Austria

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Reducing emissions
2. Saving costs
3. Saving time

PRODUCTION SYSTEM

For all production systems

THEMATIC AREA

Energy management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Die Maßnahmen zur Reduktion des Dieserverbrauchs sind sehr vielfältig, manche sind sehr einfach umzusetzen, andere wiederum erst beim nächsten Maschinenkauf zu berücksichtigen. Eines haben jedoch alle Maßnahmen gemeinsam: Das umfassende Wissen des Betriebsleiters und die aktive Umsetzung im praktischen Einsatz sind die Voraussetzung für erfolgreiches Spritsparen.

Egal ob Sie nur eine Maßnahme in Ihrem Betrieb umsetzen, oder aber mehrere – Fakt ist, dass jeder unnötig verbrauchte Liter Diesel negative Auswirkungen auf die Klimabilanz und das betriebswirtschaftliche Ergebnis Ihres Betriebs hat. Es ist daher von großer Bedeutung, treibstoffsparende Lösungen in die täglichen Entscheidungen miteinzubeziehen.

Die größten Einsparungspotentiale sind dabei:

1. 70–80 % E-Mobilität
2. 10–20 % Controlled Traffic Farming
3. 10–15 % Elektrische Antriebe
4. 25–30 % Arbeitsbreite und Arbeitstiefe
5. 10–15 % Reifendruck
6. 15–20 % Getriebe
7. 15–20 % Motor
8. 5–10 % Wartung
9. 5–10 % Ballastierung
10. Entnahme einer Bodenprobe – Ihr Start für mehr Vitalität und Effizienz am Acker

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The measures for reducing diesel consumption are very diverse, some are very easy to implement, while others only need to be considered when purchasing the next machine. However, all measures have one thing in common: the comprehensive knowledge of the farm manager and active implementation in practice are the prerequisites for successful fuel savings.

Regardless of whether you implement just one measure in your business or several - the fact is that every litre of diesel consumed unnecessarily has a negative impact on the carbon footprint and the economic results of your business. It is therefore very important to include fuel-saving solutions in your daily decision-making.

The greatest potential savings are:

1. 70-80 % E-mobility
2. 10-20 % Controlled traffic farming
3. 10-15 % Electric drives
4. 25-30 % Working width and working depth
5. 10-15 % Tyre pressure
6. 15-20 % Transmission
7. 15-20 % Engine
8. 5-10 % Maintenance
9. 5-10 % Ballasting
10. Taking a soil sample - your start for more vitality and efficiency in the field

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Der überwiegende Teil des Dieseleinsatzes ist für die Verwendung in landwirtschaftlichen Traktoren und Erntemaschinen reserviert. Die Maßnahmen zur Reduktion des Dieserverbrauchs sind sehr vielfältig, manche sehr einfach umzusetzen, andere wiederum erst beim nächsten Maschinenkauf zu berücksichtigen. In diesem Factsheet werden fünf Einsparpotentiale für den Dieserverbrauch aufgeführt.

Motor

Moderne Dieselmotoren arbeiten höchst effizient und haben trotzdem einen schlechten Gesamtwirkungsgrad. Von 20 eingesetzten Litern Diesel kommen bei einer schweren Bodenbearbeitung nur 4 Liter Diesel als reine Zugkraft am Boden an. Die restlichen 16 Liter gehen in Form von Abwärme sowie Reibungs- und Schlupfverlusten an die Umwelt verloren.

Diese Tatsache können wir als Bediener der Maschine nicht ändern – sehr wohl aber können wir uns bewusst werden, wie jeder eingesetzte Liter Diesel effizienter in Arbeitsenergie umgewandelt werden kann. Versucht man, den Motor bei einer Drehzahl von 70 % der Nenndrehzahl zu betreiben, ist man sehr spritsparend unterwegs und hat bei modernen Dieselmotoren keinen oder nur sehr wenig Leistungsverlust.

Getriebe

Selbst bei stufenlosen Getrieben kann durch das Wissen über den Wirkungsgradverlauf Diesel eingespart werden. Jedes Getriebe verfügt über spezifische Wirkungsgradkurven in Abhängigkeit vom Fahrbereich. Beispielsweise kann ein Getriebe die höchsten Wirkungsbereiche beim Wechsel in den nächsten Fahrbereich haben, während ein anderes Getriebe

die höchsten Wirkungsgrade in der Mitte der jeweiligen Fahrbereiche hat. Die unterschiedlichen Wirkungsgradkurven wirken sich direkt auf den Spritverbrauch aus. (See Photo 2)

Geräteeinstellung

Landwirtschaftliche Maschinen und Geräte weisen sehr komplexe Einstellmöglichkeiten auf. Die korrekte Einstellung einer Maschine wirkt sich nicht nur auf die Verbesserung der Arbeit, sondern auch auf den Dieserverbrauch aus. Speziell bei schwierig einzustellenden Geräten, wie z.B. bei einem Pflug, steigt der Dieserverbrauch stark an, wenn der Zugpunkt, die Seitenneigung oder der Sturz falsch eingestellt sind.

Elektrische Antriebe

Ähnlich wie im Automobilbereich werden auch in der Landtechnik künftig Elektromotoren vermehrt Einzug halten. Die großen Vorteile des Elektromotors sind das sofort verfügbare Drehmoment, ein überlegener Wirkungsgrad und nicht zuletzt die Möglichkeit, den Strom für die Aufladung der Batterie mit erneuerbarer Energie, z.B. Photovoltaik, selbst am Hof zu produzieren.

Maschinen, die einen geringen Leistungsbedarf haben und täglich annähernd gleiche Einsatzstunden aufweisen, sind für den Einsatz von Elektromotoren besonders geeignet. Elektrische Stapler und Hoflader werden von unterschiedlichen Firmen bereits seit Jahren als Serienprodukte auf dem Markt angeboten. Als weitere Vorteile bei elektrischen Staplern und Hofladern sind auch die geringere Lärmentwicklung und der nicht vorhandene Schadstoffausstoß in geschlossenen Räumen zu nennen.

Controlled Traffic Farming

Durch den Einsatz von digitaler Technik kann ein weiteres Einsparungspotential genutzt bzw. gesteigert werden. Zu Beginn steht die Ausrüstung des Traktors mit einem satellitenbasierten Spurführungssystem. Dadurch werden bereits in der Bodenbearbeitung Überlappungen je nach Schlaggröße, Schlagform und Breite des Geräts zwischen 2 % und 7 % vermieden. Durch die schnelleren Wendezeiten am Vorgewende im Zuge der durch die Spurführung möglichen Beetbearbeitung des Feldes steigt die Gesamtbearbeitungsgeschwindigkeit des Feldes um bis zu 5 %. Wird die Satellitentechnik dann auch bei anderen Anwendungen – z.B. Anbau, Düngerstreuen oder Pflanzenschutz – eingesetzt, ist der geringere

Betriebsmittelaufwand nicht nur als ökologische und ökonomische, sondern auch als energieeffiziente Maßnahme zu sehen.

LONGER DESCRIPTION – IN ENGLISH

The majority of diesel is reserved for use in agricultural tractors and harvesters. The measures for reducing diesel consumption are very diverse, some are very easy to implement, others only need to be considered when purchasing the next machine. This factsheet explains five potential savings in diesel consumption.

Engine

Modern diesel engines are highly efficient and yet have poor overall efficiency. For every 20 litres of diesel used in heavy tillage, only 4 litres of diesel reach the ground as pure tractive power. The remaining 16 litres are lost to the environment in the form of waste heat as well as friction and slip losses.

As the operator of the machine, we cannot change this fact - but we can become aware of how every litre of diesel used can be converted more efficiently into working energy. If you try to operate the engine at a speed of 70 % of the nominal speed, you will save a lot of fuel and, with modern diesel engines, there is little or no loss of power.

Transmission

Even with continuously variable transmissions, diesel can be saved by knowing the efficiency curve. Each transmission has specific efficiency curves depending on the driving range. For example, one transmission may have the highest efficiency ranges when changing to the next driving range, while another transmission has the highest efficiency in the middle of the respective driving ranges. The different efficiency curves have a direct effect on fuel consumption. (See *Photo 2*)

Equipment settings

Agricultural machines and equipment have very complex adjustment options. The correct setting of a machine not only influences the improvement of work, but also on diesel consumption. Particularly with equipment that is difficult to adjust, such as a plough, diesel consumption rises sharply if the draft point, side tilt or camber are set incorrectly.

E-Mobility

As in the automotive sector, electric motors will increasingly find their way into agricultural technology in the future. The major advantages of the electric motor are the immediately available torque, superior efficiency and, finally, the possibility of producing electricity for charging the battery with renewable energy, e.g. photovoltaics, on the farm itself.

Machines with low power requirements and approximately the same number of operating hours per day are particularly suitable for the use of electric motors. Electric forklifts and farmyard loaders have been available on the market as standard products from various companies for years. Other advantages of electric forklift trucks and yard loaders include lower noise levels and the absence of pollutant emissions in enclosed spaces.

Controlled Traffic Farming

The use of digital technology can utilize or increase further savings potential. The first step is to equip the tractor with a satellite-based guidance system. This avoids overlaps of between 2 % and 7 % during tillage, depending on the field size, field shape and width of the implement. The faster turning times at the headland because of the bed cultivation made possible by the guidance system increase the overall cultivation speed of the field by up to 5%. If the satellite technology is then also used for other applications - e.g. cultivation, fertilizer spreading or crop protection - the reduced use of operating resources can be seen not only as an ecological and economic measure, but also as an energy-efficient one.

ADDITIONAL INFORMATION

The bibliographic references in this Practice Abstract were provided by the Department of Energy, Climate and Bio-Resources at the State Chamber of Agriculture and Forestry in Styria.

PHOTOS

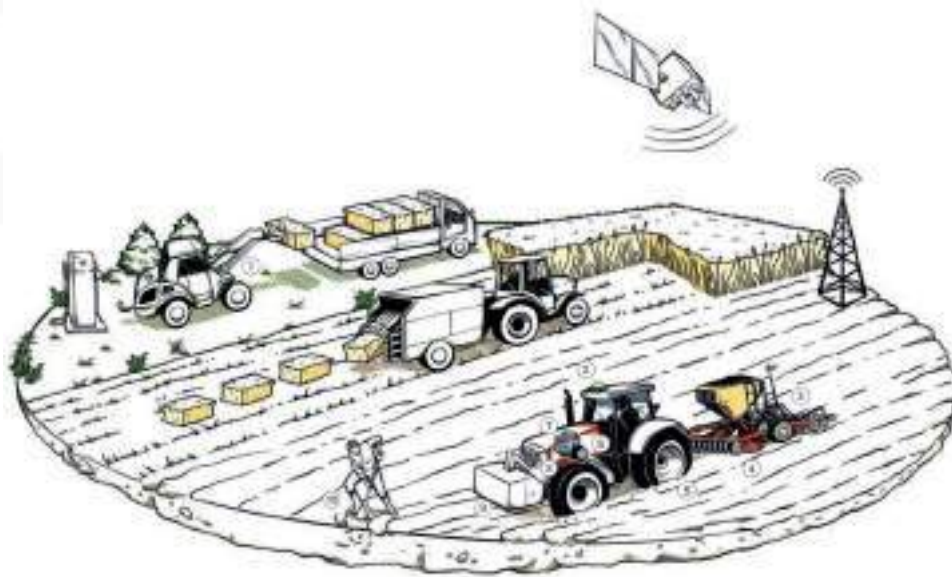
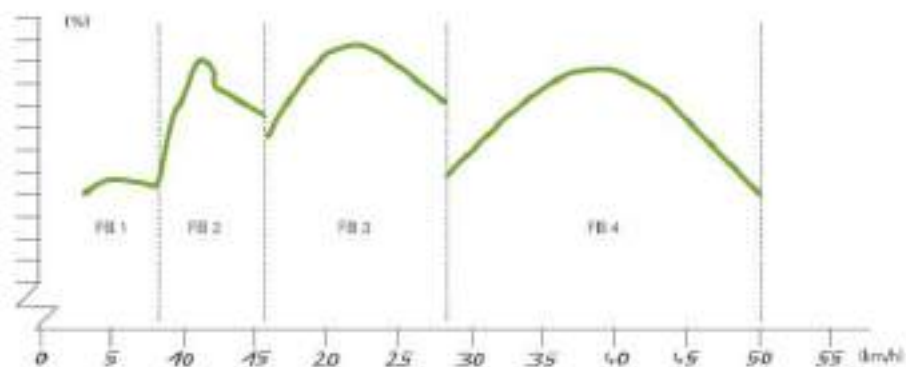
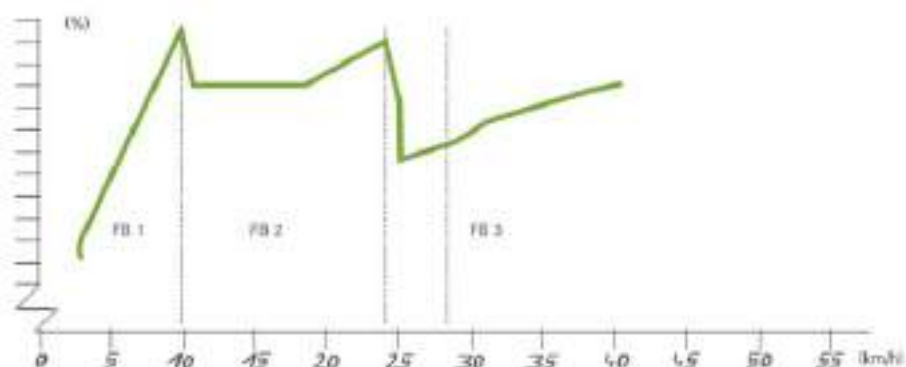


Photo 1: Farm in regard to diesel consumption

Illustration by: Cornelia Schwingenschlögl



The efficiency of the input-coupled gearbox tends to be highest in the centre of the travel ranges.



With compound transmissions, the efficiency tends to be highest at the beginning and end of a driving range.

Photo 2: Transmissions

PRACTICE ABSTRACT #29**SHORT TITLE IN NATIVE LANGUAGE**

Precisionsodling

SHORT TITLE IN ENGLISH

Precision Farming

COUNTRY AND CLIMATIC ZONE

All countries and climatic zones.

Some information is related to Sweden only.

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Right measure in the right place
2. Decreased carbon footprint
3. Increased crop yield and quality

PRODUCTION SYSTEM

Arable crops

THEMATIC AREA

Crops Management

**SUMMARY FOR PRACTICIONERS ON THE MAIN
FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE**

Precisionsodling innebär att man anpassar åtgärder efter fältens och grödornas variation. Inom ett fält kan förutsättningarna variera väldigt mycket och det beror på flera olika saker. En viktig del är jordarten - sammansättningen av lera, sand och grövre material och detta påverkar i sin tur vattnets rörelse i marken. Andra saker som påverkar grödans förutsättningar är hur väl-dränerad jorden är, markens innehåll av organiskt material, tidigare års gödsling, pH-värde samt grödans tillgång av olika växtnäringsämnen.

Det finns olika åtgärder man kan göra inom precisionsodling. Grunden för flera av åtgärderna är markkartering där jordproverna analyseras utifrån jordart, pH, växtnäring (P, K, Mg, Ca, Cu) och mullhalt.

Givor av P och K anpassas utifrån analyser av tillgängligt P och K. Man gör då styrfiler till gödningsspridaren så det sprids mer näring på de platser där tillgången på P och K är låg och mindre på de delar med god växtnäringsstatus. Styrfiler kan göras i en rad olika program, två exempel är markkartering.se och markdata.se. Utsäde kan varieras utifrån lerhalten och ju högre lerhalt desto högre utsädesmängd för att få samma antal skott/m². Kalkning kan också anpassas utifrån pH-värde, lerhalt och mullhalt.

För att variera gödsling av N behövs annat underlag än markkartering. Det finns flera olika hjälpmedel för att beräkna N-behovet hos grödan, till exempel N-tester eller kvävestickor. Detta i kombination med satellitbilder av biomassa på ett fält ger ett underlag för att variera N-givan. Kartor över biomassa, som är omgjorda från satellitbilder, finns tillgängliga på Cropsat. På sidan finns det också möjlighet att göra styrfiler till gödningsspridaren.

Ju större skillnad det är över skiftet i exempelvis lerhalt, mullhalt, pH-värde eller näringsstatus desto mer effekt kommer varierade insatser med gödning, kalkning och utsäde att ge.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Precision farming means adapting measures to the variability of fields and crops. Within a field, conditions can vary greatly, and this depends on several factors. One important element is the soil type - the composition of clay, sand and coarse material and this in turn affects the movement of water in the soil. Other things that affect crop conditions are how well-drained the soil is, the soil's organic matter content, previous years' fertilisation, pH value and the crop's access to various plant nutrients.

There are various measures that can be taken in precision farming. The basis for several of the measures is soil mapping, where soil samples are analysed based on soil type, pH, plant nutrients (P, K, Mg, Ca, Cu) and soil organic matter.

P and K applications are adjusted based on analyses of available P and K. Control files are then made for the fertiliser spreader so that more nutrients are applied in areas where P and K availability is low and less in areas with good plant nutrient status. Control files can be made in several different programmes, two examples are markkartering.se and markdata.se. Seed can be varied based on clay content and the higher the clay content, the higher the number of seed to get the same number of shoots/m². Liming can also be adapted based on pH value, clay content and soil organic matter.

To vary N fertilisation, other data than soil mapping is needed. Several tools are available to calculate the N requirement of the crop, such as N tests or nitrogen stickers. This, combined with satellite images of the biomass of a field, provides a basis for varying N application rates. Maps of biomass, converted from satellite images, are available on Cropsat. On the site, it is also possible to make control files for the fertiliser spreader.

The greater the difference across the field in, for example, clay content, soil content, pH value or nutrient status, the more effect varied inputs of fertiliser, liming and seed will have.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Precisionsodling innebär att man anpassar åtgärder efter fältens och grödornas variation. Inom ett fält kan förutsättningarna variera väldigt mycket och det beror på flera olika saker. En viktig del är jordarten - sammansättningen av lera, sand och grövre material och detta påverkar i sin tur vattnets rörelse i marken. Andra saker som påverkar grödans förutsättningar är hur väl-dränerad jorden är, markens innehåll av organiskt material, tidigare års gödsling, pH-värde samt grödans tillgång av olika växtnäringsämnen. Framförallt runt svackor och kullar kan förhållandena skilja sig mycket.

Precisionsodling är ett ganska brett begrepp och det finns olika åtgärder man kan göra. Grunden för flera av åtgärderna är markkartering där fälten provtas med en täthet av 1 prov/ha. Tätare provtagning tas ofta vid första markkarteringen, med mycket varierande jordarter och vid grönsaksodling. Proverna analyseras utifrån jordart, pH, växtnäring (P, K, Mg, Ca, Cu) och mullhalt. Jordarten analyseras bara vid första markkarteringen.

Givor av P och K anpassas utifrån markkarteringens analyser av tillgängligt P och K. Man gör då styrfiler till gödningsspridaren så det sprids mer näring på de platser i fältet där tillgången på P och K är låg och mindre på de delar med god växtnäringsstatus. Styrfiler kan göras i en rad olika program, två exempel är markkartering.se och markdata.se. Utsäde kan varieras utifrån lerhalten eftersom uppkomsten ofta är bättre på lättare jordar. Så ju högre lerhalt desto högre utsädesmängd för att få samma antal skott/m². Kalkning kan också anpassas utifrån markkarteringens resultat av pH-värde, lerhalt och mullhalt. pH-värdet påverkar tillgängligheten av många växtnäringsämnen och ett pH-värde mellan 6,5 och 7,5 är bäst för de flesta grödorna. Om pH-värdet är högre eller lägre blir många växtnäringsämnen otillgängliga för grödan.

För att variera gödsling av N behövs annat underlag än markkartering. Det finns flera olika hjälpmedel för att beräkna N-behovet hos grödan, till exempel N-tester eller kvävestickor. Detta i kombination med satellitbilder av biomassa på ett fält ger ett underlag för att variera N-givan. Kartor över biomassa, som är omgjorda från satellitbilder, finns tillgängliga på Cropsat. På sidan finns det också möjlighet att göra styrfiler till gödningsspridaren.

I höstraps kan man beräkna vårgivan av N med hjälp av grödans kväveupptag på hösten - klippmetoden. Man klipper och väger då rapsen inom 1 m² på 3-5 platser inom fältet. Instruktioner finns på greppa.nu

Det finns också möjlighet att använda ett traktormonterat mätinstrument, N-sensor. Då scannas grödan och kvävegivan varieras direkt efter behovet. Tekniken baseras på skillnaden i instrålat ljus till grödan och hur mycket grödan reflekterar tillbaka. Utifrån värdet görs en beräkning av grödans biomassa som är ett bra värde att variera kvävegivan efter.

Det behövs givetvis utrustning för att kunna tillämpa precisionsodling och i korthet är det

- Dataunderlag från markkartering, satellit, drönare eller liknande
- GPS positionering i traktor
- GPS-koordinater för insatserna
- Kommunikation mellan GPS och maskinens styrdator
- Redskap med möjlighet att ändra giva under körning
- Verktyg för att tillverka styrfil till redskap

Det finns ytterligare åtgärder inom precisionsodling, som spårstyrning och mängdreglering även av växtskyddsmedel och skördekartering.

Genom att ta hänsyn till variationen effektiviseras och optimeras insatserna till varje del av fälten, för att ge grödan bästa möjliga förutsättningar. Detta ökar skörden och förbättra kvaliteten samtidigt som miljöpåverkan och klimatavtrycket minskas.

LONGER DESCRIPTION – IN ENGLISH

Precision farming means adapting measures to the variability of fields and crops. Within a field, conditions can vary greatly, and this depends on a number of factors. One important element is the soil type - the composition of clay, sand and coarse material and this in turn affects the movement of water in the soil. Other things that affect crop conditions are how well drained the soil is, the soil's organic matter content, previous years' fertilisation, pH value and the crop's access to various plant nutrients. Especially around hollows and hills, conditions can differ greatly.

Precision farming is a fairly broad concept and there are various measures you can take. The basis for several of the measures is soil mapping where the fields are sampled at a density of 1 sample/ha. More frequent sampling is often done at the first soil mapping, with highly variable soils and in vegetable production. Samples are analysed for soil type, pH, plant nutrients (P, K, Mg, Ca, Cu) and soil content. Soil type is only analysed in the first mapping.

P and K rates are adjusted based on soil mapping analyses of available P and K. Control files are then made for the fertiliser spreader so that more nutrients are applied to the parts of the field where P and K availability is low and less to the parts with good plant nutrient status. Control files can be made in a variety of programs. Two examples are markkartering.se and markdata.se. Seed can be varied based on clay content as emergence is often better on lighter soils. So, the higher the clay content, the higher the number of seeds to get the same number of shoots/m². Liming can also be adjusted based on the soil mapping results of pH, clay content and soil organic matter. pH affects the availability of many plant nutrients and a pH between 6.5 and 7.5 is best for most crops. If the pH is higher or lower, many plant nutrients become unavailable to the crop.

To vary N fertilisation, other data than soil mapping is needed. There are several tools available to calculate crop N requirements, such as N tests or nitrogen stickers. This, combined with satellite images of the biomass of a field, provides a basis for varying N application rates. Maps of biomass, converted from satellite images, are available on Cropsat. The site also offers the possibility to make control files for the fertiliser spreader.

In autumn oilseed rape, spring application of N can be calculated using the crop's nitrogen uptake in autumn - the cutting method. This involves cutting and weighing the oilseed rape within 1 m² at 3-5 locations in the field. Instructions are available at greppa.nu

It is also possible to use a tractor-mounted measuring instrument, N-sensor. This scans the crop and varies the nitrogen rate directly according to need. The technology is based on the difference in the amount of light emitted to the crop and how much the crop reflects. Based on the value, a calculation is made of the crop's biomass, which is a good value to vary the nitrogen rate.

Of course, equipment is needed to apply precision farming and in short it is

- Data from soil mapping, satellite, drone or similar
- GPS positioning in tractor
- GPS coordinates for the inputs
- Communication between GPS and machine control computer
- Implements with the possibility to change the output while driving
- Tools to produce control file for implements

There are additional measures in precision farming, such as track control and quantity regulation of plant protection products and crop yield mapping.

Taking variation into account, inputs to each part of the field are streamlined and optimised to give the crop the best possible conditions. This increases yields and improves quality while reducing environmental impact and carbon footprint.

ADDITIONAL INFORMATION

Det är många lantbrukare som upplever att utrustningen är dyr och det är svårt och omständligt att använda sig av teknik och program för precisionsodling. Men utvecklingen går snabbt framåt och mycket utrustning är idag trådlös vilket förenklar användningen. Likaså har programvarorna förbättrats. Rådgivare och försäljare av utrustning är numera också mer erfarna av precisionsodling så det finns stöd och hjälp att få inom området.

Many farmers find the equipment expensive and the technology and programmes for precision farming difficult and cumbersome to use. But developments are moving fast and much equipment is now wireless,

making it easier to use. Similarly, software has improved. Advisors and equipment sellers are now also more experienced in precision farming, so there is support and help available in this area.

PHOTOS

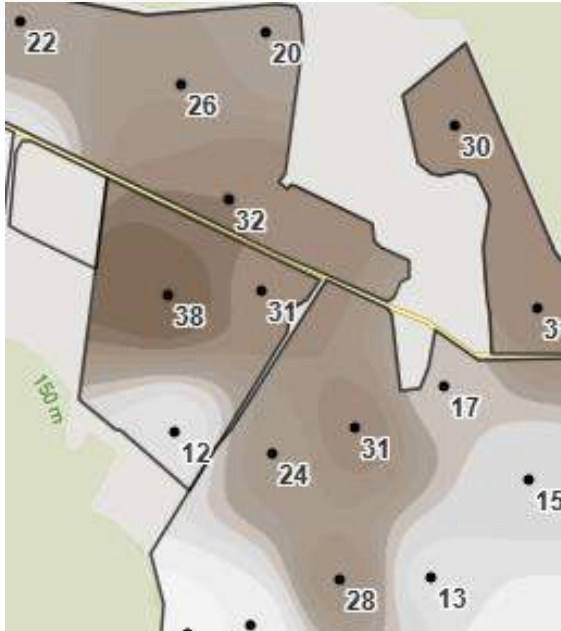


Photo 1: Markkartering clay

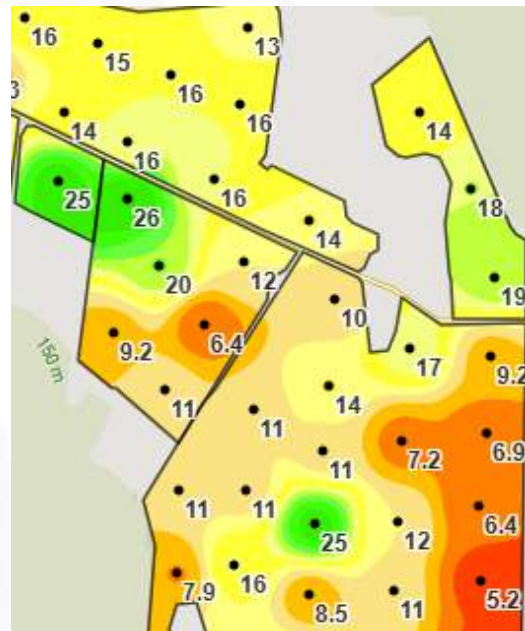


Photo 2: Markkartering K-AL 2

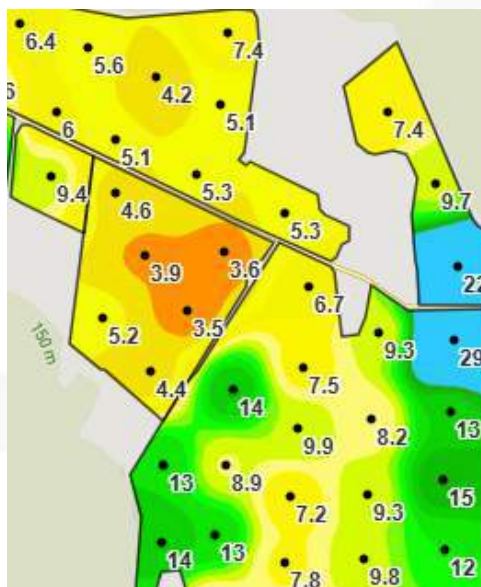


Photo 3: Markkartering P-AL 2

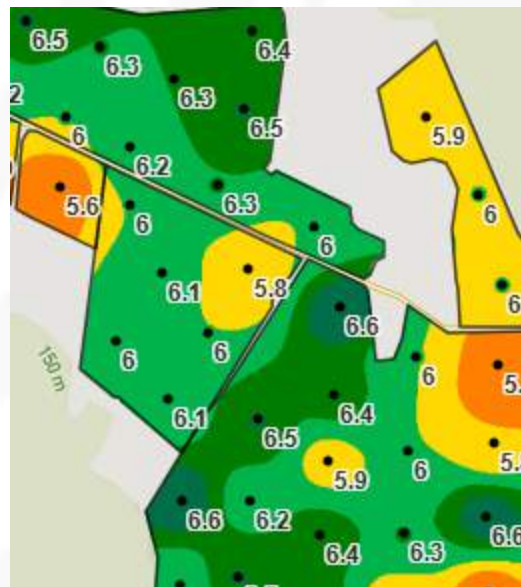


Photo 4: Markkartering pH 2

PRACTICE ABSTRACT #30**SHORT TITLE IN NATIVE LANGUAGE**

Il carbon farming come strumento di adattamento e mitigazione dei cambiamenti climatici per la produzione di foraggio

SHORT TITLE IN ENGLISH

Carbon Farming as a Climate Change Adaptation and Mitigation Tool for Forage Production

COUNTRY AND CLIMATIC ZONE

Italy and mediterranean area

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Soil organic matter
2. Carbon farming
3. Biodiversity

PRODUCTION SYSTEM (IF RELEVANT)

Animal nutrition

THEMATIC AREA

Forage production

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

I fenomeni che caratterizzano i cambiamenti climatici sono anche l'innalzamento delle temperature, eventi estremi come periodi prolungati di siccità seguiti da eventi piovosi intensi e la diminuzione della piovosità con conseguente calo delle produzioni agricole. Il mediterraneo è considerato un hotspot dei cambiamenti climatici, ossia dove i fenomeni sopra elencati avvengono più frequentemente ed in maniera più intensa. Il carbon farming è considerato uno strumento di contrasto e mitigazione dei cambiamenti climatici perché mira a preservare la fertilità dei suoli attraverso il mantenimento o l'incremento della sostanza organica. Il mantenimento della fertilità è fondamentale per continuare a produrre foraggio in termini sia quantitativi che qualitativi.

Le buone pratiche che si possono adottare sono le seguenti:

- Ridurre le lavorazioni
 - Evitare l'aratura - costi elevati, limitano la capacità portante del suolo e allungano i tempi di lavoro
 - tecniche di minima lavorazione e/o no-tillage
- Biodiversità e rotazione delle colture
 - Colture e genotipi adattati alle nuove condizioni climatiche (ad esempio, dal Sud Italia)
 - Associazione di colture (es. erba medica e panico; grano e piselli da foraggio; ecc.)
 - Cover crop
 - Prati permanenti
- Gestione razionale del letame
 - maturazione del letame e del liquame
 - spandimento in base alle esigenze delle colture

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The phenomena that characterise climate change include rising temperatures, extreme events such as prolonged periods of drought followed by intense rainfall events, and a decrease in rainfall resulting in a decrease in agricultural production. The Mediterranean area is considered a climate change hotspot, i.e. where the phenomena listed above occur most frequently and most intensively. Carbon farming is considered a tool for facing and mitigating climate change because it aims to preserve soil fertility by maintaining or increasing organic matter. Maintaining soil

fertility is essential to continue producing forage in terms of both quantity and quality.

Good practices that can be adopted include the following:

- **Reduce tillage:**
 - Avoiding ploughing - high costs, limits soil bearing capacity and lengthens working time
 - Minimum tillage and/or no-tillage techniques
- **Biodiversity and crop rotation**
 - Crops and genotypes adapted to new climatic conditions (e.g. from Southern Italy)
 - Crop associations (e.g. alfalfa and foxtail millet; wheat and forage peas; etc.)
 - Cover crop
 - Permanent meadows
- **Rational manure management**
 - Maturation of manure and slurry
 - Spreading according to crop needs

LONGER DESCRIPTION – IN NATIVE LANGUAGE

I fenomeni che caratterizzano i cambiamenti climatici sono anche l'innalzamento delle temperature, eventi estremi come periodi prolungati di siccità seguiti da eventi piovosi intensi e la diminuzione della piovosità con conseguente calo delle produzioni agricole. Il mediterraneo è considerato un hotspot dei cambiamenti climatici, ossia dove i fenomeni sopra elencati avvengono più frequentemente ed in maniera più intensa. Il carbon farming è considerato uno strumento di contrasto e mitigazione dei cambiamenti climatici perché mira a preservare la fertilità dei suoli attraverso il mantenimento o l'incremento della sostanza organica ed è fondamentale per continuare a produrre foraggio in termini sia quantitativi che qualitativi.

Il carbon farming passa attraverso l'applicazione di buone pratiche che mirano a ridurre input energetici, chimici e di lavoro. In Italia ed in Europa sono stati fatti e sono tutt'ora in corso progetti che hanno identificato le buone pratiche in funzione dell'areale, disponibilità di acqua, ciclo colturale e tipologia di azienda.

In generale il carbon farming mira a **ridurre le lavorazioni dei terreni** cercando di disturbare il meno possibile il suolo preservando la sostanza organica in esso contenuta e favorendo la micro e macro-porosità, la biodiversità del suolo e contestualmente ridurre l'utilizzo di carburante con conseguente risparmio anche in termini economici. La riduzione delle

lavorazioni inoltre consente di impiegare meno ore / ettaro, consentendo una migliore pianificazione di tutte le attività aziendali.

La minore disponibilità di acqua associata al manifestarsi di fenomeni estremi come periodi prolungati di siccità e/o eventi pluviometri intensi e a picchi di temperatura necessita l'utilizzo di **nuove specie e/o varietà** nelle **rotazioni colturali** che meglio si adattano alle nuove condizioni pedoclimatiche. Il miglioramento genetico da parte delle ditte sementiere riveste un ruolo chiave ma anche l'utilizzo di tecniche agronomiche come le **consociazioni colturali** permettono di produrre del buon foraggio e in quantità. L'utilizzo di **cover crop** rappresenta un valido strumento per proteggere il suolo fra due colture principali, per fertilizzare (per esempio le leguminose) o per ridurre i fenomeni di lisciviazione (catch crop). La conversione a **prati permanenti** di una parte dei terreni può apportare benefici sia ambientali (aumento della biodiversità e stock di carbonio nel suolo) e qualitativi del foraggio.

L'agricoltura europea incide per circa il 10% sulle emissioni di GHG, di cui il 70% dal settore zootecnico a causa anche della cattiva gestione degli effluenti. **Una gestione razionale degli effluenti** consentirebbe di ridurre le emissioni di GHG e NH₃ ma anche ridurre l'acquisto di fertilizzanti chimici se usati quando le piante ne hanno maggiore necessità.

Le principali buone pratiche che si possono adottare sono le seguenti:

- **Ridurre le lavorazioni**
 - Evitare l'aratura - costi elevati, limitano la capacità portante del suolo e allungano i tempi di lavoro
 - tecniche di minima lavorazione e/o no-tillage
- **Biodiversità e rotazione delle colture**
 - Colture e genotipi adattati alle nuove condizioni climatiche (ad esempio, dal Sud Italia)
 - Associazione di colture (es. erba medica e panico; grano e piselli da foraggio; ecc.)
 - Cover crop
 - Prati permanenti
- **Gestione razionale del letame**
 - maturazione del letame e del liquame
 - spandimento in base alle esigenze delle colture

LONGER DESCRIPTION – IN ENGLISH

The phenomena that characterise climate change are also rising temperatures, extreme events such as prolonged periods of drought

followed by intense rainfall events, and a decrease in rainfall resulting in a decrease in agricultural production. The Mediterranean area is considered a climate change hotspot, i.e. where the phenomena listed above occur most frequently and most intensively. Carbon farming is considered a tool for facing and mitigating climate change because it aims to preserve soil fertility by maintaining or increasing organic matter that it is fundamental for continuing to produce forage in both quantitative and qualitative terms.

Carbon farming involves the application of good practices that aim to reduce energy, chemical and labour inputs. In Italy and Europe, numerous projects have been carried out and are still ongoing that have identified good practices according to pedoclimatic areas, water availability, crop cycle and type of farm.

Carbon farming aims to **reduce tillage** by trying to disturb the soil as little as possible, preserving the organic matter and favouring micro and macro-porosity, soil biodiversity and at the same time reducing the use of fuel with consequent savings also in economic terms. Reduced tillage also means fewer hours/hectare are used, allowing better planning of all farm activities.

The reduced availability of water associated with the occurrence of extreme phenomena such as prolonged periods of drought and/or intense rainfall and temperature peaks requires the use of **new species and/or varieties** in crop rotations that are better adapted to the new soil and climate conditions. Genetic improvement by seed companies plays a key role, but also the use of agronomic techniques such as **crop associations** enable the production of high-quality forage. The use of **cover crops** is a valuable tool to protect the soil between two cash crops, to fertilise (e.g. leguminous crops) or to reduce leaching (catch crops). Converting part of the land to **permanent meadows** can bring both environmental (increased biodiversity and soil carbon stock) and forage quality benefits.

European agriculture accounts for about 10 % of GHG emissions, of which 70 % from the livestock sector due in part to poor manure management. **Rational manure management** would reduce GHG and NH₃ emissions but also reduce the purchase of chemical fertilisers if used when crops need it.

- **Good practices that can be adopted include the following:**
- **Reduce tillage:**
 - Avoiding ploughing - high costs, limits soil bearing capacity and lengthens working time
 - Minimum tillage and/or no-tillage techniques
- **Biodiversity and crop rotation**

- Crops and genotypes adapted to new climatic conditions (e.g. from Southern Italy)
- Crop associations (e.g. alfalfa and foxtail millet; wheat and forage peas; etc.)
- Cover crop
- Permanent meadows
- **Rational manure management**
 - Maturation of manure and slurry
 - Spreading according to crop needs

PHOTOS



Photo 1: experimental field with forage crop (clover, sainfoin, sulla, alfalfa, common bird's-foot trefoil) from Nord and South Italy in San Cesareo sul Panaro - Italy



Photo 2: cover crop (*Phacelia tanacetifolia* + *Brassica juncea* + tillage radish) after corn crop in Ferrara - Italy



Photo 3: digestate spreading with low-pressure system during grain tillering in Mantua - Italy

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description****Combining competitiveness and sustainability with conservative agriculture.**

Final conference of regional project **CO-Nservare**, financed by Emilia-Romagna region with CAP 2014-2022. EN version.

URL:

<https://youtu.be/IYD-NUo8ReA?si=KcleG4ZHXHg-eMut>

PRACTICE ABSTRACT #34**SHORT TITLE IN NATIVE LANGUAGE**

Gestão de pragas e doenças no sector hortofrutícola

SHORT TITLE IN ENGLISH

Integrated Pest Management in the Fruit and Vegetable Sector

COUNTRY AND CLIMATIC ZONE

Portugal, Mediterranean zone

CONTACT

Maria Pereira da Silva (mpereira@consulai.com)

3 BENEFITS OF THE PRACTICE

1. Costs reduction
2. Productivity increase
3. Product quality increase

PRODUCTION SYSTEM

Horticultural crops

THEMATIC AREA

Crops management, Soil health and biodiversity, Fruits sector

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

A gestão de pragas e doenças no setor hortofrutícola em Portugal é um desafio crescente. A elevada incidência desses problemas pode comprometer a produtividade e a qualidade das culturas, resultando em perdas económicas significativas para os produtores. Quando uma cultura é afetada por pragas ou doenças, os custos podem ser substanciais — não apenas no controlo da praga ou doença, mas também na possível perda de produção. Em resposta, os produtores reconhecem a necessidade de adotar medidas preventivas que melhorem a gestão de pragas e doenças.

Os principais objetivos das práticas são aumentar a produtividade das culturas e melhorar a qualidade dos frutos, garantindo um produto final mais competitivo, através da prevenção e do acompanhamento rigoroso da ocorrência de pragas e doenças. Além disso, pretendem reduzir a dependência de produtos fitofarmacêuticos, promovendo um sistema de produção mais equilibrado e economicamente eficiente.

Para alcançar esses objetivos, foram implementadas diversas medidas:

1. **Poda e tratamentos preventivos**, que ajudam a mitigar o risco de infeções por pragas e aparecimentos de doenças. Garantir que as temperaturas e a humidade relativa no pomar não sejam favoráveis ao desenvolvimento de pragas e doenças é uma medida preventiva de alto impacto.
2. **Promoção da biodiversidade**, uma abordagem eficaz que inclui a criação de faixas ecológicas, a sementeira de misturas biodiversas entre as linhas do pomar e a instalação de habitats artificiais para insetos benéficos e organismos auxiliares. Estas ações contribuem para o equilíbrio do ecossistema e reforçam o controlo biológico natural de pragas.
3. **Monitorização regular das culturas**, essencial para intervenções atempadas e eficazes. A observação regular e a contagem de pragas e organismos benéficos permitem respostas mais precisas e eficientes, reduzindo desperdícios e otimizando o uso de recursos.

Ao adotar estas boas práticas, o setor hortofrutícola pode melhorar a sustentabilidade, enquanto reforça a competitividade dos produtores portugueses, garantindo produtos de alta qualidade e ambientalmente responsáveis.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Pest and disease management in Portugal's fruit and vegetable sector is an increasing challenge. The high incidence of these issues may compromise crop productivity and quality, leading to significant economic losses for producers. When a crop is affected by pests or diseases, costs can be substantial—not only in controlling the outbreak but also in potentially lost production. In response, producers recognize the need of adopting preventive measures that enhance pest and disease management.

The primary objectives of these practices are to increase crop productivity and enhance fruit quality, ensuring a more competitive final product, by preventing and closely monitoring pest and disease occurrence. Additionally, they aim to reduce dependence on plant protection products, fostering a more balanced and cost-effective production model.

To achieve these goals, several measures have been implemented:

1. **Pruning and preventative treatments** help mitigate the risk of pest infestations and disease outbreaks. Ensuring the temperatures and relative humidity in the orchard are not optimal for pest and disease development is a preventive measure that has a high impact.
2. **Promoting biodiversity** is another effective approach, achieved through the creation of ecological strips, the sowing of biodiverse plant mixtures between orchard rows and the installation of artificial habitats for beneficial insects and auxiliary organisms. These actions support ecosystem balance and enhance natural biological pest control.
3. **Regular crop monitoring** is also essential for timely and effective intervention. Systematic observation and the counting of pests and beneficial organisms enable more precise and efficient responses, reducing waste and optimizing resource use.

By adopting these best practices, the fruit and vegetable sector can enhance sustainability while strengthening the competitiveness of Portuguese producers ensuring high-quality and environmentally responsible products.

PHOTOS



Photo 1: A cluster of ripe pears hanging on a tree in an



Photo 2: A close-up of a single pear held in hand, showing a visible dark blemish



Photo 3: A person holding a sticky trap used for pest monitoring.



Photo 4: A pear tree branch showing signs of pest presence or damage on the leaves and fruit



Photo 5: Orchard with symmetrical rows of fruit trees



Photo 6: A handmade insect hotel placed in a natural, overgrown area. Constructed with a variety of natural materials like pine cones, sticks, and bark

Photo credits: CONSULAI

PRACTICE ABSTRACT #35**SHORT TITLE IN NATIVE LANGUAGE**

Estabelecimento de um calendário de pastoreio rotacional no sistema Montado, em Portugal

SHORT TITLE IN ENGLISH

Establishing a Rotational Grazing Calendar in Mixed Farming Systems in Portugal

COUNTRY AND CLIMATIC ZONE

Portugal, Mediterranean zone

CONTACT

Maria Mendonça (mmendonca@consulai.com)

3 BENEFITS OF THE PRACTICE

1. Improving soil health
2. Promoting grassland regeneration
3. Establishing a holistic farm management

PRODUCTION SYSTEM

Mixed agroforestry systems and extensive livestock production

THEMATIC AREA

Agroforestry and relation to landscape; Soil health and biodiversity; Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

O sistema do Montado enfrenta impactos significativos das alterações climáticas, como degradação do solo, escassez de água, temperaturas elevadas, fenómenos extremos e proliferação de pragas e doenças, afetando a produtividade e sanidade das árvores e o bem-estar animal. Para aumentar a resiliência e sustentabilidade, é essencial equilibrar densidade florestal, efetivo animal e gestão das pastagens. A estratégia de pastoreio é crucial, especialmente em sistemas com um efetivo animal elevado ou diversificado.

A adoção de um calendário rotativo ajuda a minimizar a compactação do solo e otimizar a regeneração das pastagens, sendo possível adaptar a estratégia consoante a dimensão da exploração e tipo de gado. Esta estratégia pode ser aplicada a outros sistemas mistos e extensivos, promovendo a resiliência dos mesmos.

No Monte da Silveira, uma exploração com 700 hectares em Castelo Branco, o pastoreio é rotacional: cada parcela é subdividida em pequenas parcelas onde um número elevado de animais pasta por um curto período de tempo (horas ou dias), ficando a regenerar durante um longo período de tempo (meses ou anos). O número de animais por área e o tempo de pastoreio são controlados para evitar o sobre-pastoreio, erosão e degradação do solo, promovendo a regeneração dos solos.

O calendário segue uma ordem específica: os porcos entram primeiro para consumir bolotas, seguidos das ovelhas que se alimentam das espécies herbáceas, e das cabras, que controlam as espécies arbustivas. Além do sobre-pastoreio ser evitado, este método valoriza a carne de porco preto alentejano, alimentado com bolota, e reduz o risco de incêndios devido ao controlo da vegetação arbustiva.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The impact of climate change on the Montado system is severe, causing soil degradation, water scarcity, high temperatures, extreme weather events, and pest and disease proliferation. These factors affect tree health and productivity, and animal welfare. To ensure the system's resilience and sustainability, it is essential to balance forest density and livestock stocking rates, influencing grazing strategies.

Optimized grazing management is crucial, especially in systems with high stocking rates or multiple livestock types. Overgrazing can lead to soil

compaction, reduced tree health, and compromised vegetation regeneration. Well-managed pastures, however, reduce the need for supplementary feed, lowering farm costs. Defining grazing areas, rest periods, and animal numbers per plot helps to adapt the Montado system to climate change and improves pasture management.

Implementing a rotational grazing calendar varies depending on farm characteristics and livestock type but is key to system resilience. This strategy can be expanded to other mixed and extensive livestock systems, strengthening sustainability.

At Monte da Silveira, a 700-hectare farm in Castelo Branco, Portugal, livestock includes pigs, sheep, and goats, alongside crops and pastures. Grazing is rotational: each plot subdivided into small plots where a high number of animals graze for a short period (hours or days) and then rest for a long period (months or years). The number of animals and grazing time is controlled to avoid overgrazing, erosion and soil degradation, promoting soil regeneration. The system follows a specific grazing sequence: local-breed black pigs feed on acorns first, followed by sheep grazing on herbaceous species, and finally goats controlling shrubs. This model adds value to acorn-fed pigs, reduces wildfire risk, and prevents overgrazing.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

O impacto das alterações climáticas é notável no sistema do Montado. A degradação dos solos, a escassez de água, as temperaturas elevadas, os fenómenos meteorológicos extremos e a proliferação de pragas são alguns dos efeitos identificados das alterações climáticas no sistema que afetam a saúde e a produtividade das árvores e o bem-estar dos animais. O sistema precisa de ser adaptado para aumentar a sua resiliência, viabilidade económica e sustentabilidade. Uma das prioridades dos produtores é o equilíbrio das três vertentes: densidade florestal, efetivo animal e gestão das pastagens e pastoreio, o que leva a diferentes estratégias em diferentes explorações.

A estratégia de pastoreio é crucial, particularmente em sistemas com encabeçamento mais elevado ou com mais do que uma espécie animal. Se não for bem gerido, o sobre pastoreio pode levar à degradação e compactação do solo, à diminuição da sanidade e produtividade das árvores, à velocidade de regeneração nos anos seguintes, entre outros impactos. Adicionalmente, quanto mais pasto disponível para o gado se alimentar, menos forragem ou ração adicional é necessária, o que se traduz em menos custos para a exploração.

Esta medida contribui para a adaptação do sistema do Montado às alterações climáticas, uma vez que visa diminuir a compactação do solo e melhorar a gestão das pastagens, através da definição de vários fatores como a área pastoreada, o número de animais por parcela, o tempo de pastoreio *versus* o tempo de descanso. Dependendo da dimensão da exploração e do tipo de gado, o calendário terá um cronograma e uma estrutura diferentes, mas é um aspeto fundamental para promover a resiliência do sistema.

Embora o estabelecimento de um calendário de pastoreio rotativo seja dependente da existência de efetivo animal, esta estratégia pode ser alargada a outros sistemas mistos ou sistemas de produção animal extensiva, permitindo uma maior resiliência dos mesmos.

O Monte da Silveira, uma exploração agrícola de 700 hectares em Castelo Branco, Portugal, tem uma gama diversificada de animais, entre suínos, ovinos e caprinos, entre várias outras culturas e pastagens. Cada parcela é subdividida em pequenas parcelas onde um número elevado de animais pasta por um curto período de tempo (horas ou dias), ficando a regenerar durante um longo período de tempo (meses ou anos). O número de animais por área e o tempo de pastoreio são controlados para evitar o sobre-pastoreio, erosão e degradação do solo, promovendo a regeneração dos solos.

A principal diferença é a estratégia do calendário de pastoreio rotativo, de acordo com os animais existentes. Os primeiros animais a entrar nas parcelas são os porcos, para se alimentarem da bolota, seguidos das ovelhas, que se alimentam das espécies herbáceas, e finalmente das cabras, que controlam as espécies arbustivas. Algumas das vantagens desta estratégia de pastoreio, além das mencionadas anteriormente, são a valorização da carne de porco preto alentejano, alimentado com bolota, a redução de ocorrência de incêndios florestais devido ao controlo dos arbustos pelos caprinos e evitar-se o pastoreio excessivo.

LONGER DESCRIPTION – IN ENGLISH

The impact of climate change on the Montado system is severe. Soil degradation, water scarcity, high temperatures, extreme weather events and pest and disease proliferation are some of the identified effects on climate change in the system that affect tree health and productivity and animal welfare. The system needs to be adapted to increase its resilience and economic viability and sustainability. One of the farmers' priorities regarding this system is how to balance the three components: forest

density versus livestock stock rate, leading to different grazing strategies in different farms.

The grazing strategy is crucial, particularly in systems with higher stocking rates or with more than one type of livestock. If not well managed, overgrazed grassland can lead to soil degradation and compaction, decrease in tree health and productivity, reduced restoration in the following years, among other impacts. Additionally, the more available grassland for the livestock to feed on, less additional forage or feed is needed, which translates into fewer costs for the farm.

This measure contributes to the adaptation of the Montado system to climate change, as it aims to decrease soil compaction and improve grassland management, by defining various factors such as grazed area, grazing time and non-grazing time and number of animals per plot. Depending on the farm dimension and on the type of livestock, the calendar will have different timeline and structure, however it is a key aspect to promote the system's resilience.

While the establishment of a rotational grazing calendar is dependable of existing animals, this strategy can be scaled up to other mixed systems or extensive livestock production systems, allowing an improved system resilience.

In Monte da Silveira, a 700-hectare farm in Castelo Branco in Portugal, has a diverse range of livestock from pigs, sheep and goats and various crops and pastures. Each plot subdivided into small plots where a high number of animals graze for a short period (hours or days), and then rest for a long period (months or years). The number of animals and grazing time is controlled to avoid overgrazing, erosion and soil degradation, promoting soil regeneration.

The key difference is the establishment of a rotational grazing calendar according to the existing animals. The first animals to graze the plots are local-breed black pigs to feed on the acorn, followed by sheep that feed on the herbaceous species, and finally goats that control the shrubs. The benefit of these grazing systems is that acorn-fed pigs have higher value, wildfires occurrence is reduced due to shrubs control and excessive grazing is avoided.

PHOTOS



Photo 1: Montado

Source: CONSULAI



Photo 2: Montado

Source: CONSULAI



Photo 3: Montado

Source: CONSULAI

PRACTICE ABSTRACT #36**SHORT TITLE IN NATIVE LANGUAGE**

Gestão da água na produção de frutos vermelhos no Sul de Portugal

SHORT TITLE IN ENGLISH

Water Management on Raspberry Farm on the South of Portugal

COUNTRY AND CLIMATIC ZONE

Portugal, Mediterranean zone

CONTACT

Maria Pereira da Silva (mpereira@consulai.com)

3 BENEFITS OF THE PRACTICE

1. Water Use Efficiency
2. Environmental Sustainability
3. Agricultural Resilience

PRODUCTION SYSTEM

Fruit crops

THEMATIC AREA/SECTOR

Water management, Crops management, Soil health and biodiversity,
Fruits sector

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

A gestão da água no setor agrícola assume um papel fundamental em Portugal, especialmente face aos desafios impostos pelas alterações climáticas. O aumento das temperaturas, a maior frequência de períodos de seca e a variabilidade na precipitação (sendo em média cada vez mais reduzida), comprometem a disponibilidade hídrica, tornando essencial a adoção de estratégias mais eficientes.

A exploração agrícola The Summer Berry Company Portugal, localizada em regiões semiáridas de Portugal, tem como objetivo desenvolver uma gestão responsável da água e a redução dos riscos decorrentes da sua escassez, tendo como principais compromissos:

- Manter uma avaliação contínua dos recursos hídricos da exploração e desenvolver um plano de gestão adaptado ao seu estado atual
- Reduzir o consumo de água e aumentar a eficiência do seu uso (através da instalação de sistemas de rega adaptados às condições locais, reservatórios para armazenamento de água e utilização de equipamentos de monitorização hídrica)
- Preservar e melhorar a qualidade da água nos ecossistemas, através da instalação de plantas nas linhas de água para evitar a lixiviação de nutrientes) (*Figura 1*)
- Maximizar a reutilização da água (e.g. utilização de águas cinzentas para regar sebes e outras áreas improdutivas, utilização de sistemas de rega de recirculação) (*Figura 3*)

Em 2024, a empresa conseguiu aumentar a utilização de fontes de água sustentáveis, com 60% da água utilizada nas suas explorações agrícolas a ter origem na captação de água da chuva e na reutilização através de um sistema de recirculação. Este valor representa um aumento em comparação com 2023 (53%) e 2022 (43%).

Por último, a regulação da luz e temperatura nos túneis é outra estratégia fundamental para a gestão dos recursos hídricos. As redes de ensombramento são periodicamente ajustadas, consoante as condições meteorológicas, cobrindo as plantas nos dias quentes para reduzir a evaporação excessiva. Nos dias mais húmidos, as redes são retiradas para estimular a atividade das plantas e manter o processo de fotossíntese. Esta abordagem não só promove o desenvolvimento saudável das culturas,

como também contribui para a poupança de água, reforçando o compromisso que a empresa tem para com a sustentabilidade.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Water management plays a key role in Portuguese agriculture, considering the challenges posed by climate change. Rising temperatures, more frequent drought periods, and increasing variability in precipitation and in water availability, making the adoption of more efficient strategies essential.

In the specific case of The Summer Berry Company, located in semi-arid regions of Portugal, a responsible water management and mitigating the risks associated with water scarcity are key objectives of the company's environmental strategy. The main commitments include:

- Maintaining continuous assessment of the farm's water resources and developing a management plan adapted to their current state
- Reducing water consumption and increasing overall efficiency in its use (irrigation systems adapted to local conditions, regular water consumption monitoring through precision equipment (humidity sensors))
- Preserving and improving water quality in ecosystems by planting species in water lines to avoid nutrient runoff
- Maximizing water reuse and recycling by installing water reservoirs
- Using greywater for hedge irrigation and other unproductive areas

In 2024, the company successfully increased the use of sustainable water sources, with 60% of the water used on its farms coming from storing rainwater and using open and closed hydraulic irrigation systems. This figure represents an increase compared to 2023 (53%) and 2022 (43%). As a result, dependence on the Santa Clara Dam was reduced to just 40%.

Finally, light and shade regulation is another key strategy. Shading nets are periodically adjusted according to weather conditions, covering plants on hot days to reduce excessive evaporation. On more humid days, the nets are removed to stimulate plant activity and maintain the photosynthesis process. This approach not only promotes the healthy development of crops but also contributes to water conservation, reinforcing the company's commitment to sustainability.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

A gestão da água desempenha um papel fundamental na agricultura portuguesa, sobretudo tendo em conta os desafios colocados pelas alterações climáticas. O aumento das temperaturas, a maior frequência de períodos de seca e a crescente variabilidade da precipitação e da disponibilidade de água, tornam essencial a adoção de estratégias mais eficientes.

No caso específico da The Summer Berry Company, localizada em regiões semi-áridas de Portugal, uma gestão responsável da água e a mitigação dos riscos associados à escassez de água são objectivos-chave da estratégia ambiental da empresa. Os principais compromissos incluem:

- Manter a avaliação contínua dos recursos hídricos da exploração e desenvolver um plano de gestão adaptado ao seu estado atual
- Reduzir o consumo de água e aumentar a eficiência global da sua utilização (sistemas de irrigação adaptados às condições locais)
- Preservar e melhorar a qualidade da água nos ecossistemas, plantando espécies nas linhas de água para evitar o escoamento de nutrientes (Foto 1)
- Maximizar a reutilização e a reciclagem da água através da instalação de reservatórios de água (Foto 3)
- Utilização de águas cinzentas para irrigação de sebes

Em 2024, a empresa aumentou com sucesso a utilização de fontes de água sustentáveis, com 60% da água utilizada nas suas explorações agrícolas proveniente do armazenamento de águas pluviais e da utilização de sistemas de irrigação hidráulicos abertos e fechados. Este valor representa um aumento em relação a 2023 (53%) e 2022 (43%). Assim, a dependência da barragem de Santa Clara foi reduzida para apenas 40%.

Para otimizar a utilização da água, os sistemas de irrigação são adaptados às condições locais, nomeadamente ao tipo de solo:

- Nas parcelas com solos argilosos, as framboesas são colocadas em vasos e regadas através de um sistema avançado de rega gota a gota, garantindo que cada planta recebe a quantidade exacta de água necessária ao seu desenvolvimento e que a água drenada é recolhida e reutilizada pelo sistema (Foto 4).
- Nas parcelas com solo arenoso, as plantas são instaladas no solo, e foi estabelecido um objetivo de 30% de água drenada para irrigar as plantas, mas também para manter a cobertura contínua de relva nas entrelinhas.

Ambos os métodos contribuem para a eficiência dos sistemas de forma diferente, adaptando-se às condições locais (por exemplo, tipo de solo). Além disso, para evitar perdas de água desnecessárias, o consumo de água é monitorizado regularmente, são realizadas inspeções periódicas em diferentes sectores e são identificadas potenciais fugas ao longo do dia. Para garantir um acompanhamento preciso das condições ambientais, são instalados sensores de humidade relativa a cada três hectares.

Por fim, a regulação da luz e da sombra é outra estratégia fundamental. As redes de sombreamento são ajustadas periodicamente de acordo com as condições meteorológicas, cobrindo as plantas nos dias quentes e húmidos para reduzir a evaporação excessiva. Nos dias mais húmidos, as redes são retiradas para estimular a atividade das plantas e manter o processo de fotossíntese. Esta abordagem não só promove o desenvolvimento saudável das culturas, como também contribui para a conservação da água, reforçando o compromisso da empresa com a sustentabilidade.

LONGER DESCRIPTION – IN ENGLISH

Water management plays a key role in Portuguese agriculture, particularly considering the challenges posed by climate change. Rising temperatures, more frequent drought periods, and increasing variability in precipitation and in water availability, making the adoption of more efficient strategies essential.

In the specific case of The Summer Berry Company, located in semi-arid regions of Portugal, a responsible water management and mitigating the risks associated with water scarcity are key objectives of the company's environmental strategy. The main commitments include:

- Maintaining continuous assessment of the farm's water resources and developing a management plan adapted to their current state
- Reducing water consumption and increasing overall efficiency in its use (irrigation systems adapted to local conditions)
- Preserving and improving water quality in ecosystems by planting species in water lines to avoid nutrient runoff (**Error! Reference source not found.Photo 1**)
- Maximizing water reuse and recycling by installing water reservoirs
- Using greywater for hedge irrigation

In 2024, the company successfully increased the use of sustainable water sources, with 60% of the water used on its farms coming from storing rainwater and using open and closed hydraulic irrigation systems. This

figure represents an increase compared to 2023 (53%) and 2022 (43%). As a result, dependence on the Santa Clara Dam was reduced to just 40%.

To optimize water use, irrigation systems are adapted to local conditions, particularly soil type:

- In plots with clay soils, raspberry plants are placed in pots and irrigated through an advanced drip irrigation system, ensuring that each plant receives the exact amount of water needed for its development, and that the drained water is collected and re-used by the system
- In the plots with sandy soil, plants are installed on the ground, and a 30% water drained goal has been established to irrigate the plants but also maintain the continuous grass cover in the interrows.

Both methods contribute to the systems' efficiency differently by adapting to local conditions (e.g soil type). Additionally, to prevent unnecessary water loss, water consumption is regularly monitored, periodic inspections are carried out across different sectors, and potential leaks are identified throughout the day. To ensure accurate tracking of environmental conditions, relative humidity sensors are installed every three hectares.

Finally, light and shade regulation is another key strategy. Shading nets are periodically adjusted according to weather conditions, covering plants on hot and humid days to reduce excessive evaporation. On more humid days, the nets are removed to stimulate plant activity and maintain the photosynthesis process. This approach not only promotes the healthy development of crops but also contributes to water conservation, reinforcing the company's commitment to sustainability.

PHOTOS



Photo 1: Water lines with species installed to avoid nutrient runoff.



Photo 2: Water reservoir (1)



Photo 3: Water reservoir (2) where nutrient adjustments and water quality corrections are made.



Photo4: Irrigation system of plots with clay soils.

PRACTICE ABSTRACT #37**SHORT TITLE IN NATIVE LANGUAGE**

O impacto da gestão de água na agricultura.

SHORT TITLE IN ENGLISH

The Impact of Climate Change on Water Management in Agriculture

COUNTRY AND CLIMATIC ZONE

Portugal, Mediterranean pedoclimatic zone

CONTACT

Maria Mendonça (mmendonca@consulai.com)

3 BENEFITS OF THE PRACTICE

1. Water use efficiency
2. Water management
3. Crop management under water scarcity

PRODUCTION SYSTEM

All production systems

THEMATIC AREA

Water management

**SUMMARY FOR PRACTITIONERS ON THE MAIN
FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE**

A preocupação com o uso eficiente da água no setor agrícola tem aumentado. Diante das pressões causadas por cenários de seca, variações na precipitação e outros eventos extremos, a gestão desse recurso tornou-se ainda mais urgente.

Ao considerar a eficiência da gestão da água na agricultura, é essencial ter em conta o contexto regional. Na bacia mediterrânica, a redução da disponibilidade de água causada pela seca limita a produtividade agrícola e impulsiona a adoção de práticas mais eficientes. Na Bélgica, os sistemas de gestão hídrica estão desatualizados em relação aos padrões atuais de precipitação, comprometendo a retenção de água. Já nos Países Baixos, a qualidade da água é afetada pelo aumento da salinidade, consequência da subida do nível do mar. Cada região enfrenta desafios e impactos distintos, exigindo abordagens específicas.

A gestão da água pode ser segmentada em quatro áreas-chave que impactam a quantidade e qualidade de água disponível:

- **Gestão da água na exploração agrícola** | A utilização eficiente depende do tipo de exploração, dos sistemas de rega, das práticas culturais e da monitorização. A adoção de novas tecnologias e equipamentos de monitorização são cruciais para o aumento de eficiência.
- **Infraestruturas e distribuição** | A disponibilidade de água é influenciada por sistemas regionais/nacionais. Os sistemas por gravidade mais tradicionais têm menores custos energéticos, mas perdem mais água por evaporação, enquanto os sistemas pressurizados têm menos perdas e permitem uma melhor monitorização.
- **Mecanismos de regulação e investimento** | A regulação contribui para a eficiência através de políticas e incentivos, investimento público em infraestruturas hídricas, gestão de risco e planos de contingência, e potencialidade do uso de fontes alternativas de água.
- **Impacto das alterações climáticas** | A alteração dos padrões climáticos afeta a disponibilidade de água, exigindo novas práticas, tecnologias e alteração da mentalidade, para garantir a sustentabilidade a longo prazo.

O futuro da gestão eficiente da água será fundamental para a segurança alimentar e a sustentabilidade da produção agrícola. Para garantir a resiliência às alterações climáticas, será necessário mudar mentalidades, adotar novas tecnologias e práticas agrícolas, investir em infraestruturas adequadas e implementar uma regulação eficaz.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

There has been growing concern about the efficient use of water in the agricultural sector, particularly in the Mediterranean region, but not excluding other areas of Europe. With increasing pressure from drought scenarios, unpredictable rainfall or other extreme climatic events, the valorization and management of this resource has become increasingly urgent.

Water management varies by region. While in the Mediterranean Basin, reduced rainfall causes water scarcity, that leads to water restrictions for agriculture, in Belgium, drainage systems are outdated and hinder water retention with the current (reduced) average rainfall, and in the Netherlands, rising sea levels increase water salinity.

Water management thematic area can be segmented into quantity and quality, impacting four key areas:

- **On-Farm Water Management** | Efficient use depends on farm type, irrigation systems, farming practices, and monitoring techniques. Adoption of new technologies and investment in irrigation equipment are crucial.
- **Infrastructure & Distribution** | Water availability is influenced by regional/national systems adapted to the local needs. These systems need to be maintained to be efficient.
- **Regulation and investment mechanisms** | Efficiency is shaped through (1) policies, incentives, and regulations adapted to local needs, (2) public investment in water infrastructure, (3) crisis management and contingency plans and (4) alternative water sources (re-used, desalinated).
- **Climate Change Impact** | Changing weather patterns affect water availability, requiring new practices, technologies, and mindsets to ensure long-term sustainability.

Efficient water management is key to food security and agricultural sustainability, demanding the implementation of new practices, the investment in infrastructure, technology, and adapted regulations to build climate resilience.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

A preocupação com o uso eficiente da água no setor agrícola tem aumentado. Diante das pressões causadas por cenários de seca, variações na precipitação e outros eventos extremos, a gestão desse recurso tornou-se ainda mais urgente.

Ao considerar a eficiência da gestão da água na agricultura, é essencial ter em conta o contexto regional. Na bacia mediterrânica, a redução da disponibilidade de água causada pela seca limita a produtividade agrícola e impulsiona a adoção de práticas mais eficientes. Na Bélgica, os sistemas de gestão hídrica estão desatualizados em relação aos padrões atuais de precipitação, comprometendo a retenção de água. Já nos Países Baixos, a qualidade da água é afetada pelo aumento da salinidade, consequência da subida do nível do mar.

Diferentes regiões têm prioridades distintas e precisarão de diferentes abordagens. Porém, é possível dividir a temática da gestão da água em duas sub-temáticas – quantidade e qualidade, e em quatro vertentes de impacto:

Gestão na exploração agrícola

A gestão eficiente da água na exploração agrícola está imperativamente ligada ao **tipo de exploração e agricultor** (dimensão da exploração e tipo de produção, perfil do agricultor), **sistemas de rega e equipamentos** (tipos de sistemas de rega utilizados, capacidade de retenção, distribuição e drenagem), **práticas culturais promotoras da retenção de água no solo** (mobilizações do solo, capacidade de retenção hídrica do solo, enrelvamento na entrelinha, entre outras) e **monitorização e revisão** (sistemas de apoio à decisão, sondas de medição de teor de água, auditorias regulares ao sistema de rega). A evolução da gestão eficiente da rega e da água está fortemente condicionada pela decisão do agricultor ou decisor no investimento em equipamentos e equipa especializada em rega e gestão de água.

Infraestruturas e sistemas de distribuição

Os sistemas de distribuição regionais e nacionais influenciam a disponibilidade de água na exploração. Sistemas tradicionais como os **sistemas de distribuição por gravidade em canais abertos**, embora tenham menor custo energético, têm perdas por evaporação mais elevadas. Já os **sistemas pressurizados** são mais automatizados na distribuição à

produção primária, permitindo uma monitorização de consumo mais eficiente.

Mecanismos de regulação e investimento

A existência de regulação na gestão hídrica desempenha um papel crucial na gestão eficiente da água, influenciando as práticas e equipamentos utilizados, a gestão de risco na exploração e a nível regional, entre outros.

1. Desenvolvimento de políticas, programas de incentivo e regulamentação adaptadas ao contexto local e promotoras da eficiência hídrica.
2. Investimento público em infraestruturas hídricas.
3. Gestão de crises, através do desenvolvimento de planos de emergência/contingência.
4. Exploração de fontes alternativas de água (reutilizada, dessalinizada).

Alterações climáticas

A variabilidade dos eventos climáticos é um dos efeitos mais claros e que mais impacto tem na produção primária, traduzindo-se diretamente na quantidade de água disponível. A necessidade de mudança de práticas, utilização de novos equipamentos e alteração da perceção sobre a mudança tornam-se cada vez evidentes para garantir a sustentabilidade hídrica.

O futuro da gestão hídrica eficiente será essencial para a segurança alimentar e sustentabilidade da produção agrícola, exigindo a mudança de mentalidade, a adoção de novos equipamentos, tecnologias e práticas culturais, infraestruturas e regulamentação adequada, de modo a garantir a resiliência às alterações climáticas.

LONGER DESCRIPTION – IN ENGLISH

There has been growing concern about the efficient use of water in the agricultural sector, particularly in the Mediterranean region, but not excluding other areas of Europe. With increasing pressure from drought scenarios, unpredictable rainfall or other extreme climatic events, the valorization and management of this resource has become increasingly urgent.

However, when considering the efficiency of water management in agriculture, the regional context has to be taken into account. While in the Mediterranean Basin, reduced rainfall causes water scarcity, that leads to water restrictions for agriculture, in Belgium, drainage systems are outdated and hinder water retention with the current (reduced) average rainfall, and in the Netherlands, rising sea levels increase water salinity.

Different regions have different priorities and will need different approaches. Water management can be addressed into two sub-themes - quantity and quality, and into four types of impact:

1. **On-farm management** | Efficient water management on the farm is imperatively linked to the type of farm and farmer (size of farm and type of production, farmer profile), irrigation systems and equipment (types of irrigation systems used, retention capacity, distribution and drainage), cultural practices that promote water retention in the soil (soil tillage, water management, etc.) and monitoring and review (decision support systems, water content measuring probes, regular audits of the irrigation system). The evolution of efficient irrigation and water management is strongly conditioned by the decision of the farmer or decision-maker to invest in equipment and staff specialized in irrigation and water management.
2. **Infrastructure and distribution systems** | Regional and national distribution systems influence the availability of water on the farm. Traditional systems such as gravity distribution systems in open channels, although they have lower energy costs, have higher evaporation losses. Pressurized systems, on the other hand, are more automated in their distribution to primary production, allowing for more efficient monitoring of consumption.
3. **Regulation and investment mechanisms** | The existence of regulation in water management plays a crucial role in efficient water management, influencing the practices and equipment used, risk management on the farm and at regional level, among others.
 - a. Development of policies, incentive programs and regulations adapted to the local context and promoting water efficiency.
 - b. Public investment in water infrastructure.
 - c. Crisis management, through the development of emergency/contingency plans.
 - d. Exploitation of alternative water sources (recycled, desalinized).
4. **Climate change** | The variability of climatic events is one of the clearest effects and has the greatest impact on primary production, directly translating into the amount of water available. The need to change practices, use new equipment and alter mindsets to perceive change is becoming increasingly evident to guarantee water sustainability.

The future of efficient water management will be essential for food security and the sustainability of agricultural production, requiring a change of mindset, the adoption of new equipment, technologies and changes in

farming practices, infrastructures and appropriate regulations to guarantee resilience to climate change.

PHOTOS



Photo 1: A panoramic view of a water reservoir system integrated into a rural landscape.

Photo 2: A close-up of a water source in a natural setting, equipped with pipes and



pumping infrastructure.



Photo 3: A center pivot irrigation system stretching across a flowering field

PRACTICE ABSTRACT #40**SHORT TITLE IN NATIVE LANGUAGE**

Maßnahmen zur Anpassung an den Klimawandel in der Pflanzenproduktion

SHORT TITLE IN ENGLISH

Adaptation to Climate Change in Crop Production

COUNTRY AND CLIMATIC ZONE

Luxembourg, continental Europe

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Challenges for crop production due to climate change
2. Adaptation measures
3. Research needs

PRODUCTION SYSTEM

Mixed farms of crop production and animal husbandry

THEMATIC AREA

Grassland management, forage production, crop management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

In Luxemburg macht sich der Klimawandel auf verschiedene Weise bemerkbar, unter anderem durch den Temperaturanstieg, die rasche Abwechselung von extrem Trocken- und Nässeperioden und immer kürzere Winter, welche eine längere Vegetationsperiode als Folge haben. Um diese Herausforderungen zu begegnen, gibt es verschiedene Strategien. Diese betreffen folgende Gebiete:

- **Züchtung neuer Pflanzensorten.** Diese sollen eine bessere Anpassung an die veränderten Klimabedingungen gewährleisten.
- **Diversifizierung der Fruchtfolge.** Dadurch wird eine höhere Resilienz im Pflanzenbau gegenüber Klimaschwankungen erreicht
- **Ackerbau.** Hier sind besonders die Wahl des richtigen Saattermins und die Steigerung der Humusgehalte im Boden zu nennen.
- **Futterproduktion.** Auf diesem Gebiet sind das Anlegen von Futterreserven sowie die Steigerung der Artenvielfalt im Grünland ausschlaggebend.
- **Einführung neuer Pflanzenarten.** Diesbezüglich sind vor allem die Körnerhirse, die Sojabohne, die Sonnenblume und das Sorghum vielversprechend.
- **Berücksichtigung von neuen Schädlingen und Pflanzenkrankheiten.** Sich gegen aggressivere Arten von Schädlingen und Parasiten ist durch den Klimawandel unabdingbar geworden.

Eine allgemeingültige Strategie zur Anpassung an den Klimawandel im Pflanzenbau ist nicht vorhanden. Nur eine Kombination aus verschiedenen vorhandenen Techniken kann erfolgreich die Herausforderungen durch den Klimawandel meistern.

Forschungsbedarf besteht auf folgenden Gebieten:

- Bereitstellung von Grasaufwuchs-Modellen zur besseren Anpassung der Bestandsführung an die Witterungsbedingungen
- Präzisierung von Möglichkeiten und Grenzen der Nutzung von Herbstaufwuchs, um ein maximales Nutzen daraus zu ziehen.
- Züchtung von Sorten mit höherer Anpassung an den Klimawandel.
- Maximierung der Nährstoffeffizienz unter ungünstiger Witterungsbedingungen.
- Bereitstellung von verlässlichen Meteo-Informationen.
- Klärung des Einflusses von Humushaushalt und Pflanzenkohle auf den Wasserhaushalt.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

In Luxembourg, climate change is making itself felt in various ways, including the rise in temperature, the rapid alternation of extremely dry and wet periods and ever shorter winters, which result in a longer growing season. There are various strategies to meet these challenges. These relate to the following areas:

- **Breeding new plant varieties.** These should ensure better adaptation to the changed climate conditions.
- **Diversification of crop rotation.** This will make crop cultivation more resilient to climate fluctuations
- **Arable farming.** The choice of the right sowing date and increasing the humus content in the soil are particularly important here.
- **Fodder production.** In this area, the creation of fodder reserves and increasing biodiversity in grassland are crucial.
- **Introduction of new plant species.** Grain millet, soya beans, sunflowers and sorghum are particularly promising in this respect.
- **Consideration of new pests and plant diseases.** Defense against more aggressive types of pests and parasites has become essential due to climate change.

There is no generally applicable strategy for adapting to climate change in crop production. Only a combination of different existing techniques can successfully master the challenges posed by climate change.

There is a need for research in the following areas:

- Provision of grass growth models for better adaptation of stock management to weather conditions
- Specification of the possibilities and limits of using autumn grass growth to derive maximum benefit from it.
- Breeding varieties with higher adaptation to climate change.
- Maximizing nutrient efficiency under unfavorable weather conditions.
- Provision of reliable meteorological information.
- Clarification of the influence of humus balance and biochar on the water balance.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

In Luxemburg macht sich der Klimawandel auf verschiedene Weise bemerkbar, unter anderem durch den Temperaturanstieg, die rasche

Abwechselung von extrem Trocken- und Nässeperioden und immer kürzere Winter, welche eine längere Vegetationsperiode als Folge haben. Um diese Herausforderungen zu begegnen, gibt es verschiedene Strategien, die sich nach Anwendungsgebiet unterscheiden. Diese betreffen im Einzelnen:

- **Züchtung neuer Pflanzensorten.** Neben der Bereitstellung von trocken- und frosttoleranten Sorten sollte sich die Züchtung darauf konzentrieren, Sorten mit langen Wurzeln, mit einer guten Jugendentwicklung und einer frühen Reife zu erzeugen.
- **Die Betriebsebene.** Hier soll auf die Diversifikation der Fruchtfolge, auf das Anlegen von Futterreserven und auf eine höhere Flexibilität im Pflanzenbau bei der Auswahl der Sorten Acht gegeben werden. Dabei soll der Maschinenaufwand nicht außer Acht gelassen werden.
- **Ackerbau.** Als wichtigste Strategien im Ackerbau wurden die Wahl des richtigen Saattermins, die Steigerung der Bodenfruchtbarkeit durch Humusmehrung, die Auswahl von wassersparenden Sorten, eine möglichst ganzjährige Bedeckung des Bodens sowie das Geringhalten von C4-Pflanzen wie Mais und Sorghum, die viel Wasser verbrauchen, zugunsten von C3-Pflanzen genannt.
- **Futterproduktion.** Im Bereich Futterproduktion, bieten sich neben dem schon erwähnten Anlegen von Futterreserven, das Führen von dichten Pflanzenbeständen, die Steigerung der Artenvielfalt im Grünland, die standortgerechte Auswahl von Sorten (z.B. Raygras vs. Knaulgras) sowie das Auswählen von frühen Sorten und Arten an.
- **Neue Pflanzenarten.** Ein vielversprechendes Feld ist vom Anbau neuer Arten von Pflanzen dargestellt. Diesbezüglich stehen vor allem die Körnerhirse, die Sojabohne, die Sonnenblume und das Sorghum zur Verfügung. Ein besonderes Wort verdient hier die Sojabohne. Der Anstieg der Temperaturen dürfte sich wohl positiv auf die Ausbreitung des Anbauareals dieser Pflanze, die bis dato in Luxemburg wegen der hiesigen Klimabedingungen kaum Berücksichtigung gefunden hat. Gepaart mit der Züchtung von trocken- und frostresistenten Sorten könnte dies eine gangbare alternative zu anderen Körnerleguminosen bilden.
- **Berücksichtigung von neuen Schädlingen und Pflanzenkrankheiten.** Es darf nicht unerwähnt bleiben, dass der Klimawandel auch Gefahren im Hinblick auf die Ausbreitung von Schädlingen und Pflanzenkrankheiten birgt. So z.B. breitet sich der Maiszünsler durch die wärmeren Temperaturen vermehrt aus, so wie auch eine Vielzahl von Schädlingen im Obst- und Gemüsebau. Allgemein gilt: je kürzer die Winterperiode, umso leichter ist es für Pilze und Viren, über den Winter zu kommen und ein höheres Befall-Potential zu bilden.

Es zusammenfassend gesagt werden, dass es keine allgemeingültige Strategie zur Anpassung an den Klimawandel im Pflanzenbau vorhanden ist. Vielmehr muss eine Kombination aus verschiedenen vorhandenen Techniken angewendet werden, um erfolgreich die Herausforderungen durch den Klimawandel zu meistern. Hier ist auch die Beratung im hohen Maß gefragt.

Forschungsbedarf besteht auf folgenden Gebieten:

- **Grünland.** Die Bereitstellung von Grasaufwuchs-Modellen kann helfen, die Bestandsführung an die Witterungsbedingungen besser anzupassen. Weiter sollten Anstrengungen unternommen werden, die Möglichkeiten und Grenzen der Nutzung von Herbstaufwuchs zu präzisieren, damit der maximale Nutzen daraus gezogen werden kann.
- **Futterbau.** Auf diesem Gebiet wurde die Züchtung von Sorten mit höherer Anpassung an den Klimawandel an erster Stelle genannt. Dies auch im Hinblick auf die Maximierung der Nährstoffeffizienz unter ungünstiger Witterungsbedingungen.
- **Ackerbau** Hilfreiche Forschungsergebnisse werden vor allem bei der Bereitstellung von verlässlichen Meteo-Informationen. Weiterer Forschungsbedarf ist bei der Klärung der Zusammenhänge zwischen Pflanzen, Boden und Humus, sowie über den Einfluss von Pflanzenkohle auf den Wasserhaushalt.

LONGER DESCRIPTION – IN ENGLISH

In Luxembourg, climate change is making itself felt in various ways, including the rise in temperature, the rapid alternation of extremely dry and wet periods and ever shorter winters, which result in a longer growing season. To meet these challenges, there are various strategies that differ depending on the area of application. These are as follows:

- **Breeding.** In addition to providing drought- and frost-tolerant varieties, breeding should focus on producing varieties with long roots, good juvenile development and early maturity.
- **The farm level.** Here, attention should be paid to the diversification of crop rotation, the creation of forage reserves and greater flexibility in crop production when selecting varieties. At the same time, the cost of machinery should not be disregarded.
- **Arable farming.** The most important strategies in arable farming were named as choosing the right sowing date, increasing soil fertility by increasing humus, selecting water-saving varieties, covering the

soil as much as possible all year round and keeping C4 crops such as maize and sorghum, which consume a lot of water, to a minimum in favor of C3 crops.

- **Forage production.** In the area of forage production, in addition to the aforementioned creation of forage reserves, the management of denser plant populations, the increase of species diversity in grassland, the site-appropriate selection of crops and the use of more favorable conditions are also possible.
- **New plant species.** The cultivation of new types of plants is a promising field. The most promising of these are grain millet, soya beans, sunflowers and sorghum. The soya bean deserves a special mention here. The rise in temperatures is likely to have a positive effect on the expansion of the cultivation area of this plant, which has hardly been considered in Luxembourg to date due to the local climatic conditions. Coupled with the breeding of drought- and frost-resistant varieties, this could provide a viable alternative to other grain legumes.
- **Consideration of new pests and plant diseases.** It should not be unmentioned that climate change also harbors risks about the spread of pests and plant diseases. For example, the European corn borer is spreading more frequently due to warmer temperatures, as are a number of pests in fruit and vegetable cultivation. In general, the shorter the winter period, the easier it is for fungi and viruses to survive the winter and develop a higher infestation potential.

To summarise, there is no universal strategy for adapting to climate change in crop production. Rather, a combination of different existing techniques must be used to successfully master the challenges posed by climate change. This also requires a great deal of advice.

There is a need for research in the following areas:

- **Grassland.** The provision of grass growth models can help to better adapt crop management to weather conditions. Efforts should also be made to clarify the possibilities and limits of using autumn growth so that maximum benefit can be derived from it.
- **Forage production.** In this area, the breeding of varieties that are better adapted to climate change was given top priority. This is also with a view to maximising nutrient efficiency under unfavourable weather conditions.
- **Arable farming.** Helpful research results will be obtained above all in the provision of reliable meteorological information. Further research

is needed to clarify the relationships between plants, soil and humus, as well as the influence of biochar on the water balance.

PHOTOS



Photo 1: Example of drought stress in crop production in Luxembourg (2020)



Photo 2: Example of inundation in Luxembourg (2021)

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Luxembourgish Government strategy paper for adaptation to climate change

URL:

https://environnement.public.lu/content/dam/environnement/documents/klima_an_energie/Anpassungsstrategie-Klimawandel-Clean.pdf

Title/Description

AgriMeteo: 2022 war das wärmste Jahr seit Beginn der Wetteraufzeichnungen - Anzeichen für eine seit 1838 dokumentierte globale Erwärmung in Luxemburg

URL:

https://gouvernement.lu/de/actualites/toutes_actualites/communiques/2022/12-decembre/27-agrimeteo.html

PRACTICE ABSTRACT #44**SHORT TITLE IN NATIVE LANGUAGE**

Βελτιστοποίηση άρδευσης στην καλλιέργεια της ελιάς με την χρήση τεχνολογιών όπως αισθητήρες, εφαρμογή στάγδην άρδευσης και παρακολούθηση κλιματικών συνθηκών.

SHORT TITLE IN ENGLISH

Optimisation of Irrigation in Olive Cultivation Using Sensors, Drip Irrigation and Monitoring of Climatic Conditions

COUNTRY AND CLIMATIC ZONE

Greece, mediterranean

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Irrigation optimisation to reduce water loss
2. Increasing production even in periods of severe drought

PRODUCTION SYSTEM

Arboriculture for fruit

THEMATIC AREA

Water management, Crops Management, Fruits Sector

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Η βελτιστοποίηση της άρδευσης σε ελαιώνες αποτελεί κρίσιμο παράγοντα για την αύξηση της αποδοτικότητας και τη διασφάλιση της βιωσιμότητας των καλλιεργειών, ειδικά σε περιοχές με περιορισμένους υδάτινους πόρους. Η σωστή διαχείριση της άρδευσης μειώνει τη σπατάλη νερού, ενώ παράλληλα διασφαλίζει τη μέγιστη απόδοση της παραγωγής ελιάς.

Οι μετεωρολογικοί σταθμοί αποτελούν σημαντικό εργαλείο για την αποδοτική διαχείριση της άρδευσης στους ελαιώνες, καθώς παρέχουν ακριβή και έγκαιρη πληροφόρηση για τις καιρικές συνθήκες που επηρεάζουν την ανάγκη των φυτών για νερό. Μέσω της παρακολούθησης παραμέτρων όπως η θερμοκρασία, η υγρασία, η ταχύτητα του ανέμου, οι βροχοπτώσεις και άλλες κλιματικές συνθήκες, οι μετεωρολογικοί σταθμοί επιτρέπουν την ακριβή εκτίμηση των αναγκών άρδευσης σε πραγματικό χρόνο.

Για παράδειγμα, οι μετεωρολογικοί σταθμοί βοηθούν στην εκτίμηση της εξάτμισης του νερού από το έδαφος και τα φυτά (EBP), η οποία εξαρτάται από τη θερμοκρασία και την υγρασία του αέρα. Όταν οι συνθήκες είναι ξηρές και ζεστές, η εξάτμιση αυξάνεται και απαιτείται μεγαλύτερη άρδευση, ενώ όταν οι καιρικές συνθήκες είναι υγρές ή έχει προηγηθεί βροχή, η ανάγκη για άρδευση μειώνεται.

Επιπλέον, οι μετεωρολογικοί σταθμοί συμβάλλουν στην πρόβλεψη επικείμενων βροχοπτώσεων, επιτρέποντας στους αγρότες να προγραμματίσουν την άρδευση ανάλογα, αποφεύγοντας την άσκοπη σπατάλη νερού. Εάν αναμένονται βροχές, οι αγρότες μπορούν να αναβάλουν ή να μειώσουν την άρδευση, βελτιώνοντας τη διαχείριση των υδάτινων πόρων.

Αυτός ο συνδυασμός δεδομένων και τεχνολογίας διευκολύνει τη λήψη αποφάσεων με βάση τις πραγματικές ανάγκες του ελαιώνα και τις καιρικές συνθήκες.

Οι σύγχρονες τεχνολογίες αποτελούν τον πυρήνα αυτής της βελτιστοποίησης. Η χρήση αισθητήρων υγρασίας στο έδαφος, για παράδειγμα, επιτρέπει την ακριβή παρακολούθηση της ανάγκης του φυτού για νερό σε πραγματικό χρόνο. Αυτοί οι αισθητήρες παρέχουν δεδομένα που επιτρέπουν στον αγρότη να προγραμματίσει την άρδευση με βάση τις πραγματικές ανάγκες της καλλιέργειας, μειώνοντας την υπερβολική ή ανεπαρκή άρδευση.

Η μέθοδος άρδευσης στάγδην είναι επίσης μια από τις πιο αποδοτικές για ελαιώνες, καθώς προσφέρει νερό απευθείας στη ρίζα του φυτού με ελεγχόμενη ποσότητα, μειώνοντας τις απώλειες λόγω εξάτμισης και απορροής. Επίσης, η εφαρμογή συστημάτων άρδευσης που συνδυάζουν αυτόματα συστήματα με κλιματικές προβλέψεις μπορεί να προσαρμόσει την άρδευση με βάση τις καιρικές συνθήκες, εξασφαλίζοντας τη μέγιστη δυνατή αποδοτικότητα.

Αξιοποιώντας τα δεδομένα από την παρακολούθηση του εδάφους, την υγρασία και τις καιρικές συνθήκες, οι αγρότες μπορούν να εξοικονομήσουν σημαντικά ποσά από τη χρήση νερού, ενώ ταυτόχρονα προστατεύουν την ποιότητα του εδάφους και την υγεία των δέντρων.

Η εφαρμογή αυτών των τεχνολογιών απαιτεί αρχικά μια επένδυση, αλλά τα μακροπρόθεσμα οφέλη είναι σημαντικά. Η βελτιστοποίηση της άρδευσης μπορεί να αυξήσει την παραγωγή, να μειώσει το κόστος και να συμβάλει στην αειφόρο διαχείριση των φυσικών πόρων, εξασφαλίζοντας την οικονομική βιωσιμότητα των ελαιώνων.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Optimising irrigation in olive groves is critical for increasing efficiency and ensuring sustainability, especially in regions with limited water resources. Proper irrigation management reduces water waste and supports higher olive yields.

Meteorological stations are essential tools for efficient irrigation, providing real-time data on temperature, humidity, wind, and rainfall. These parameters help estimate water evaporation from soil and plants (EVP). In hot, dry conditions, EVP rises, and irrigation needs increase, while rain or high humidity reduce water demand. Forecasting rain also helps avoid unnecessary irrigation, improving water use efficiency.

This climate data supports informed decisions tailored to the olive grove's real needs. Modern technologies further enhance optimisation. Soil moisture sensors, for example, monitor water needs in real time, enabling precise irrigation planning and avoiding over- or under-watering.

Drip irrigation systems, which deliver water directly to the plant roots in controlled amounts, are highly efficient, minimizing evaporation and runoff. Advanced systems combining moisture sensors with weather forecasts allow automated adjustments, maximising water efficiency.

Integrating data from soil monitoring, moisture levels, and climate conditions enables significant water savings while maintaining soil quality and tree health.

Although initial investments are required, the long-term benefits are substantial. Optimised irrigation increases productivity, reduces costs, and supports sustainable resource management, helping ensure the economic viability of olive groves.

LONGER DESCRIPTION – IN ENGLISH

Optimising irrigation in olive groves is a critical factor for increasing efficiency and ensuring the sustainability of crops, especially in areas with limited water resources. Proper irrigation management reduces water wastage while ensuring maximum yield of olive production.

Meteorological stations are an important tool for the efficient management of irrigation in olive groves, as they provide accurate and timely information on weather conditions that affect the plants' need for water. By monitoring parameters such as temperature, humidity, wind speed, precipitation and other climatic conditions, weather stations allow accurate estimation of irrigation needs in real time.

For example, weather stations help to estimate the evaporation of water from soil and plants (EVP), which depends on air temperature and humidity. When conditions are dry and hot, evaporation increases and more irrigation is required, while when the weather is wet or preceded by rain, the need for irrigation is reduced.

In addition, weather stations help to predict upcoming rainfall, allowing farmers to plan irrigation, accordingly, avoiding unnecessary waste of water. If rain is expected, farmers can postpone or reduce irrigation, improving water management.

This combination of data and technology makes it easier to make decisions based on actual olive grove needs and weather conditions

Modern technologies are at the core of this optimisation. The use of moisture sensors in the soil, for example, allows the precise monitoring of the plant's need for water in real time. These sensors provide data that allow the farmer to plan irrigation based on the actual needs of the crop, reducing over- or under-irrigation.

Drip irrigation is also one of the most efficient methods for olive groves, as it delivers water directly to the root of the plant in a controlled amount, reducing losses due to evaporation and runoff. Also, the implementation of irrigation systems that combine automatic systems with climate forecasts can adjust irrigation based on weather conditions, ensuring maximum efficiency.

By utilizing data from soil monitoring, moisture and weather conditions, farmers can save significant amounts of water while protecting soil quality and tree health.

Implementing these technologies requires an initial investment, but the long-term benefits are significant. Optimizing irrigation can increase

production, reduce costs and contribute to sustainable management of natural resources, ensuring the economic viability of olive groves.

PHOTOS



Photo 1: Meteorological station

PRACTICE ABSTRACT #45**SHORT TITLE IN NATIVE LANGUAGE**

Βελτιστοποιημένη λίπανση σε καλλιέργεια ελιάς με την χρήση εδαφικών αναλύσεων, νέων σταθεροποιημένων λιπασμάτων και νέων τεχνολογιών.

SHORT TITLE IN ENGLISH

Optimized Fertilization in Olive Cultivation Using Soil Analysis, New Stabilized Fertilizers and New Technologies

COUNTRY AND CLIMATIC ZONE

Greece, mediterranean

CONTACT

Vasilis Psiroukis (vpsiroukis@aua.gr), Stathis Stathopoulos

3 BENEFITS OF THE PRACTICE

1. Increase in oil yields
2. Reduction of water pollution

PRODUCTION SYSTEM

Arboriculture for fruit

THEMATIC AREA/SECTOR

Crops Management, Fruits sector

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Η βελτιστοποιημένη λίπανση στην καλλιέργεια ελιάς είναι ζωτικής σημασίας για την αύξηση της απόδοσης και την επίτευξη υψηλής ποιότητας καρπών, ενώ παράλληλα

προστατεύει το περιβάλλον. Η σύγχρονη προσέγγιση στη λίπανση βασίζεται στη χρήση προηγμένων τεχνολογιών, όπως οι εδαφικές αναλύσεις, τα σταθεροποιημένα λιπάσματα και τα συστήματα ακριβείας για τη βελτίωση της αποδοτικότητας και την ελαχιστοποίηση της σπατάλης θρεπτικών συστατικών.

Οι εδαφικές αναλύσεις αποτελούν το πρώτο και πιο σημαντικό βήμα στην προσέγγιση της βελτιστοποιημένης λίπανσης. Μέσω της ανάλυσης του εδάφους, μπορούμε να κατανοήσουμε τις πραγματικές ανάγκες του εδάφους σε θρεπτικά συστατικά και να προσαρμόσουμε την ποσότητα και τον τύπο λιπάσματος που απαιτείται για κάθε περιοχή του ελαιώνα. Αυτή η διαδικασία βοηθά στον προσδιορισμό των ελλείψεων ή των υπερβολών σε θρεπτικά συστατικά, όπως άζωτο, φώσφορο και κάλιο, και επιτρέπει την ακριβή εφαρμογή λιπασμάτων σύμφωνα με τις ανάγκες του εδάφους.

Τα σταθεροποιημένα λιπάσματα αποτελούν μία καινοτόμο λύση στη λίπανση των ελαιώνων. Αυτά τα λιπάσματα έχουν σχεδιαστεί με τέτοιο τρόπο ώστε να απελευθερώνουν τα θρεπτικά συστατικά σταδιακά και με ακρίβεια, αποτρέποντας τις απώλειες μέσω διάβρωσης ή εξάτμισης. Με τη χρήση τους, τα θρεπτικά συστατικά παραμένουν διαθέσιμα στο έδαφος για μεγαλύτερο χρονικό διάστημα, ενισχύοντας τη διαθεσιμότητά τους για τα φυτά και μειώνοντας την ανάγκη για συχνές εφαρμογές.

Οι νέες τεχνολογίες όπως τα συστήματα ακριβείας και οι δορυφορικές εικόνες προσφέρουν εξαιρετικές δυνατότητες για την παρακολούθηση της υγείας των φυτών και την ακριβή εφαρμογή λιπασμάτων. Μέσω της χρήσης GPS και δορυφορικών συστημάτων, οι καλλιεργητές μπορούν να εφαρμόζουν τα λιπάσματα μόνο στις περιοχές που το χρειάζονται, αποφεύγοντας τη σπατάλη και μειώνοντας την επίδραση στο περιβάλλον.

Συνολικά, η συνδυασμένη χρήση των εδαφικών αναλύσεων, των σταθεροποιημένων λιπασμάτων και των νέων τεχνολογιών επιτρέπει μια πιο αποδοτική, οικονομική και περιβαλλοντικά φιλική προσέγγιση στη λίπανση της ελιάς.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Optimized fertilization in olive cultivation is vital to increase yields and achieve high quality fruit while protecting the environment. The modern approach to fertilization is based on the use of advanced technologies such as soil analysis, stabilized fertilizers and precision systems to improve efficiency and minimize nutrient wastage.

Soil analyses are the first and most important step in the approach to optimized fertilization. Through soil analysis, we can understand the actual nutrient needs of the soil and adjust the amount and type of fertilizer required for each area of the grove. This process helps to identify deficiencies or excesses of nutrients, such as nitrogen, phosphorus and

potassium, and allows the precise application of fertilizer according to the needs of the soil.

Stabilized fertilizers are an innovative solution for fertilizing olive groves. These fertilizers are designed to release nutrients gradually and precisely, preventing losses through erosion or evaporation. By using them, nutrients remain available in the soil for longer periods of time, enhancing their availability to plants and reducing the need for frequent applications.

New technologies such as precision systems and satellite imagery offer excellent possibilities for monitoring plant health and accurately applying fertilizers. Through the use of GPS and satellite systems, farmers can apply fertilizer only where it is needed, avoiding waste and reducing the impact on the environment.

Overall, the combined use of soil analysis, stabilized fertilizers and new technologies allows for a more efficient, economical and environmentally friendly approach to olive fertilization.

PRACTICE ABSTRACT #47**SHORT TITLE IN NATIVE LANGUAGE**

Cajas nido para el control de topillo en cultivos agrícolas

SHORT TITLE IN ENGLISH

Nest Boxes for Vole Control in Agricultural Crops

COUNTRY AND CLIMATIC ZONE

Spain, mediterranean climate

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Natural pest control through nest boxes for Barn Owls and Kestrels
2. Medium- and long-term effectiveness in reducing vole populations
3. Cost-effective and eco-friendly alternative to chemical rodenticides

PRODUCTION SYSTEM

Crops sector

THEMATIC AREA

Crops management (Integrated Pest Management)

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Los roedores son una de las plagas con mayor repercusión económica en la agricultura de todo el mundo y la Península Ibérica no es una excepción. La especie de roedor que mayor conflicto ha desatado ha sido el Topillo Campesino (*Microtus arvalis*), aunque se encuentran varias especies que causan daños agrícolas. Puede afectar prácticamente a cualquier cultivo sin excepción. En nuestra región (Navarra) el topillo campesino ha aumentado tanto en abundancia como en distribución.

El uso de plástico en los cultivos hortícolas y la siembra directa de cultivos extensivos han favorecido el incremento de esta especie. Los topillos aumentan sus poblaciones en cultivos permanentes y/o plurianuales, como es el caso de la alfalfa entre otros y en parcelas donde se realizan técnicas de laboreo. Además, la modernización de las infraestructuras agrícolas y ganaderas ha limitado los espacios de anidación de aves depredadoras de estos roedores.

Con el fin de hacerle frente, tradicionalmente se ha recurrido a la quema de rastrojos y linderos y al uso de rodenticidas. Medidas con un impacto medioambiental muy elevado y una eficacia muy cuestionada.

La colocación de nidales artificiales para depredadores (cernícalos, lechuzas) evitan el crecimiento excesivo de las poblaciones de topillos minimizando los daños en los cultivos. El mantenimiento de setos también tiene implicaciones positivas.

Los nidales se colocan a una altura mínima de 3 metros en edificios tales como corrales restaurados o almacenes agrícolas. En el caso del cernícalo se pueden colocar también en postes. Dado que el área de campeo de una pareja de lechuzas o cernícalos está en torno a las 30 ha, estas cajas deben colocarse separadas un mínimo de 300 m para optimizar la eficacia de las mismas.

Esta estrategia persigue el control de estos roedores de la manera más eficaz a medio y largo plazo, teniendo además la ventaja de ser económica y ambientalmente más sostenible que la habitual aplicación de fitosanitarios.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Rodents are one of the pests with the greatest economic impact on agriculture worldwide, and the Iberian Peninsula is no exception. The rodent

species that has unleashed the greatest conflict has been the vole (*Microtus arvalis*), although there are several species causing agricultural losses. It can affect practically any crop without exception. In our region (Navarra) the vole has increased both in abundance and distribution.

The use of plastic in horticultural crops and the direct sowing of extensive crops have favoured the increase of this species. Voles also increase their numbers in either permanent and multi-year crops, such as alfalfa, and where no-tillage techniques are used. In addition, the modernisation of agricultural and livestock infrastructures has limited the nesting areas for birds that prey on these rodents.

In order to deal with this problem, the burning of stubble and boundaries and the use of rodenticides have traditionally been used. Those are measures with a very high environmental impact and a highly questionable effectiveness.

Artificial nest boxes for predators (kestrels, owls) prevent the overgrowth of vole populations and minimise crop damage. Hedges also have a positive effect.

The nest boxes are placed at a minimum height of 3 metres in buildings such as restored farmyards or agricultural warehouses. In the case of the kestrel they can also be placed on poles. As the breeding area of a pair of barn owls or kestrels is around 30 ha, these boxes should be placed at least 300 m apart to optimise their effectiveness.

This strategy aims to control these rodents in the most effective way in the medium and long term and also has the advantage of being economically and environmentally more sustainable than the usual application of pesticides.

PHOTOS



Picture 1: Nest box 1



Picture 1: Nest box 2

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Technical paper (in Spanish): Topillos en Navarra. Biología y estrategias de control

URL:

<https://www.navarraagraria.com/categories/item/1141-topillos-en-navarra-biologia-y-estrategias-de-control/1141-topillos-en-navarra-biologia-y-estrategias-de-control>

Title/Description

Technical paper (in Spanish): Plan de Control Biológico del Topillo Campesino en la mitad sur de Navarra

URL:

<https://www.navarraagraria.com/categories/item/1660-control-biologico-del-topillo-campesino-en-navarra>

Title/Description

GREFA (Group for the Rehabilitation of Native Fauna and their Habitats)

URL:

<https://www.grefa.org/proyectosgrefa/control-biol%C3%B3gico-del-topillo-campesino.html#el-topillo>

PRACTICE ABSTRACT #50**SHORT TITLE IN NATIVE LANGUAGE**

Outil de sensibilisation à l'adaptation au changement climatique à l'échelle de l'exploitation agricole

SHORT TITLE IN ENGLISH

Tool to Discuss Climate Change Adaptation at a Farm Level

COUNTRY AND CLIMATIC ZONE

Europe

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Quantify climate change effect at the farm level
2. Discuss solutions to adapt specific farmer issues
3. Simple tool to understand farmer issues

THEMATIC AREA

N/A

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Most European farmers face climatic hazards on their farms due to climate change. This climatic instability makes multi-year projections difficult. To help advisors understand what farmers are experiencing, we developed a simple climate adaptation tool in an Excel sheet during the project. One of

the goals was to keep it simple to discuss climate change without adding too many questions to the already planned mitigation audit.

This is a questionnaire divided into four parts. The first part describes the farm's production. The second part, titled "Climatic Risks," aims to determine whether the farmer has experienced more climatic incidents in the past five years than before (such as drought, excess water, frost, storm damage, or biotic stress) and how these have impacted their livestock or crop production.

The third part covers farm-specific characteristics related to adaptation of climate change, such as climate insurance, access to irrigation, and soil type. The final section addresses practices the farmer has already tested on the farm.

This short survey has two objectives: quantifying climatic incidents at the farm level and opening a discussion with the farmer on adaptation in a simple way. It is linked to the adaptation measures library also developed during the project. In this way, advisors can suggest tailored measures to farmers and contribute practical examples from the field to enrich the library.

PRACTICE ABSTRACT #56**SHORT TITLE IN NATIVE LANGUAGE**

Wie Bodenbedeckung und reduzierte Bodenbearbeitung die Stabilität und Widerstandsfähigkeit der Landwirtschaft gegenüber extremen Wetterereignissen fördern

SHORT TITLE IN ENGLISH

How Soil Cover and Reduced Tillage Enhance the Stability and Resilience of Agriculture to Extreme Weather Events

COUNTRY AND CLIMATIC ZONE

Switzerland, temperate climatic zone

CONTACT

Melissa Näf-Doffey (melissa.naef@agridea.ch)

3 BENEFITS OF THE PRACTICE

1. Maintaining soil health
2. Increase resilience
3. Emission mitigation

THEMATIC AREA

Crops management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Die Climate Farm Demo Veranstaltung in Bavois, Schweiz, im Oktober 2024 legte den Schwerpunkt auf die Aufklärung und Weiterbildung von Fachleuten in der Landwirtschaft über die wesentliche Rolle von Bodenbedeckungspflanzen, wie Gründüngungen und Zwischenfrüchten und Methoden wie der Direktsaat, zur Bewältigung der Herausforderungen des Klimawandels.

An der Veranstaltung präsentierte Forschungsergebnisse zeigten auf, dass durch Pflanzen bedeckte Böden Regenwasser effektiver aufnehmen, Erosion reduzieren und sich im Sommer weniger stark erhitzen. Unbedeckte Böden hingegen sind anfällig für Wasser- und Nährstoffverluste sowie Bodenerosion. Ein vor Ort durchgeführter Aggregatsstabilitätstest illustrierte, wie die Bodenstabilität durch die Bodenbewirtschaftungsart beeinflusst wird, und wie eine Bodenbedeckung durch Pflanzen die Stabilität des Bodens verbessert.

Personen aus der landwirtschaftlichen Praxis und Beratung können die gewonnenen Erkenntnisse nutzen, indem sie Strategien für die Implementierung der Bodenbedeckung durch Pflanzen und der reduzierten Bodenbearbeitung in ihren Anbau integrieren. Diese Methoden verbessern die Bodenqualität und -fruchtbarkeit und tragen dazu bei, die Erträge langfristig zu stabilisieren und zu steigern.

Zum Abschluss der Veranstaltung stellte Hanspeter Liniger (Universität Bern) die Ergebnisse des Projekts „Hot earth is not cool“ vor und zeigte auf, dass unbedeckte Böden sehr anfällig für Erosion, Abfluss und Hitzestress sind. Er erläuterte, dass bedeckte Böden Regenwasser besser aufnehmen und speichern und so vor Erosion und Trockenheit schützen. Studien mit Regensimulatoren zeigen, dass bis zu 50 % der starken Regenfälle von unbedeckten Böden abfließen und große Verluste an Wasser, Boden und Nährstoffen verursachen. Im Gegensatz dazu wiesen Böden unter Dauergrünland oder Deckfrüchten mit Direktsaatverfahren nur minimale Abfluss- und Erosionswerte auf. Unbedeckte Böden können sich im Sommer auf über 60 °C aufheizen und das Bodenleben schädigen. Mulch kann die Oberbodentemperaturen um 15-20 °C senken, während lebende Pflanzendecken noch wirksamer sind und zur Stabilisierung der Bodenstruktur beitragen. Häufiges Pflügen stört Wurzeln und Bodenmikroben, schwächt die Bodenstabilität und erhöht das Erosionsrisiko.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Climate Farm Demo event in Bavois, Switzerland, in October 2024 focused on educating and training agricultural professionals about the essential role of cover crops as well as methods like direct seeding, in addressing the challenges posed by climate change.

Research presented at the event showed that soil covered by plants can absorb rainwater more effectively, reduce erosion, and heat up less in summer. In contrast, uncovered soils are vulnerable to water and nutrient losses, as well as soil erosion. An aggregate stability test conducted on-site illustrated how soil stability is affected by management practices and how plant cover can improve soil stability.

Individuals from agricultural practice and advisory can leverage these insights by integrating strategies for implementing cover crops and reduced tillage into their farming practices. These methods improve soil quality and fertility, contributing to long-term yield stability and increases.

At the end of the event, Hanspeter Liniger (University of Bern) shared findings from the "Hot earth is not cool" project, highlighting how uncovered soils are highly vulnerable to erosion, runoff, and heat stress. He explained that covered soils absorb and store rainwater better, protecting against erosion and drought. Rain simulator studies show that up to 50% of heavy rainfall runs off uncovered soils, causing major losses of water, soil, and nutrients. In contrast, soils under permanent pasture or cover crops with no-till practices showed minimal runoff and erosion. Uncovered soils can heat up to over 60°C in summer, harming soil life. Mulch can lower topsoil temperatures by 15–20°C, while living plant covers are even more effective and help stabilize soil structure. Frequent ploughing disrupts roots and soil microbes, weakens soil stability and increases erosion risks.

<https://www.ufarevue.ch/pflanzenbau/warum-boeden-vor-hitze-zu-schuetzen-sind>

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Im Zuge des Klimawandels sind landwirtschaftlich genutzte Böden zunehmend extremen Wetterbedingungen wie Hitzewellen, Dürren und Starkregen ausgesetzt. Diese Veränderungen gefährden die Bodenfruchtbarkeit und somit auch die Erträge in der Landwirtschaft.

An der gut besuchten Climate Farm Demo Veranstaltung am 9. Oktober 2024 in Bavois VD wurde die entscheidende Rolle der Bodenbedeckung im

Rahmen einer praxisorientierten Veranstaltung verdeutlicht. Nach einer Begrüssung der Anwesenden durch eine Beraterin des Verbands Prométerre berichtete der Climate Farm Demo Landwirt Thierry Salzmann von seinen Erfahrungen mit Bodenbedeckung durch Pflanzen und reduzierter Bodenbearbeitung. Er erläuterte, wie er Techniken wie die Direktsaat in seinem Betrieb praktisch umsetzt und welche Vorteile er darin sieht. Im Anschluss hatten die Fachpersonen aus der Landwirtschaft die Möglichkeit, an verschiedenen Posten zu erfahren, wie sich die Bodenbedeckung positiv auf verschiedene Eigenschaften des Bodens, wie Bodenstruktur, Nährstoffverfügbarkeit, Biodiversität und Bodenlebewesen auswirkt.

Zum Ende der Veranstaltung präsentierte Hanspeter Liniger von der Universität Bern wichtige Forschungsergebnisse zum Thema Bodenschutz. Im Rahmen des Projektes „Heisse Erde ist nicht cool“ erklärte Liniger, zu welchen Problemen unbedeckte Böden führen können und welche landwirtschaftlichen Praktiken dazu beitragen können, Böden vor extremen Wetterereignissen zu schützen und die Bodenfruchtbarkeit langfristig zu erhalten:

- Bedeckte Böden können Regenwasser effektiver aufnehmen und speichern und sind somit besser gegen Erosion und Dürre geschützt. Unbedeckte und frisch bearbeitete Böden sind hingegen besonders anfällig für Oberflächenabfluss und Erosion. Untersuchungen mit Regensimulatoren zeigen: auf unbedecktem Boden fliessen bis 50 % eines simulierten Starkniederschlags ab, was zu erheblichen Verlusten an Wasser, Boden und Nährstoffen führt. Im Gegensatz dazu verringern Dauerweiden oder Böden, die mit Direktsaat und Zwischenfrucht bewirtschaftet wurden, den Oberflächenabfluss deutlich.
- Unbedeckte Böden können sich im Sommer über 60 °C erhitzen, was das Bodenleben stört. Eine Abdeckung mit Mulch kann die Oberbodentemperatur um 15 bis 20 °C senken. Eine lebendige Bodenbedeckung ist noch effektiver und verbessert zusätzlich die Stabilität des Bodengefüges.
- Wurzeln und Bodenmikroben sind entscheidend für die Stabilität des Bodens. Häufiges Pflügen stört das Bodenleben und führt zu instabilen Böden, was wiederum den Oberflächenabfluss und die Erosion begünstigt.

Fazit, die Untersuchungen von Hanspeter Liniger und Jovana Askrabic im Sommer 2023 und 2024 zeigen, dass der Schutz der Böden vor Hitzestress,

Oberflächenabfluss und Erosion entscheidend ist für eine resiliente Landwirtschaft. Durch angepasste Anbaumethoden können Böden widerstandsfähiger gegen klimatische Extreme gemacht werden, was sowohl die Erträge als auch die Umwelt langfristig schützt.

Der vollständige Artikel zur Forschung von Liniger und Askrabic kann hier nachgelesen werden (Sprachen: Deutsch und Französisch).

LONGER DESCRIPTION – IN ENGLISH

As a result of climate change, agricultural soils are increasingly exposed to extreme weather conditions such as heatwaves, droughts and heavy rainfall. These changes threaten soil fertility and therefore also agricultural yields.

At the well-attended Climate Farm Demo event on 9 October 2024 in Bavois VD, the crucial role of soil cover was illustrated in a practice-oriented event. After a welcome to the attendees by a consultant from the Prométerre association, the Climate Farm Demo farmer Thierry Salzmann shared his experiences with cover cropping and reduced tillage. He explained how he practically implements techniques such as no-till farming on his farm and the advantages he sees in it. Afterwards, the agricultural experts had the opportunity to experience at various stations how soil cover has a positive effect on various soil properties, such as soil structure, nutrient availability, biodiversity and soil organisms.

Towards the end of the event, Hanspeter Liniger from the University of Bern presented important research findings on the topic of soil protection. As part of the 'Hot earth is not cool' project, Liniger explained the problems that uncovered soils can lead to and which agricultural practices can help to protect soils from extreme weather events and maintain soil fertility in the long term:

- Covered soils can absorb and store rainwater more effectively and are therefore better protected against erosion and drought. Uncovered and freshly tilled soils, on the other hand, are particularly susceptible to surface runoff and erosion. Studies with rain simulators show that as much as half of the simulated heavy rainfall runs off on uncovered soil, resulting in substantial losses of water, soil and nutrients. Conversely, soils cultivated with permanent pasture or protected by a green cover crop sown using no-till practices markedly diminished surface runoff and minimized erosion to nearly zero.
- Uncovered soils can heat up to over 60°C in summer, stressing soil life. Mulch cover can lower the top soil temperature by 15 to 20 °C. A living

soil cover is even more effective and also improves the stability of the soil structure.

- Roots and soil microbes are crucial for soil stability. Frequent ploughing disturbs soil life and leads to unstable soils, which in turn favours runoff and erosion.

As a conclusion, the investigations of Hanspeter Liniger und Jovana Askrabic in summer 2023 and 2024 showed that protecting soils from heat stress, surface runoff and erosion is crucial for resilient agriculture. Adapted cultivation methods can make soils more resistant to climatic extremes, secure yields and also protect the environment in the long term.

<https://www.ufarevue.ch/pflanzenbau/warum-boeden-vor-hitze-zu-schuetzen-sind>
The full article on Liniger and Askrabic's research can be read below (see Additional information; languages: German and French).
<https://www.ufarevue.ch/pflanzenbau/warum-boeden-vor-hitze-zu-schuetzen-sind>

ADDITIONAL INFORMATION

Link to the UFA revue: <https://www.ufarevue.ch/pflanzenbau/warum-boeden-vor-hitze-zu-schuetzen-sind>

Contact for enquiries about the research project:
hanspeter.liniger@unibe.ch

PHOTOS



Photo 1: The Climate Farm Demo event in Bavois was well attended. This shows that there is interest among farmers in innovative practices like cover crops.



Photo 2: Temperatures of different surfaces, presented by Hanspeter Liniger during his presentation at the event in Bavois. The attendees were surprised that plowed soil, at nearly 60 °C, is significantly higher than that of asphalt (around 50 °C).



Photo 3: Aggregate stability test, conducted by Hanspeter Liniger at the Climate Farm Demo event in Bavois (from left to right): fallow soil (very low stability), plowed soil from Jeuss (reduced stability), reduced tillage, direct seeding (high stability), and direct seeding (fresh) from Bavois. (Image: AGRIDEA, Pascal Python)



Photo 4: Various machines for direct seeding and mulching could be viewed at the hands-on event (Image: AGRIDEA, Pascal Python).

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Liniger, H.; Askrabic, J. (2024). *Warum Böden vor Hitze zu schützen sind*. UFA Revue.

URL:

<https://www.ufarevue.ch/pflanzenbau/warum-boeden-vor-hitze-zu-schuetzen-sind>

Title/Description

Video Regensimulator (Liniger und Askrabic, 2024)

URL:

<https://www.youtube.com/watch?v=2ScHBT3pSjY>

Title/Description

Video Aggregatstabilitätstest (Liniger und Askrabic, 2024)

URL:

<https://www.youtube.com/watch?v=AQ3muYSlabE>

Title/Description

Agroscope page on cover crops

URL:

<https://www.agroscope.admin.ch/agroscope/en/home/topics/plant-production/field-crops/ackerbausysteme/couverts-vegetaux.html>

PRACTICE ABSTRACT #59**SHORT TITLE IN NATIVE LANGUAGE**

Farma s riadenou dopravou

SHORT TITLE IN ENGLISH

Control Traffic Farming

COUNTRY AND CLIMATIC ZONE

Slovakia, mild continental climate

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Increase in the yields of cultivated crops
2. Restore land degradation
3. Effectiveness of machine operations

PRODUCTION SYSTEM

Crops production

THEMATIC AREA

Soil management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Vysokoškolský poľnohospodársky podnik Slovenskej poľnohospodárskej univerzity v Nitre využíva na cca 20 hektároch CTF (control traffic farming) technológiu, založenú na systéme riadenia pohybu poľnohospodárskych strojov po poli. Jej úlohou je koncentrovať a zmenšiť na najmenšiu mieru utlačenú plochu po prejazde strojov a eliminovať technogénne zhutnenie pôdy vyvolané pohybom strojov, čím sa podporí infiltračná schopnosť pôdy, zvýši jej retenčná schopnosť a zároveň sa znižuje riziko vodnej erózie. Vytvorený systém prepravných/ dopravných dráh je následne udržiavaný počas celého roka.

Pri aplikácii uvedených technológií dosahuje navýšenie úrod pestovaných plodín v priemere 3-10%, a to predovšetkým v prípade pestovania obilnín, kukurice a strukovín. Uvedený efekt sa prejavuje najmä v suchších rokoch. Pri správnom návrhu organizácie pohybu stroja sa optimalizujú jednotlivé pracovné operácie, znižujú sa náklady na pohonné hmoty a zvyšuje sa efektivita prevádzky strojov. Benefitom je tiež zvýšenie technologickej presnosti paralelných prejazdov strojov a jasná identifikácia chemicky ošetrovaných – neošetrovaných plôch. Okrem ekologického efektu je možné aj zníženie spotreby výrobných vstupov vo forme osív a hnojív, ktoré môže pri ich optimálnom využití dosiahnuť až 10%-ný pokles.

Zvýšenie komfortu ovládania stroja znižuje únavu a stres obsluhy, čo umožňuje prácu aj za zníženej viditeľnosti.

Pre implementáciu je podstatným zaobstaranie navigačného systému (optimálne s presnosťou RTK- real time kinematic) a jeho inštalácia na traktor a samohybné stroje.

Následne sa stroje optimalizujú z hľadiska šírky záberu. Zadefinuje sa využitie telematického softvéru a optimalizujú navigačné línie na príslušných pozemkoch. Jednotlivé stroje sa postupne adaptujú na stanovené navigačné línie a zaškoľuje sa ich obsluha. Je tiež potrebné zabezpečiť korekčný signál.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The University Farm of the Slovak University of Agriculture in Nitra uses Controlled Traffic Farming (CTF) technology on about 20 hectares, based on a system for controlling the movement of agricultural machinery in the field. Its aim is to concentrate and minimise the compacted area resulting from machinery movement and to eliminate technogenic soil compaction, thereby promoting soil infiltration, increasing soil retention capacity, and

reducing the risk of water erosion. The created system of conveyor/transport tracks is then maintained throughout the year.

The application of the above technologies results in an average yield increases of 3–10% for the crops grown, especially in the case of cereals, maize, and legumes. This effect is particularly pronounced in drier years. The correct design and organisation of machinery movement optimise individual work operations, reduce fuel costs, and increase the efficiency of machinery use. An additional benefit is the increased technological precision of parallel machinery passes and clear identification of chemically treated versus untreated areas. In addition to the ecological benefits, it is also possible to reduce the consumption of production inputs such as seeds and fertilisers, which can be lowered by up to 10% when optimally applied.

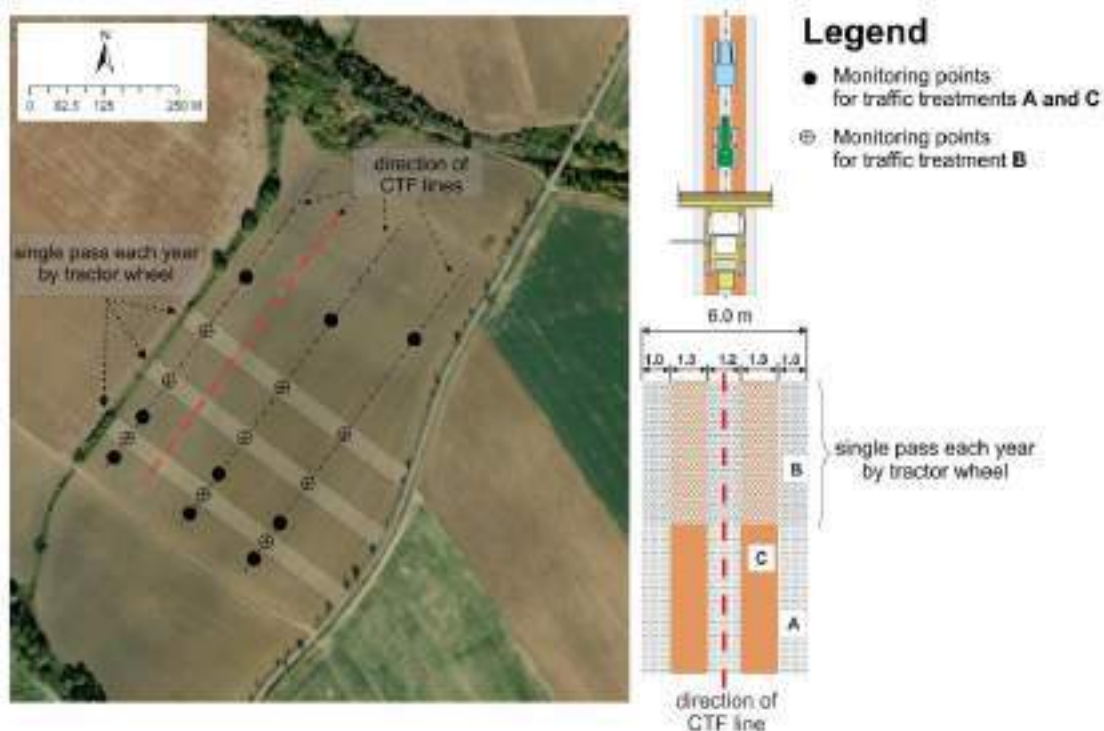
Increased comfort during machine operation reduces operator fatigue and stress, allowing work even in conditions of reduced visibility.

For implementation, the acquisition of a navigation system (optimally with RTK- real time kinematic accuracy) and its installation on the tractor and self-propelled machines is essential. The machines are then optimised in terms of their range. The use of telematics software is to be defined and the navigation lines on the respective plots are optimised. The individual machines are gradually adapted to the established navigation lines and their operators are trained. It is also necessary to provide a GNSS correction signal.

ADDITIONAL INFORMATION

Farmers usually prefer to apply best practices from the past and are reluctant to adopt new technologies. They need sufficient funds to procure a navigation system and to train the machine operators. Before that, a fleet analysis is necessary to show whether there is a need for fleet investment, which may also represent a financial cost.

PHOTOS



ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Macák, M. 2019. Machines movement and their impact to effectiveness of crop production. Habilitation thesis. Slovak agriculture in Nitra. 2019.

PRACTICE ABSTRACT #61**SHORT TITLE IN NATIVE LANGUAGE**

Utilisation des écrans thermiques pour réduire la consommation énergétique des serres

SHORT TITLE IN ENGLISH

Using Thermal Screen to Reduce Energy Consumption in Greenhouses

COUNTRY AND CLIMATIC ZONE

France and North of Europe, temperate

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Reducing energy consumption
2. Improving climate control
3. Yield efficiency

PRODUCTION SYSTEM

Greenhouse production

THEMATIC AREA/SECTOR

Vegetables sector

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

L'objectif de l'écran thermique est de réduire les pertes thermiques de la serre au moment où elles sont les plus importantes, c'est-à-dire de nuit. Une bonne isolation thermique est obtenue en limitant à la fois les échanges convectifs (écran bien fermé et relativement étanche) et radiatifs (matériaux réfléchissants et à faible émissivité). Les toiles sont constituées de matériaux divers (polyéthylène, polyester, acrylique), en film, à maille, tissés ou non et plus ou moins métallisés. L'efficacité thermique augmente lorsque l'émissivité et la transmissivité de la toile décroissent. Les fabricants indiquent généralement la transmission lumineuse et l'économie d'énergie attendue.

L'écran thermique est déployé au-dessus de la culture en début de nuit, quand la demande de chauffage devient importante, et est retiré au lever du soleil de manière progressive pour éviter le choc thermique. En fonctionnement normal de nuit, l'écran est fermé, mais une légère ouverture temporaire peut être nécessaire pour maîtriser l'hygrométrie et la température. L'utilisation d'un écran ajouré est possible, afin de laisser passer la vapeur d'eau et éviter des taux d'hygrométrie trop importants. Il est également possible d'utiliser des systèmes pour déshumidifier la serre en complément. Enfin, la mise en œuvre de l'écran thermique nécessite un pilotage automatique. La gestion de l'écran doit en effet être bien maîtrisée, pour éviter les problèmes sanitaires et les pertes de rendement, notamment par rapport à l'hygrométrie.

L'économie d'énergie par la mise en place d'un écran thermique est de 20-25% et de 30-35% avec un double écran par rapport à une serre sans écran. L'intérêt du double écran est également d'avoir deux toiles avec des propriétés différentes permettant de l'utiliser de nuit et pendant les jours sombres.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The thermal screen is the first equipment to be installed to reduce the energy consumption of greenhouses. The objective of the thermal screen is to reduce heat losses in the greenhouse when they are most significant, namely at night. High-performance thermal insulation is achieved by limiting both convective exchanges (a well-closed and relatively airtight screen) and radiative exchanges (using reflective and low-emissivity materials). The screens are made from various materials (polyethylene, polyester, acrylic), in film, mesh, woven, or non-woven forms, and are more or less metallized. Thermal efficiency increases as the emissivity and

transmission of the screen decreases. Manufacturers generally specify the light transmission and the expected energy savings.

The thermal screen is deployed above the crops at the beginning of the night when heating demand becomes significant and is gradually retracted at sunrise to avoid thermal shock. During normal nighttime operation, the screen remains closed, but a slight temporary opening may be necessary to control humidity and temperature. It is possible to use a perforated screen to allow water vapor to pass through and prevent excessive humidity levels. Additionally, devices can be used to dehumidify the greenhouse. Double screens are used in which the highest energy savings are combined with transparent materials for flexible usage during dull days and nighttime.

Finally, implementing the thermal screen requires automatic control. Management of the screen is crucial to avoid health issues and yield losses, especially concerning humidity. Energy savings from using a thermal screen are about 20–25%, and 30–35% with a double screen, compared to a greenhouse without a screen.

PHOTOS



Photo 1: Thermal screen deployed in cucumber crop

Photo credits: CTIFL©



PRACTICE ABSTRACT #62**SHORT TITLE IN NATIVE LANGUAGE**

Klimat- och jordfördelar med fånggrödor: Kolinlagring, kvävehantering och ogräskontroll

SHORT TITLE IN ENGLISH

Climate and Soil Benefits of Cover Crops: Carbon Sequestration, Nitrogen Management, and Weed Control

COUNTRY AND CLIMATIC ZONE

Sweden, subarctic and humid continental

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Soil carbon sequestration
2. Efficient nitrogen use
3. Reduce Environmental impact

PRODUCTION SYSTEM

Arable crops and horticultural crops on field

THEMATIC AREA

Soil management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Mellangrödor spelar en viktig roll i kolinlagring genom att utnyttja tiden mellan huvudgrödor. De bidrar till stabil kolinlagring, särskilt genom rötter, som har högre lagringspotential än ovanjordisk biomassa. Gräsarter har generellt en större andel rötter än korsblommiga växter, och jordens egenskaper påverkar inlagringens effektivitet. Mikroorganismer stabiliserar kolet efter nedbrytning, och odlingstekniker samt klimatförändringar kan påverka både kolinlagring och nedbrytningstakt.

Mellangrödor minskar kväveläckage, särskilt på lätta jordar, och kan reducera läckaget med upp till 43 %. För att vara effektiva måste kvävet frigöras i rätt tid för efterföljande gröda. Gräs kan tömma marken på kväve på våren, medan baljväxter kan bidra med kväve. Blandningar av gräs och klöver kan kombinera kväueupptag och förfruktseffekt. Tidpunkten för nedbrukning påverkar både kvävetillgång och läckagerisk, särskilt på sandjordar.

Effekten på lustgasutsläpp varierar beroende på skötsel och grödval. Nedbrytning av mellangrödor på blöt mark kan leda till höga utsläpp, särskilt från korsblommiga växter som rättika och senap. Att föra bort biomassa på hösten för biogasproduktion eller foder kan minska emissionerna. Övervintrande mellangrödor kan också sänka lustgasutsläpp genom att hålla kvar kväve.

Mellangrödor kan också konkurrera med ogräs och minska förekomsten med upp till 90 %. Växter som oljerättika och honungsört är särskilt effektiva. Kombination med mekanisk bearbetning kan hantera fleråriga ogräs, och strategier som ogräshackning medan mellangrödor kan minska ogräs utan att öka kväveläckage.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Cover crops play a vital role in carbon sequestration by utilising the period between main crops. They contribute to stable carbon storage, particularly through roots, which have a higher sequestration potential than aboveground biomass. Grass species generally have a greater root proportion compared to brassicas, and soil properties influence sequestration efficiency. Microorganisms stabilise carbon after decomposition, and farming techniques as well as climate change can affect both sequestration and decomposition rates.

Cover crops reduce nitrogen leaching, especially in light soils, and can lower leaching by up to 43%. For optimal efficiency, nitrogen must be released at the right time for the subsequent crop. Grasses can deplete soil nitrogen in spring, whereas legumes can contribute nitrogen. A mixture of grasses and clover balances nitrogen uptake and residual effects. The timing of incorporation affects both nitrogen availability and leaching risks, particularly in sandy soils.

The impact on nitrous oxide emissions varies depending on management and crop selection. The decomposition of cover crops in wet soils can lead to high emissions, especially from brassicas such as radish and mustard. Removing biomass in autumn for biogas production or fodder can reduce emissions. Overwintering cover crops can also lower nitrous oxide emissions by retaining nitrogen.

Cover crops also compete with weeds and can reduce weed occurrence by up to 90%. Plants such as oil radish and phacelia are particularly effective. Combining cover crops with mechanical tillage can help manage perennial weeds, and strategies such as inter-row hoeing between cover crops can control weeds without increasing nitrogen leaching.

LONGER SUMMARY FOR THE CLIMATE FARM DEMO WEBSITE – IN NATIVE LANGUAGE

Mellangrödor ökar kolinlagringen genom att utnyttja tiden mellan huvudgrödor. I genomsnitt binds 320 kg stabilt kol per hektar, där rötter spelar en avgörande roll eftersom de har 2,5 gånger högre inlagringsvärde än ovanjordisk biomassa. Gräsarter har generellt en större andel rötter än korsblommiga växter, vilket främjar kolbindning. Klimat, jordart och odlingsteknik påverkar kolstabilisering, där kallare temperaturer bromsar nedbrytning och ökar nettoinlagringen.

Mikroorganismer är centrala i kolinlagringen, eftersom kolet stabiliseras efter nedbrytning. Vid inlagring av 100 kg kol binds även 7–10 kg kväve och mindre mängder fosfor, vilket förbättrar jordens bördighet. Lerjordar lagrar kol mer effektivt genom kemiska bindningar, medan sandjordar har snabbare mineralisering. För att mäta kolinlagring krävs långsiktiga försök och modeller som ICBM, används för att beräkna markkolsförändringar.

Mellangrödor minskar kväveläckage, särskilt på lätta jordar, med i genomsnitt 43 % enligt nordiska studier. Gräs är mest effektiva, medan baljväxter bidrar med kväve till efterföljande gröda. Blandningar av gräs och baljväxter balanserar kväveupptag och förfruktseffekt. Tidpunkten för

nedbrukning påverkar kväveutnyttjandet – sen nedbrytning minskar läckage men kan ge kvävebrist för nästa gröda.

Lustgasutsläppen från mellangrödor varierar beroende på växtval och skötsel. Nedbrytning av korsblommiga mellangrödor på blöt mark kan öka utsläppen, medan övervintrande mellangrödor minskar dem genom att hålla kvar kvävet i växtmaterialet. Bortförsel av biomassa till biogas eller foder kan minska nitratnivåer och lustgasutsläpp.

Mellangrödor förbättrar även markstrukturen och odlingssäkerheten genom att minska erosion och öka mullhalten. Deras effekt på fosforläckage är dock begränsad, och sönderfrysning kan i vissa fall öka fosforförluster. För att vara effektiva bör mellangrödor fokusera på att hålla mineralkvävenivåerna låga snarare än att enbart producera biomassa.

Mellangrödor kan också användas för ogräsbekämpning, särskilt i system med reducerad jordbearbetning. Täta bestånd konkurrerar ut ogräs och kan minska ogrästrycket med upp till 90 %. Arter som oljerättika och honungsört har visat god effekt, och kombination med mekanisk bearbetning kan förbättra kontrollen av fleråriga ogräs.

För att optimera mellangrödornas klimatnytta krävs en balans mellan kolinlagring, kväveeffektivitet och lustgasutsläpp. Även om mellangrödor bidrar till kolinlagring kan de öka växthusgasutsläpp, vilket gör att deras totala klimatpåverkan beror på odlingssystem och skötselstrategier.

Mellangrödor blir allt viktigare i framtidens odlingssystem för att minska näringsläckage, jorderosion och bevara markens bördighet, särskilt med varmare höstar och vintrar. Den längre växtsäsongen ökar möjligheten att odla mellangrödor, även längre norrut. Det behövs mer forskning och erfarenhetsutbyte kring etableringsmetoder, artval och mellangrödors påverkan på klimat och odlingssystem. Särskilt krävs ökad kunskap om lustgasutsläpp för att optimera mellangrödor i ett förändrat klimat.

LONGER DESCRIPTION - IN ENGLISH

Cover crops enhance carbon sequestration by utilising the period between main crops. On average, 320 kg of stable carbon is stored per hectare, with roots playing a crucial role, as they have 2.5 times higher sequestration value than above-ground biomass. Grasses generally develop a larger root system than cruciferous plants, promoting carbon retention. Climate, soil type, and cultivation practices influence carbon stabilisation, with lower temperatures slowing decomposition and increasing net sequestration.

Microorganisms are central to carbon sequestration, as carbon stabilises after microbial decomposition. For every 100 kg of carbon stored, 7–10 kg of nitrogen and smaller amounts of phosphorus are also retained, improving soil fertility. Clay soils sequester carbon more efficiently through chemical bonding, whereas sandy soils have a higher mineralisation rate. Measuring carbon sequestration requires long-term studies, and models such as ICBM are used to estimate changes in soil carbon stocks.

Cover crops significantly reduce nitrogen leaching, particularly in light soils, with Nordic studies showing an average reduction of 43%. Grasses are the most effective, while legumes contribute nitrogen to the following crop. Mixtures of grasses and legumes help balance nitrogen uptake and residual fertility. The timing of incorporation affects nitrogen availability – delayed decomposition minimises leaching but may result in nitrogen deficiency for the next crop.

Nitrous oxide emissions from cover crops vary depending on species and management. Decomposition of cruciferous cover crops in wet conditions can increase emissions, while overwintering species reduce them by retaining nitrogen in plant material. Removing biomass for biogas or fodder can lower nitrate levels and mitigate nitrous oxide emissions.

Cover crops also improve soil structure and resilience by reducing erosion and increasing soil organic matter. However, their effect on phosphorus leaching is limited, and frost damage can sometimes increase phosphorus losses. To maximise efficiency, cover crops should focus on maintaining low mineral nitrogen levels rather than solely producing high biomass.

Cover crops are also used for weed control, particularly in reduced tillage systems. Dense plant stands suppress weed growth and can reduce weed pressure by up to 90%. Species such as oil radish and phacelia have shown good results, and combining cover crops with mechanical weed control can further enhance the management of perennial weeds.

To optimise the climate benefits of cover crops, a balance is needed between carbon sequestration, nitrogen efficiency, and nitrous oxide emissions. Although cover crops contribute to carbon storage, they can also increase greenhouse gas emissions, meaning their overall climate impact depends on the cultivation system and management strategies.

Cover crops are becoming increasingly important in future farming systems to reduce nutrient leaching, prevent soil erosion, and maintain soil fertility, especially with warmer autumns and winters. The extended growing season enhances the potential for cultivating cover crops, even further north. More

research and knowledge exchange are needed regarding establishment methods, species selection, and the impact of cover crops on the climate and cropping systems. A deeper understanding of nitrous oxide emissions is required to optimise cover crop management in a changing climate.

ADDITIONAL INFORMATION

Much information is available for cover crops, but a more comprehensive knowledge base on variety selection and mixtures suitable for different crop rotations needs to be compiled. There is a lot of scattered knowledge among farmers that needs to be collected. Experience of which varieties work best is often very local and can differ from where you grow in Sweden.

PRACTICE ABSTRACT # 66**SHORT TITLE IN ENGLISH**

Carbon Audits and Adaptation and Mitigation Plans (AMPs) to Support Farms in Improving their Environmental Performance

COUNTRY AND CLIMATIC ZONE

All

CONTACT

Elena Bortolazzo (e.bortolazzo@crpa.it)

3 BENEFITS OF THE PRACTICE

- AMPs support efficient resource use (economic, human, time)
- AMPs define clear and feasible environmental objectives
- AMPs help identify and mitigate risks and obstacles

PRODUCTION SYSTEM

All

THEMATIC AREA

All

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The improvement of farms' environmental sustainability is both a priority and a challenge for farmers. They must develop ways to become more productive and sustainable while adapting to climate change and contributing to its mitigation. To succeed in this objective, it is relevant to

develop a “Plan”. A plan is a set of actions designed to achieve something, an idea or method of doing something.

Planning applies to various areas, including farms. Writing a plan provides a clear vision of the goals, actions, resources (economic, human), and time needed to reach those objectives. Planning also helps identify weaknesses and obstacles that might occur during implementation and find possible solutions in advance to increase the chances of success. The adaptation and mitigation plan (AMP) is a tool that helps farmers minimise the impacts of climate change on farms while reducing greenhouse gas (GHG) emissions. There are no strict rules regarding the format of an AMP, but to be effective, it should include: a description of the current situation, the objectives, necessary actions, and the timeline. A carbon audit measures the farm's efficiency in terms of emissions and removals (carbon stored through sequestration). It requires an analysis of the entire production system and provides a baseline for emissions and sequestration. While the AMP can be created without the audit, the audit offers in-depth insights for better management of production inputs like energy, water, fertilisers, feed, and labour.

Carrying out the audit enables farmers and advisors to assess the actual success of the plan by comparing net emissions before and after implementation. During implementation, monitoring ensures that adaptation and mitigation measures (AMMs) are carried out as planned.

It helps farmers identify challenges, make adjustments, and improve strategies to meet AMP objectives. In Climate Farm Demo, a common AMP template was developed for use on 1,500 farms across Europe.

LONGER DESCRIPTION - IN ENGLISH

The improvement of farms' environmental sustainability is both a priority and a great challenge for farmers. They must therefore develop ways of becoming more productive and sustainable while adapting to climate change and contributing to its mitigation. To success in this objective, it is relevant to develop a “**Plan**”. A plan is a set of things to do in order to achieve something, it is an idea of how to do something or a method of doing something.

Planning applies to various areas, including farms. Writing a plan provides a clear vision of the goals, actions, resources (economic, human) and time needed to reach such objectives. Planning is also useful to identify weaknesses and obstacles that might occur during its implementation and to find possible solutions in advance to increase the chances of success.

The **adaptation and mitigation plan** (AMP) is an instrument that helps farmers to minimise the impacts of climate change on farms while reducing greenhouse gas emissions. There are no rules regarding the format of an AMP, but to be effective, it must contain certain information: the description of the actual situation of the farm, the objectives of the plan, the actions necessary to reach the goal and the time needed for them.

In **Climate Farm Demo**, 1,500 farms across Europe are implementing AMPs to reduce the environmental impact. Climate Farm Advisors (CFAs) are supporting the Pilot-Demo farms in implementing AMPs, assessing & monitoring their environmental performance thanks to harmonised methodologies & tools. Among these tools a common AMP template was created in order to be able to compare strategies and results.

To create a feasible plan, objectives must be defined clearly and carefully. They must be specific, measurable, feasible and relevant for the farmer and the farm. To identify the objectives, a key factor is understanding the context in which the strategies of climate smart agriculture will be applied, how it may change, and providing insights into possible threats.

The **carbon audit** can be a good instrument to understand the context of the plan. It measures the farm's efficiency in terms of carbon emissions (greenhouse gases - GHG) and removals (carbon stored in the soil through sequestration). The carbon audit requires an analysis of the farm's entire production system and, as a result, provides a baseline for GHG emissions and carbon sequestration. Although the AMP can be produced without the audit, the audit provides in-depth information that allows a better management of costly production factors such as energy, water, fertilisers, feeds, etc., as well as human resources.

Furthermore, carrying out the audit enables farmers to assess the real success of the AMPs by comparing the net emissions at the beginning and at the end of the implementation period.

To perform the carbon audit in Climate Farm Demo (CFD) the Climate Farm Advisors (CFA) together with the farmers are using an available farm carbon calculator tool, approved by the project to fulfil the needs for reliable and comprehensive audit performance.

During implementation, the monitoring process ensures that Adaptation and Mitigation Measures (AMMs) are carried out as planned. This process allows CFAs and farmers to identify any deviations or challenges that should be addressed, to make any necessary adjustments, to improve

implementation strategies and to ensure that plans (AMPs) objectives are being met.

ADDITIONAL INFORMATION

- Preparing an Adaptation and mitigation plan (AMP) is important to increase the probability of achieving farm's environmental goals.
- The carbon audit provides in-depth information that allows better management of costly production factors such as energy, water, fertilisers, feeds, etc., as well as human resources.
- It is possible to produce an AMP plan without carrying out the carbon audit. It is necessary to make a context analysis using all the farm's available information to better define goals and measures.
- Monitoring the implementation of the plan ensures that adaptation and mitigation measures (AMMs) are carried out as planned, allowing advisors and farmers to identify any deviations or challenges that should be addressed, to make any necessary adjustments.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Manual for application of AMPs on farms: from audits to AMP implementation

URL:

https://climatefarmdemo.eu/wp-content/uploads/2025/02/D.2.2_AMP-manual_PRO-AGRIA_30.09.2024.pdf

Title/Description

1500 Adaptation and Mitigation Plans - AMPs

URL:

https://climatefarmdemo.eu/wp-content/uploads/2025/02/D2.1_1500-Adaptation-and-Mitigation-plans_CRPA_24.10.24.pdf

PRACTICE ABSTRACT #67**SHORT TITLE IN NATIVE LANGUAGE**

Effet du stress hydrique sur la production de luzerne

SHORT TITLE IN ENGLISH

Effect of Water Stress on Alfalfa Yield

COUNTRY AND CLIMATIC ZONE

France, temperate

CONTACT

Sophie Gendre (s.gendre@arvalis.fr)

3 BENEFITS OF THE PRACTICE

1. Maintaining forage production
2. Anticipating possible yield loss
3. Adapting hydric stress due to climate change

PRODUCTION SYSTEM

Polyculture livestock farming

THEMATIC AREA

Water management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

En raison de l'évolution récente du climat et des épisodes de fortes températures liées à du manque de pluie, la pratique d'irrigation des

fourrages s'est peu à peu démocratisée en France. En 2010, les prairies et fourrages représentaient 4% de la sole irriguée française et 6% en 2020. Afin de pouvoir accompagner au mieux les agriculteurs et quantifier la plus-value de l'irrigation sur les fourrages, Arvalis a mis en place des essais de réponse à l'eau sur plusieurs cultures fourragères, dont la luzerne. Trois essais ont été mis en place (La Jaillière – département 44, Le Magneraud – département 17, Pusignan – département 69) sur 3 ans (2022-2023-2024) avec 3 niveaux d'irrigation ainsi qu'une conduite en sec. Une partie de l'essai a été irriguée pour couvrir les besoins théoriques de la culture, une autre partie a été volontairement stressée en couvrant seulement la moitié des besoins d'irrigation théorique. La troisième conduite a consisté à mettre plus d'eau que le besoin théorique d'irrigation afin de bien encadrer le besoin de la culture. Les efficacités de l'eau d'irrigation qui ont été mesurées dans ces essais sont très disparates et varient entre 17 kg de matière sèche/ha/mm et 30 kg de matière sèche/ha/mm avec une médiane autour de 20-22 kg MS/ha/mm. Cela signifie que pour une irrigation de 30 mm, l'agriculteur peut espérer un gain de fourrage de l'ordre de 650 kg/ha. Ces références peuvent permettre à l'agriculteur de mieux raisonner sa répartition de l'eau sur sa sole irrigable et voir si c'est intéressant pour lui de prioriser son irrigation sur la luzerne afin de nourrir ses animaux.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Due to recent climate change and episodes of high temperatures linked to a lack of rain, the practice of fodder irrigation has gradually become more widespread in France. In 2010, meadows and fodder represented 4% of the irrigated area in France and 6% in 2020. To best support farmers and quantify the added value of irrigation on fodder, Arvalis has set up water response trials on several fodder crops, including alfalfa. Three trials were set up (La Jaillière – department 44, Le Magneraud – department 17, Pusignan – department 69) over 3 years (2022-2023-2024) with 3 irrigation levels as well as dry management.

Part of the trial was irrigated to cover the theoretical needs of the crop; another part was deliberately stressed by covering only half of the theoretical irrigation needs. The third approach consisted of putting in more water than the theoretical irrigation need to properly manage the crop's needs.

The irrigation water use efficiency measured in these trials vary between 17 kg of dry matter/ha/mm and 30 kg of dry matter/ha/mm with a median around 20-22 kg DM/ha/mm. This means that for 30 mm irrigation, the

farmer can expect a forage gain of around 650 kg/ha. These references can allow the farmer to better reason his water distribution on his irrigable land and see if it is interesting for him to prioritize his irrigation on alfalfa to feed his animals.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Besoin en eau des fourragères et réponse à l'irrigation

URL:

https://www.researchgate.net/publication/382888539_Besoin_en_eau_des_fourrageres_et_reponse_a_l'irrigation

PRACTICE ABSTRACT #74**SHORT TITLE IN NATIVE LANGUAGE**

Setev strniščnih dosevkov

SHORT TITLE IN ENGLISH

Sowing Stubble Crops

COUNTRY AND CLIMATIC ZONE

Slovenia, Marine west coast, warm summer

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Improve soil fertility,
2. Improve crop rotation,
3. Avoid soil structure deterioration due to heat and summer storms in the summer.

PRODUCTION SYSTEM

Conventional/organic

THEMATIC AREA

Soil management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Strniščne dosevke sejemo po pravilu žit, zgodnjega krompirja in vmesnih posevkov. Setev strniščnih dosevkov ima v njivskem kolobarju več prednosti:

izboljšamo kolobar, v poletnem času se izognemo propadanju strukture tal zaradi vročine in poletnih neviht, pridelamo dodatno krmo za živino in preprečujemo razmnoževanje bolezni in škodljivcev. S setvijo dosevkov zmanjšamo zapleveljenost, izboljšamo zračnost tal ter bilanco humusa, zmanjšamo negativne vplive dežja, sonca in vetra na strukturo tal, preprečujemo izpiranje hranil (dušika) v podtalnico, izboljšamo krmno bilanco na kmetiji, čebelam zagotavljamo bogato pašo v jesenskem času, z biofumigacijo negativno vplivamo na nekatere talne škodljivce. Z mešanicami večih dosevkov pripomoremo k večji biodiverziteti. Strniščni dosevki so pomembni, ker polepšajo tudi izgled krajine. Setev strniščnih posevkov lahko opravimo brez oranja, samo s plitvo površinsko obdelavo tal. Strniščne dosevke sejemo za prehrano ljudi, za krmo živali in za zeleni podor. Pomen setve strniščnih dosevkov je še večji na površinah na katerih ne zaoravamo hlevskega gnoja.

Za človeško prehrano sejemo ajdo, proso, strniščno repo ali rdečo peso, za prehrano živali najpogosteje sejemo mnogocvetno ljulko, inkarnatko, grašljinko, črno deteljo, krmno ogrščico, lucerno in deteljno travno mešanico, za zeleni podor pa oljno redkev, belo gorjušico, sončnice, facelijo in mešanice rastlin. Strniščni posevki so lahko prezimni ali neprezimni.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Stubble crops are sown after the harvest of cereals, early potatoes, and catch crops. Sowing stubble crops in the crop rotation has several advantages: it improves the rotation, prevents the deterioration of soil structure in the summer due to heat and summer storms, produces additional fodder for livestock, and prevents the spread of diseases and pests.

By sowing stubble crops, we reduce weed infestation, improve soil aeration and the humus balance, lessen the negative effects of rain, sun, and wind on soil structure, prevent the leaching of nutrients (especially nitrogen) into groundwater, improve the farm's feed balance, provide bees with rich pasture in the autumn, and benefit from biofumigation, which has a suppressive effect on certain soil pests. Mixtures of several stubble crops also contribute to greater biodiversity.

Stubble crops are important because they enhance the visual appearance of the landscape. They can be sown without ploughing, using only shallow surface tillage. Stubble crops are grown for human consumption, animal feed, and green cover. Their importance is even greater in areas where manure is not ploughed in.

For human consumption, buckwheat, millet, stubble turnip, or beetroot are sown. For animal feed, the most sown crops include multi-flowered ryegrass, red clover, vetch, black clover, fodder rape, alfalfa, and clover-grass mixtures. For green cover, oil radish, white mustard, sunflowers, phacelia, and plant mixtures are used.

Stubble crops can be either winter or non-winter varieties.

LONGER DESCRIPTION - IN NATIVE LANGUAGE

Setev strniščnih dosevkov je naravi prijazen in učinkovit način izboljšanja rodovitnosti tal. Omogoča nam celoletno pokritost tal ter je s strokovnega stališča zelo priporočljiv ukrep. Glede na letošnje vremenske razmere, ko še imamo dovolj vlage v zemlji lahko priporočamo čimprejšnjo setev dosevkov.

Za človeško prehrano sejemo ajdo, proso, strniščno repo ali rdečo peso, za prehrano živali najpogosteje sejemo mnogocvetno ljulko, inkarnatko, grašljinko, črno deteljo, krmno ogrščico, lucerno in deteljno travno mešanico, za zeleni podor pa oljno redkev, belo gorjušico, sončnice, facelijo in mešanice rastlin. Strniščni posevki so lahko prezimni ali neprezimni. *(Check Table 1 and Table 2)*

Po pravilu žit tla čim prej pripravimo za setev. Če slamo uporabljamo za živino, jo čim prej zbaliramo in odpeljemo z njive. Na strnišče lahko v nočnem času ali neposredno pred padavinami navozimo gnojevko (do 25a m³) in jo takoj zadelamo v tla, da preprečimo izgube amonijske oblike dušika. V primeru, da slame ne odvažamo jo čim prej plitvo zadelamo v tla. Da bi se slama normalno razkrajala potrebuje dovolj dušika, ki ga lahko dodamo z gnojevko ali manjšimi odmerki mineralnega gnojila z dušikom (do 40 kg N/ha), saj je za razkroj slame potrebno zmanjšati razmerje med ogljikom in dušikom (C:N razmerje). To razmerje je v slami, zaradi velikega deleža celuloze preširoko za normalen razkroj slame.

Po žetvi se priporoča plitvejša obdelava tal (15-18 cm) in setvena priprava do drobno grudičaste strukture. Če nam tehnologija dopušča lahko izvedemo tudi direktno setev. V literaturi pogosto najdemo priporočila, da pred setvijo dodamo do 60 kg fosforja ter do 100 kg kalija, ampak velja priporočilo, da gnojimo glede na rezultate analize tal. Dodajanju dušikovih gnojil se poskušamo izogniti, kajti dosevki so ga sposobni črpati iz globljih plasti tal ter tako preprečiti njegovo izpiranje. To posebej velja za strniščno setev posevkov ajde in prosa, ki lahko zaradi gnojenja z dušikom poležejo. V praksi nam pogosto tako sploh ni potrebno dodajati hranil za normalno rast dosevkov.

LONGER DESCRIPTION – IN ENGLISH

Sowing stubble crops is an environmentally friendly and effective way to improve soil fertility. It provides year-round soil coverage and is a highly recommended measure from a professional point of view. Given this year's (2025) weather conditions, when there is still enough moisture in the soil, we can recommend sowing the stubble as soon as possible.

For human consumption, we sow buckwheat, millet, stubble turnip or beetroot, for animal consumption we most often sow multi-flowered ryegrass, red clover, vetch, black clover, fodder rape, alfalfa and clover grass mixture, and for green fodder we sow oil radish, white mustard, sunflowers, phacelia and plant mixtures. Stubble crops can be winter or non-winter crops. (See Table 1 and Table 2)

ADDITIONAL INFORMATION

Results of the stubble yield experiment (See more information in Table 3):

- Fertilization: 30m³ of cattle manure per ha
- Cultivation: - hoeing to a depth of 15 cm 8.8.2020
 - harrow 9.8.2020
- Sowing: 10. 8. 2020
- Harvest of the experiment and weighing: 3. 11. 2020
- Mulched: 12.11.2020
- Ploughed: 15.11.2020

Sowing is mostly done with grain seeders or mineral fertilizer spreaders, but it can also be done manually. After sowing, we can also roll the seeds to ensure more even and faster emergence. If your main crop (e.g. pumpkins) has failed and was sprayed with soil herbicides, we advise you to call us for detailed instructions on how to sow follow-up crops in such a case.

PHOTOS



Photo 1: Experiment with 6 different winter-hardy crops



Photo 2: Presentation of the effect of non-winter crops on the soil. Demonstration in pedological pits of how far the roots reach

Photo credits: Timotej Horvat, MA in Agriculture. Agriculture specialist at CAFS-Institute Maribor

Crop	Sowing time	Sowing rate (ha)	Special features
<i>Lolium multiflorum</i> Lam.	August to mid-September	40-50 kg	Uses a lot of water
<i>Trifolium incarnatum</i>	July-August	25-30 kg	In autumn, powdery mildew
Grašljinka	July-August	60 kg	Gives a lot of mass
Black clover	July-August	30-35 kg	Produces the highest yields in medium and heavy soils
Lantern	August	30-35 kg	Suitable for lighter soil types, does not tolerate acidic soil
Fodder kale	June-July	4-5 kg	Tolerates low temperatures, for green fodder in late autumn, biofumigation possible
<i>Lolium perenne</i>	August to mid-September	30-40 kg	Perennial, difficult to grow
<i>Dactylis glomerata</i>	August to mid-September	20-22 kg	Suitable for light soils, requires timely mowing
<i>Brassica napus</i> L.	July-September	10-15 kg	Suitable for early spring feed, biofumigation possible
White clover	July-August	5-8 kg	Tolerates trampling well, in a mixture with grasses, displaces grasses, suitable for wet areas

Table 1: Winter stubble crops intended for animal feed

Crop	Sowing time	Sowing rate (kg/ha)	Special features
Buckwheat	From mid-May to mid-July	70-80 kg	Quickly covers the soil, rids fields of annual weeds
Millet	From mid-May to mid-July	30-40 kg	For extremely dry and warm growing areas
<i>Brassica rapa</i>	July	3-5 kg	Attention needed due to fleas
Sudan grass	June-July	20-30 kg	For extremely dry and warm growing areas
Persian clover	July	18-20 kg	In a mixture with multi-flowered ryegrass
Alexandrian clover	May-mid-August	25-30 kg	In a mixture with multi-flowered ryegrass
Phacelia	June-mid-August	10-15 kg	Fast growth, for bee grazing, biofumigation possible
Oil radish	July-mid-August	25-30 kg	Fast growth, for bee grazing, biofumigation possible
<i>Sinapis alba</i>	July-mid-August	20-25 kg	Fast growth, for bee grazing, biofumigation possible
<i>Raphanus sativus L. var. longipinnatus</i>	July-mid-August	8 kg	Fast growth, deeply loosens the soil, plants freeze in cold weather

Table 2: Non-winter stubble crops intended for human consumption, animal consumption and fallow

YIELD	SOWING RATE PER HA	YIELD PER HA IN KG	MOISTURE %	DRY MATTER in kg
<i>Trifolium incarnatum</i> "INKARA"	25-30 KG	6625	86,22	912,9
<i>Trifolium hybridum</i> L. "AKENATON"	25-30 KG	21895,8	88,83	2445,8
<i>Sinapis alba</i> "SEVERKA"	20-25 KG	12416,7	80,71	2395,2
OIL RADISH "ROMESA"	25-30 KG	20208,3	88,75	2273,4
<i>Raphanus sativus</i> L. var. <i>longipinnatus</i> - roots and leaves together:	8 KG	73250		6289,3
ROOTS		49250	92,6	3644,5
LEAVES		24000	88,98	2644,8
<i>Brassica napus</i> L. "DANIELA"	10-15 KG	13666,7	84,94	2058,2
PHACELIUS	10-15 KG	16020,8	88,95	1770,3
<i>Lolium multiflorum</i> Lam. "MELQUATRO"	40-50 KG	9770,8	83,25	1636,6
FIELD 1	35-40 KG	9791,7	83,64	1601,9
GRAŠLJINKA	60 KG	13487,5	88,27	1582,1
Buckwheat "DARJA"	70-80 KG	5708,3	62,75	2126,4

Table 3: Results of the stubble yield experiment

PRACTICE ABSTRACT #75**SHORT TITLE IN NATIVE LANGUAGE**

Globinsko podrahlavanje tal (subsoiling)

SHORT TITLE IN ENGLISH

Subsoiling

COUNTRY AND CLIMATIC ZONE

Slovenia, Marine west coast, warm summer

CONTACT

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(timotej.horvat@kmetijski-zavod.si)

3 BENEFITS OF THE PRACTICE

1. Deep soil loosening,
2. Soil drainage,
3. Soil aeration and thus stimulating soil microbiological activity.

PRODUCTION SYSTEM (IF RELEVANT)

Conventional/organic

THEMATIC AREA

Soil management

**SUMMARY FOR PRACTITIONERS ON THE MAIN
FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE**

Glavni namen globinskega podrahljavanja je prebiti plazino, ki se ustvari z dolgoletno obdelavo tal na isti globini. Plazina je strnjena, neprebojna plast zemlje, ki ustavlja kroženje zraka, predvsem pa odvajanje vode v globino. Pozitivni učinki takšne obdelave tal so globinsko podrahljanje tal, drenažiranje tal, prezračevanje tal ter s tem spodbujanje mikrobiološke aktivnosti tal. Ko tla prerahljamo dosežemo to, da so tla manj zbita in omogočimo lažjo rast korenin v globlji plasti zemlje. Znano je, da korenine če ne morejo prebiti plazine, preusmerijo rast vodoravno in rastejo tako naprej. V kolikor imamo sušno obdobje je to zelo slabo, saj ne dosežejo globljih plasti zemlje, ki še zadržujejo določeno količino vode, zato hitreje utrpijo sušni stres. V obdobjih, ko imamo veliko padavin, prihaja zaradi plazine tudi do zastajanja vode na površini zemlje. S globinskim podrahljavanjem lahko to zastajanje omilimo, saj prerahljamo tla v globino, prebijemo plazino, zato voda hitreje odteče. Prav tako imajo določene izvedbe globinskih podrahljačev nameščene za glavo nogače drenažni kegelj, ki naredi v globini naravno cev, ki služi odtekanju vode iz površine v najbližje jarko za odvodnjavanje. Ta ukrep je veliko bolj učinkovit, če začnemo s samo obdelavo ob jarku za odvajanje vode in nato obdelujemo v notranjost površine. S tem usmerimo tok vode v jarek. Ko tla globinsko podrahljamo, spravimo zrak v globino tal. Zrak omogoča hitrejšo razmnoževanje in delovanje mikroorganizmov v zemlji. Kadar imamo dobro delovanje mikroorganizmov imamo tudi več hranil, ki so na voljo rastlinam.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The main purpose of deep tillage is to break through the silt, which is created by many years of tillage at the same depth. Silt is a compacted, impenetrable layer of soil that stops air circulation and, above all, water draining into the depths. The positive effects of such deep tillage are soil drainage, soil aeration, and thus stimulating soil microbiological activity. When we loosen the soil, we achieve that the soil is less compacted and enable easier root growth into deeper layers of the soil. It is known that if the roots cannot break through the silt, they redirect their growth horizontally and continue to grow. If we have a dry period, this is very bad, because they do not reach the deeper layers of the soil, which still retain a certain amount of water, and therefore suffer drought stress more quickly. In periods of high rainfall, silt also causes water to stagnate on the surface of the soil. With deep tillage, we can alleviate this stagnation, because we loosen the soil deeply, break through the silt, and therefore the water drains faster. Also, certain versions of deep tillers have a drainage cone installed behind the head of the tiller, which creates a natural tube in the depth, which serves to

drain water from the surface into the nearest drainage ditches. This measure is much more effective if we start with the processing itself next to the water drainage ditch and then process inland. This directs the flow of water into the ditch. When we deeply loosen the soil, we bring air into the depth of the soil. Air allows faster reproduction and activity of microorganisms in the soil. When we have good activity of microorganisms, we also have more nutrients available to plants.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

V poljedelstvu poznamo več načinov obdelave tal. Od konvencionalne obdelave z plugom, preko minimalne obdelave z orodji, ki tla samo plitvo obdelajo, vse do direktne setve oziroma no-till obdelave. Vsem tem obdelavam je skupno to, da ne obdelujejo globlje kot 25 – 30 cm v samo globino tal. Kadar obdelujemo globlje imenujemo to globinsko podrahljavanje tal. Pri tem mehanskem opravilu posegamo v tla tudi do 120 cm globine.

Glavni namen tega ukrepa je prebiti plazino, ki se ustvari z dolgoletno obdelavo tal na isti globini. Plazina je strnjena, neprebojna plast zemlje, ki ustavlja kroženje zraka, predvsem pa odvajanje vode v globino. Pozitivni učinki takšne obdelave tal so globinsko podrahljanje tal, drenažiranje tal, prezračevanje tal ter s tem spodbujanje mikrobiološke aktivnosti tal. Ko tla prerahljamo dosežemo to, da so tla manj zbita in omogočimo lažjo rast korenin v globlji plasti zemlje. Znano je, da korenine če ne morejo prebiti plazine, preusmerijo rast vodoravno in rastejo tako naprej. V kolikor imamo sušno obdobje je to zelo slabo, saj ne dosežejo globljih plasti zemlje, ki še zadržujejo določeno količino vode, zato hitreje utrpijo sušni stres. V obdobjih, ko imamo veliko padavin, prihaja zaradi plazine tudi do zastajanja vode na površini zemlje. S globinskim podrahljavanjem lahko to zastajanje omilimo, saj prerahljamo tla v globino, prebijemo plazino, zato voda hitreje odteče. Prav tako imajo določene izvedbe globinskih podrahljačev nameščene za glavo nogače drenažni kegelj, ki naredi v globini naravno cev, ki služi odtekanju vode iz površine v najbližje jarke za odvodnjavanje. Ta ukrep je veliko bolj učinkovit, če začnemo s samo obdelavo ob jarku za odvajanje vode in nato obdelujemo v notranjost površine. S tem usmerimo tok vode v jarek. Ko tla globinsko podrahljamo, spravimo zrak v globino tal. Zrak omogoča hitrejše razmnoževanje in delovanje mikroorganizmov v zemlji. Kadar imamo dobro delovanje mikroorganizmov imamo tudi več hranil, ki so na voljo rastlinam.

Globinskega podrahljavanja se kmetje v največji meri poslužujejo v poletnih mesecih. Po spravilu žit in oljne ogrščiце ter pred setvijo dosevkov je za to

opravilo najprimernejši čas. Prav tako je zemlja v tem času dovolj suha da se ta ukrep sploh izvede. V kolikor bomo imeli prisotno kulturo čez celotno poletje in imamo težave z zastajanjem vode, lahko globinsko podrahljavanje opravimo tudi pred setvijo te kulture. Seveda morajo biti tla primerno suha in pohodna.

Globinskega podrahljavanja ni potrebno izvajati vsako leto. Najprimerneje je z tem ukrepom kolobariti. S tem mislimo, da ga izvajamo takrat, ko imamo na površini žito ali oljno ogrščico in je njiva prazna v poletnih mesecih. V takem primeru pride obdelava na isto površino vsako drugo oziroma vsako tretje leto odvisno od kolobarja.

Na Poljedelskem dnevu, ki je potekal 2. avgusta 2024 v Bohovi, so bili predstavljeni različni globinski podrahljači. Demonstrirani so bili podrahljači, ki so primerni za manjše traktorje (70-100 KM) in tisti, ki zahtevajo veliko večjo vlečno moč (250+ KM). Razlike so bile tudi v obliki nogače in njihovem vplivu na zemljo. Po predstavitvi vsakega podrahljača smo skopali luknjo, da smo lahko od blizu opazovali učinke na zemljo v globini. Namen dogodka je bil kmetom in širši javnosti prikazati uporabnost podrahljačev ter pomagati pri odločitvah glede njihovega nakupa in uporabe.

LONGER DESCRIPTION – IN ENGLISH

In agriculture, we know several methods of soil cultivation: from conventional cultivation with a plow, through minimal cultivation with tools that only work the soil shallowly, to direct sowing or no-till cultivation. All these treatments have in common that they do not work deeper than 25 - 30 cm into the very depth of the soil. When we work deeper, we call this subsoiling (deep soil loosening). In this mechanical work, we intervene in the soil up to a depth of 120 cm.

The main purpose of this measure is to break through the silt, which is created by many years of soil cultivation at the same depth. Silt is a compacted, impenetrable layer of soil that stops air circulation, and above all, the drainage of water into the depth. The positive effects of such soil cultivation are deep soil loosening, soil drainage, soil aeration and thus stimulating soil microbiological activity. When we loosen the soil, we achieve that the soil is less compacted and enable easier root growth in the deeper layers of the soil. It is known that if the roots cannot break through the soil, they redirect their growth horizontally and continue to grow. If we have a dry period, this is very bad, because they do not reach the deeper layers of the soil, which still retain a certain amount of water, and therefore suffer drought stress more quickly. In periods when we have a lot of precipitation,

soil also causes water to stagnate on the surface of the soil. With deep loosening, we can alleviate this stagnation, because we loosen the soil deeply, break through the soil, so the water drains faster. Also, certain versions of deep looseners have a drainage cone installed behind the head of the legs, which creates a natural pipe in the depth, which serves to drain water from the surface into the nearest drainage ditches. This measure is much more effective if we start with the processing only next to the water drainage ditch and then process into the interior of the surface. This directs the flow of water into the ditch. When we deeply loosen the soil, we get air into the depth of the soil. Air allows for faster reproduction and activity of microorganisms in the soil. When microorganisms are functioning well, we also have more nutrients available to plants.

Farmers use deep loosening to the greatest extent in the summer months. After harvesting cereals and oilseed rape and before sowing follow-up crops is the most suitable time for this task. The soil is also dry enough at this time to carry out this measure. If we have a crop present throughout the summer and have problems with water retention, deep loosening can also be carried out before sowing this crop. Of course, the soil must be suitably dry and walkable.

At the Agricultural Day, which took place on August 2, 2024 in Bohova, various subsoilers were presented. Subsoilers suitable for smaller tractors (70-100 HP) and those requiring much greater pulling power (250+ HP) were demonstrated. The differences were also in the shape of the tines and their effect on the soil. After the presentation of each subsoiler, we dug a hole so that we could closely observe the effects on the soil at depth. The purpose of the event was to show farmers and the general public the usefulness of subsoilers and to help them make decisions regarding their purchase and use.

ADDITIONAL INFORMATION

Subsoiling does not have to be done every year. It is best to use this measure in crop rotation. By this we mean that it is done when there is grain or oilseed rape on the surface and the field is empty during the summer months. In such a case, the same area is cultivated every second or third year, depending on the crop rotation.

Why Perform Deep Subsoiling?

- Prevention of Soil Compaction (Hardpan Layers)

Due to machine traffic or repeated shallow tillage, an impermeable layer can form in the soil, restricting root growth.

- Improvement of Aeration and Water Permeability

Deep loosening allows better absorption of rainfall and reduces water stagnation on the surface.

- Promotion of Root Growth

Plants can penetrate deeper into the soil, giving them access to more nutrients and water, especially during dry periods.

- Increase in Soil Biological Activity

A better soil structure promotes the activity of microorganisms and earthworms, contributing to natural soil fertility.

PHOTOS



Photo 1: Pedological hole dug after the passage of the subsoiler.



Photo 2: Showing the effects of a subsoiler in the soil itself.



Photo 3: 5 different subsoilers and a demonstration of their effect on the soil



Photo 4: The effect of a deep tiller at a depth of 80 cm creates a drainage channel at the depth to drain excess water

Photo credits: Timotej Horvat, MA in Agriculture. Agriculture specialist at CAFS-Institute Maribor

PRACTICE ABSTRACT #76**SHORT TITLE IN NATIVE LANGUAGE**

Digitalizzazione e zootecnia di precisione: quali benefici per la riduzione dell'impatto ambientale negli allevamenti di bovini da latte.

SHORT TITLE IN ENGLISH

Digitalization and Precision Livestock Farming: What are the Benefits for Reducing the Environmental Impact in Dairy Farms

COUNTRY AND CLIMATIC ZONE

Italy and Mediterranean area

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Animal welfare
2. Farm production efficiency
3. Environmental sustainability

PRODUCTION SYSTEM (IF RELEVANT)

Livestock farming

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

La zootecnia di precisione (Precision Livestock Farming, PLF), rappresenta la nuova opportunità per gli allevamenti da latte per affrontare le sfide dei mercati attraverso un miglioramento dell'efficienza di produzione aziendale, valorizzando sia il benessere animale, grazie alla possibilità di monitorare e gestire il soggetto e non solo il gruppo, sia la sostenibilità delle produzioni. La PLF è l'utilizzo di tecnologie per misurare indicatori fisiologici, comportamentali, produttivi e riproduttivi sui singoli animali, con l'obiettivo di migliorare le strategie gestionali e le performance dei soggetti allevati. L'applicazione di queste tecnologie permette il rilievo e la gestione di un grande numero di informazioni, che, se gestito in maniera ottimale, può risultare di grande aiuto per gestire e controllare la mandria in maniera efficace e remunerativa. Con la PLF si possono monitorare diversi parametri con cui si valuta lo stato di salute, il benessere animale, le performance produttive e riproduttive dell'allevamento, che sono strettamente correlati all'impatto ambientale. E' stato dimostrato che la riduzione delle mastiti derivante dal riconoscimento tempestivo della patologia può comportare una diminuzione del 2,5% del potenziale di riscaldamento globale oltre che ad una riduzione nell'utilizzo degli antibiotici. Una buona gestione dello stato riproduttivo degli animali può contribuire alla riduzione dell'impatto ambientale. Infatti, mantenendo la fertilità al massimo livello, si ritiene possibile ridurre l'emissione di gas serra aziendale per più del 20%. La PLF, se ben utilizzata, consente all'allevatore di prendere con più tempestività alcune decisioni, migliorando in questo modo la produttività e la redditività del proprio allevamento. Per sfruttare al massimo le informazioni ottenute con queste tecnologie ed interpretarle in maniera corretta, è fondamentale che queste siano integrate con sistemi informativi computerizzati in grado di gestire ed elaborare l'enorme "mole" di dati prodotti e che ci sia in stalla del personale qualificato che li sappia interpretare.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Precision Livestock Farming (PLF) represents a new opportunity for dairy farms to address market challenges by improving the efficiency of company production, enhancing both animal welfare, thanks to the ability to monitor and manage the individual and not just the group, and the sustainability of production. PLF is the use of technologies to measure physiological, behavioral, productive and reproductive indicators on individual animals, with the aim of improving management strategies and the performance of the subjects raised. The application of these

technologies allows the collection and management of a large amount of information, which, if managed optimally, can be of great help in managing and controlling the herd in an effective and profitable way.

With PLF, various parameters can be monitored to evaluate the state of health, animal welfare, productive and reproductive performance of the farm, which are closely related to the environmental impact. It has been shown that the reduction of mastitis resulting from the timely recognition of the pathology can lead to a 2.5% decrease in global warming potential as well as a reduction in the use of antibiotics. (See *Tullo et. Al, 2019*) Good management of the reproductive status of animals can contribute to reducing environmental impact. In fact, by maintaining fertility at the highest level, it is believed possible to reduce the farm's GHG emissions by more than 20%. (See *Tullo et. Al, 2019*) The PLF, if used well, allows the breeder to make some decisions more promptly, thus improving the productivity and profitability of his farm. To make the most of the information obtained with these technologies and interpret them correctly, it is essential that they are integrated with computerized information systems capable of managing and processing the enormous "amount" of data produced and that there are qualified personnel in the stable who knows how to interpret them.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

La zootecnia di precisione (Precision Livestock Farming, PLF), rappresenta la nuova opportunità per gli allevamenti da latte per affrontare le sfide dei mercati attraverso un miglioramento dell'efficienza di produzione aziendale, valorizzando sia il benessere animale, grazie alla possibilità di monitorare e gestire il soggetto e non solo il gruppo, sia la sostenibilità delle produzioni. Con il termine di PLF si intende l'applicazione dei principi e delle tecniche di ingegneria all'allevamento del bestiame, così da monitorare, modellare e gestire la produzione animale in modo automatico. Con l'utilizzo di queste tecnologie si possono misurare indicatori fisiologici, comportamentali, produttivi e riproduttivi sui singoli animali, con l'obiettivo di migliorare le strategie gestionali e le performance dei soggetti allevati per rendere l'azienda zootecnica più sostenibile da un punto di vista economico, ambientale e sociale. L'applicazione di queste tecnologie permette il rilievo e la gestione di un grande numero di informazioni, che, se gestito in maniera ottimale, può risultare di grande aiuto per controllare la mandria in maniera efficace e remunerativa. Con la PLF si possono identificare e localizzare gli animali attraverso l'utilizzo di

GPS e analizzatori di immagini, utili per il monitoraggio del comportamento degli animali e per le valutazioni automatiche del peso corporeo, del Body Condition Score e delle lesioni podali; monitorare diversi parametri in tempo reale con cui si valuta lo stato di salute, il benessere animale, le performance produttive e riproduttive dell'allevamento che sono strettamente correlati all'impatto ambientale, le caratteristiche del latte utilizzando attivometri, collari o misuratori della temperatura corporea, il robot di mungitura o dispositivi basati sulla spettroscopia nel vicino infrarosso (NIRS). E' stato dimostrato che la riduzione delle mastiti derivante dal riconoscimento tempestivo della patologia può comportare una diminuzione del 2,5% del potenziale di riscaldamento globale oltre che ad una riduzione nell'utilizzo degli antibiotici. Una buona gestione dello stato riproduttivo degli animali può contribuire alla riduzione dell'impatto ambientale. Infatti, mantenendo la fertilità al massimo livello, si ritiene possibile ridurre l'emissione di gas serra aziendale per più del 20%. Anche il controllo delle caratteristiche chimiche della dieta somministrata agli animali mediante l'utilizzo della precision feeding possono favorire l'aumento della produttività della mandria riducendo l'intensità delle emissioni di metano enterico e l'escrezione azotata determinando conseguentemente minori emissioni derivanti dai reflui zootecnici.

La PLF, se ben utilizzata, consente all'allevatore di prendere con più tempestività alcune decisioni, grazie ad un monitoraggio costante della mandria migliorando in questo modo la produttività, la redditività e l'utilizzo dei farmaci veterinari del proprio allevamento. Per sfruttare al massimo le informazioni ottenute con queste tecnologie ed interpretarle in maniera corretta, è fondamentale che queste siano integrate con sistemi informativi computerizzati in grado di gestire ed elaborare l'enorme "mole" di dati prodotti e che ci sia in stalla del personale qualificato che li sappia interpretare.

LONGER DESCRIPTION – IN ENGLISH

Precision Livestock Farming (PLF) represents a valuable opportunity for dairy farms to respond to market challenges by increasing production efficiency, enhancing animal welfare—thanks to the ability to monitor and manage animals individually rather than as a group—and improving the overall sustainability of production.

PLF refers to the application of engineering principles and techniques in livestock farming to automatically monitor, model, and manage animal production. Through these technologies, it is possible to measure

physiological, behavioral, productive, and reproductive indicators at the individual animal level. The goal is to improve management strategies and animal performance, making livestock farms more sustainable economically, environmentally, and socially.

The use of PLF technologies enables the collection and management of large volumes of data, which—if handled effectively—can significantly improve herd control in a cost-efficient and productive manner. Animals can be identified and tracked via GPS and image analyzers, which are useful for observing animal behavior and conducting automated assessments of body weight, Body Condition Score, and foot lesions. Real-time monitoring tools such as activometers, collars, body temperature sensors, milking robots, and devices based on near-infrared spectroscopy (NIRS) provide valuable information on health status, welfare, and productive and reproductive performance, all of which are closely linked to environmental impacts and milk quality.

Studies have shown that timely identification and management of mastitis through PLF technologies can lead to a 2.5% reduction in global warming potential, in addition to decreased antibiotic usage. Proper reproductive management can also reduce environmental impacts; maintaining optimal fertility levels may decrease greenhouse gas emissions from the farm by more than 20%.

Furthermore, monitoring the chemical composition of animal diets using precision feeding technologies can boost herd productivity while reducing enteric methane emissions and nitrogen excretion, thereby lowering emissions from livestock waste.

When effectively implemented, PLF empowers farmers to make more timely and informed decisions, improving productivity, profitability, and veterinary drug use on the farm. However, to fully capitalize on the potential of these technologies, it is crucial to integrate them with computerized information systems capable of processing the vast amount of data generated. Equally important is the presence of qualified personnel on-site who can correctly interpret and act on this information.

ADDITIONAL INFORMATION

Precision livestock farming is a rapidly evolving and expanding field that allows for increasingly accurate control of individual cows in the group, which could have great prospects for impact on farm management. The complexity of the devices and the excessive number of monitored parameters can be negative elements from the point of view of practical

utility, as the average farmer can be disoriented and have difficulty in correctly "reading" the values returned by the management system; furthermore, there is also the problem of the time to dedicate to these tools in order to fully exploit them, and time is not an element that farmers are particularly rich in and the purchase of these devices represents a significant cost that the farmer must sustain and does not always have the possibility of doing so.

PHOTOS

The screenshot shows the 'Mungitura' app interface. At the top, it says 'Mungitura' and 'Info vacca'. Below this, the cow's name '268 LUCREZIA' is displayed. The interface is divided into two main sections: 'Mungitura' on the left and 'Calendario' on the right. The 'Mungitura' section contains a list of data points with their values. The 'Calendario' section shows a calendar view with dates and times. At the bottom, there is a table with columns for 'Capacità', 'Mle', 'Ple', 'Ple', and 'Adx'.

Mungitura	
Produzione giornaliera	11.2/18.2
Deviazione produzione giornaliera	2.8
Produzione di latte grezzo	8.8
Mungitura (minuti)	1.2
Salute (migli)	8
Alimenti (kg)	1
Infiammazione	18.18
Temperatura corporea	38.4
Temperatura rettale	40
Capacità	Mle Ple Ple Adx
Capacità	80 40 40 40
Capacità	0 0 0 0
Temperatura di mungitura	38.14 38.15 38.15 38.15
Temperatura di mungitura	38.15 38.15 38.15 38.15

Calendario	
Data mungitura	Prognosi (17.1)
Data dell'ultima mungitura	15-05-2024
Al. di mungitura	2
Data parto	21-03-2023
Messa in gravidanza	21-12-2024

Altre informazioni	
Prima / seconda mungitura	4.3/2.7
Quantità latte (kg)	840

Photo 1: Example of data that can be obtained in real time thanks to the use of the milking robot during the milking of a dairy cow.



Photo 2: Use of collars in dairy cattle breeding for the collection of data relating to feeding behavior and rumination.



Photo 3: Use of collars – application

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Tullo, E., Finzi, A., & Guarino, M. (2019). Environmental impact of livestock farming and Precision Livestock Farming as a mitigation strategy. Science of the total environment, 650, 2751-2760.

URL:

[Review: Environmental impact of livestock farming and Precision Livestock Farming as a mitigation strategy - PubMed](#)

PRACTICE ABSTRACT #77**SHORT TITLE IN NATIVE LANGUAGE**

Kako smanjiti ugljični otisak u proizvodnji ratarskih kultura?

SHORT TITLE IN ENGLISH

How to Reduce the Carbon Footprint in Arable Crop Production?

COUNTRY AND CLIMATIC ZONE

Croatia, Continental and Mediterranean

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Decrease GHG emission in arable production
2. Cover crop sowing methods
3. Positive effect of introducing legumes into the crop rotation

PRODUCTION SYSTEM

Arable crop

THEMATIC AREA

Crop management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Svjedoci smo klimatskih promjena, a utjecaj klime na poljoprivredu je ogroman. Poljoprivreda je jedan od najranjivijih sektora na koje utječu klimatske promjene. Stoga su se poljoprivredni proizvođači koji su svjesni utjecaja klimatskih promjena na poljoprivrednu proizvodnju, ali i potrebe da svoju poljoprivrednu proizvodnju prilagode te implementiraju klimatski pametne prakse na svom gospodarstvu, uključili u CFD projekt. Stoga je bitno poljoprivrednicima koji se bave ratarskom proizvodnjom predstaviti strukturu sjetve na gospodarstvima, način obrade tla te siju li pokrovne usjeve i koje (ozime ili jare). Kao sastavni dionici AKIS-a, u prilagodbu na klimatske promjene u ratarstvu moraju se uključiti i proizvođači i distributeri sjemena sa svojom ponudom sjemena mahunarki, ali i smjesa sjemena različitih botaničkih vrsta za različite namjene. Također, vrlo je bitno ratarima tijekom obilaska parcela prikazati različite tipove ozimog pokrovnog usjeva poput smjese ozime grahorice, ozimog boba i inkarnatke te usjeva boba namijenjenog preradi. Svakako treba prikazati nodule na korijenu mahunarki i istaknuti pozitivan učinak uvođenja mahunarki u plodored. Međutim, bitno je naglasiti da sjetva pokrovnih usjeva podrazumijeva više različitih mjera održavanja tla uz prisutnost vegetacije na zemljištu, a s namjerom održanja ili povećanja sadržaja organske tvari tla, poboljšanja fizikalnih svojstava tla (struktura tla, vodozračni odnosi u tlu), akumulacije dušika u tlu uzgojem mahunarki (leguminoza), poboljšanja mikrobiološke aktivnosti tla, suzbijanja korova biološkim mjerama, odnosno, općenito - podizanja plodnosti tla. Pri tome pokrovni usjevi imaju dodatnu funkciju “pokrivača tla” s namjerom sprječavanja erozije (vodom i/ili vjetrom) i ispiranja hranjiva, prije svega nitrata, a time i sprječavanja onečišćenja podzemnih voda.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

We have been witnessing climate change, and its impact on agriculture is enormous. Agriculture is one of the most vulnerable sectors affected by climate change. Therefore, several agricultural producers who are aware of this impact, as well as the need to adapt their production and implement climate-smart practices on their farms, have joined the Climate Farm Demo project.

It is important to present to farmers engaged in arable production the structure of sowing on farms, the method of tillage, and whether, and which, cover crops are sown (winter or spring). As integral stakeholders of the ecosystem, seed producers and distributors—with their offer of leguminous seeds and mixtures of seeds from different botanical species for various

purposes—must be included in efforts to adapt agriculture to climate change.

It is also very important to show farmers different types of winter cover crops, such as mixtures of winter vetch, winter broad beans, black beans, and broad bean crops intended for processing. Demonstrating the nodules on the roots of legumes and emphasizing the positive effects of introducing legumes into crop rotation is essential.

However, it is important to emphasize that sowing cover crops involves several soil maintenance measures that include the presence of vegetation on the land, with the aim of maintaining or increasing soil organic matter content, improving the physical properties of the soil (soil structure, water-air relations), accumulating nitrogen in the soil through legume cultivation, enhancing soil microbiological activity, and controlling weeds through biological methods—in general, increasing soil fertility.

Additionally, cover crops serve the important function of “soil cover” with the intention of preventing erosion (by water and/or wind) and nutrient leaching, primarily nitrates, thereby helping to prevent groundwater pollution.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Unatrag desetak i više godina svjedoci smo da klimatske promjene uzrokuju značajne poremećaje u svakodnevnim društvenim aktivnostima. Nažalost, uz energiju i transport kao glavne izvore emisije stakleničkih plinova, poljoprivreda i šumarstvo se u većini zemalja smatra 3. izvorom stakleničkih plinova. Republika Hrvatska ne ulazi u prvu skupinu europskih država – emitera stakleničkih plinova. No mi svakako ne možemo niti želimo ostati izolirani u toj dugotrajnoj borbi za postizanje nulte emisije do 2050.godine.

Brojčani pokazatelji i prognostički modeli u svezi klimatskih promjena koji cirkuliraju unutar znanstveno-stručne zajednice su u mnogim segmentima zabrinjavajući i zovu na ozbiljnost i hitne promjene u našem načinu razmišljanja, života, prehrane, transporta, opskrbe energijom, raspolaganja otpadom te zahvatima u poljoprivredi i šumarstvu.

Posebno veliki izazovi bit će u prilagodbi i ublažavanju klimatskih promjena u sektoru poljoprivrede. Pri tome se u tim stremljenjima za smanjenje ugljične emisije ne može niti smije biti isključiv već naprotiv uključiv i otvoren za sve aktere sustava AKIS koji je ugrađen u same temelje Zajedničke poljoprivredne politike.

Raduje stoga spoznaja da je projekt Climate Farm Demo blistavi primjer AKIS-a na nacionalnom i EU nivou jer razmjena znanja na svim razinama te primjene inovativnih tehnika u poljoprivredi predstavljaju polaznu točku u borbi klimatskih promjena. Predloženi radni paketi kao i tematska područja unutar Climate Farm Demo projekta; zatim primjena ugljičnih kalkulatora za procjenu emisije stakleničkih plinova na pilot demo gospodarstvima, izrada i primjena Plana prilagodbe i ublažavanja na klimatske promjene te održavanje 75 demonstracijskih događaja u RH s više od 1500 očekivanih sudionika garancija su da će Climate Farm Demo sigurno ostvariti svoje temeljne ciljeve, a to su uvođenje klimatski pametnih politika u poljoprivredu, smanjenje ugljičnih emisija za barem 30 % na pilot demo gospodarstvima te u konačnici pozitivan učinak na poljoprivrednike, agrobiznis, potrošače i društvo.

Poljoprivreda je jedan od najranjivijih sektora na koje utječu klimatske promjene. Stoga su se poljoprivredni proizvođači koji su svjesni utjecaja klimatskih promjena na poljoprivrednu proizvodnju, ali i potrebe da svoju poljoprivrednu proizvodnju prilagode te implementiraju klimatski pametne prakse na svom gospodarstvu, uključili u Climate Farm Demo projekt. Stoga je bitno poljoprivrednicima koji se bave ratarskom proizvodnjom predstaviti strukturu sjetve na gospodarstvima, način obrade tla te siju li pokrovne usjeve i koje (ozime ili jare). Kao sastavni dionici AKIS-a, u prilagodbu na klimatske promjene u ratarstvu moraju se uključiti i proizvođači i distributeri sjemena sa svojom ponudom sjemena mahunarki, ali i smjesa sjemena različitih botaničkih vrsta za različite namjene.

Također, vrlo je bitno ratarima tijekom obilaska parcela prikazati različite tipove ozimog pokrovnog usjeva poput smjese ozime grahorice, ozimog boba i inkarnatke te usjeva boba namijenjenog preradi. Svakako treba prikazati nodule na korijenu mahunarki i istaknuti pozitivan učinak uvođenja mahunarki u plodored. Međutim, bitno je naglasiti da sjetva pokrovnih usjeva podrazumijeva više različitih mjera održavanja tla uz prisutnost vegetacije na zemljištu, a s namjerom održanja ili povećanja sadržaja organske tvari tla, poboljšanja fizikalnih svojstava tla (struktura tla, vodozračni odnosi u tlu), akumulacije dušika u tlu uzgojem mahunarki (leguminoza), poboljšanja mikrobiološke aktivnosti tla, suzbijanja korova biološkim mjerama, odnosno, općenito - podizanja plodnosti tla. Pri tome pokrovni usjevi imaju dodatnu funkciju "pokrivača tla" s namjerom sprječavanja erozije (vodom i/ili vjetrom) i ispiranja hranjiva, prije svega nitrata, a time i sprječavanja onečišćenja podzemnih voda.

LONGER DESCRIPTION – IN ENGLISH

For the past ten or more years, we have witnessed climate change causing significant disruptions in everyday social activities. Unfortunately, alongside energy and transport as the main sources of greenhouse gas (GHG) emissions, agriculture and forestry are considered the third largest sources of GHGs in most countries.

The Republic of Croatia does not belong to the group of leading European GHG emitters, but we certainly cannot—and do not want to—remain isolated in the long-term effort to achieve zero emissions by 2050. The numerical indicators and forecast models related to climate change, which are circulating within the scientific and professional communities, are concerning in many respects. They call for serious and urgent changes in our way of thinking, living, eating, transporting, supplying energy, managing waste, and making interventions in agriculture and forestry.

The agricultural sector, in particular, will face major challenges in adapting to and mitigating climate change. In this effort to reduce carbon emissions, the agricultural knowledge and innovation ecosystem—embedded in the very foundations of the Common Agricultural Policy—must be inclusive and open to all actors.

It is encouraging to note that the Climate Farm Demo (CFD) project is a shining example of this ecosystem in action at both the national and EU levels. The exchange of knowledge at all levels and the application of innovative techniques in agriculture represent the starting point in the fight against climate change.

Agriculture is one of the most vulnerable sectors affected by climate change. Therefore, agricultural producers who recognize the impact of climate change on agricultural production—as well as the need to adapt their practices and implement climate-smart approaches—have joined the CFD project.

It is important to present to farmers engaged in arable production the structure of sowing on farms, the methods of tillage, and whether (and which) cover crops are sown (winter or spring). As integral stakeholders in the AKIS system, producers and distributors of seeds—particularly those offering leguminous seeds and seed mixtures of different botanical species for various purposes—must be involved in agricultural adaptation to climate change.

It is also important to demonstrate to farmers the variety of winter cover crops, such as mixtures of winter vetch, winter broad beans, and black beans, as well as broad bean crops intended for processing. It is essential to

show the nodules on legume roots and to emphasize the benefits of incorporating legumes into crop rotation.

However, it must also be emphasized that sowing cover crops involves several different soil maintenance measures, supported by vegetation on the land. These measures aim to maintain or increase soil organic matter, improve the physical properties of the soil (including structure and water-air balance), accumulate nitrogen in the soil through legume growth, enhance soil microbiological activity, and control weeds through biological means—in general, to increase soil fertility.

Additionally, cover crops serve the function of “soil cover,” intended to prevent erosion (by water and/or wind) and nutrient leaching, particularly nitrates, thus reducing the risk of groundwater pollution.

PHOTOS



Photo 1: Farm Demo Event in Croatia



Photo 2 Farm Demo Event in Croatia



Photo 3: Farm Demo Event in Croatia

PRACTICE ABSTRACT #78**SHORT TITLE IN NATIVE LANGUAGE**

Добри практики за задържане на въглерода в почвата при трайни насаждения (ягодоплодни)

SHORT TITLE IN ENGLISH

Good Practices for Soil Carbon Retention in Perennial Crops (berry)

COUNTRY AND CLIMATIC ZONE

Bulgaria, Continental Climate

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Retention of carbon in the soil and promotion of a sustainable agricultural ecosystem.
2. Improved soil health.
3. Enhanced crop yield combines with healthier plant growth.

PRODUCTION SYSTEM (IF RELEVANT)

Garden (vegetable / fruit) crops

THEMATIC AREA/SECTOR

Crops management, Soil health and biodiversity

Fruits sector

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Задържането на въглерода в почвата е важен аспект от управлението на трайни насаждения като ягодоплодни култури. Сред най-ефективните методи за задържане на въглерода са използването на минерални продукти на базата на калциев хидрооксид (например овощарска вар) и специфични технологии на мулчиране.

Овощарската вар е продукт, който се отличава с високо съдържание на калций, магнезий и силициев диоксид. Тя се използва широко в овощарството за регулиране на рН на почвата, което е от съществено значение за усвояването на хранителни вещества от растенията. Освен това, вартата подпомага задържането на въглерод в почвата чрез стабилизирането на органичната материя.

Ползи от използването на овощарска вар:

- Регулиране на рН на почвата: Поддържането на оптимално рН подобрява микробиологичната активност и задържането на въглерод.
- Подобряване на структурата на почвата: Калцият подпомага агрегацията на почвените частици, което увеличава способността на почвата да задържа въглерод.
- Увеличаване на минералното съдържание: Високото съдържание на калций, магнезий и силициев диоксид е от съществено значение за здравето на растенията и тяхната устойчивост към стресови фактори.

Мулчирането е техника, при която почвата около растенията се покрива с органични или неорганични материали. Това не само подпомага задържането на влага, но и съществено намалява ерозията и увеличава съдържанието на органични вещества в почвата.

Специфични технологии на мулчиране за ягодоплодни:

- Органични мулчове: Използването на мулчи от растителни материали като слама, дървени стърготини, и компост подпомага задържането на въглерод в почвата. Те се разграждат бавно, обогатявайки почвата с органична материя.
- Неорганични мулчове: Мулчи от пластмасови фолиа или геотекстили също могат да бъдат ефективни, като те предотвратяват загубата на влага и намаляват растежа на

плевели, което от своя страна намалява необходимостта от често обработване на почвата.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Soil carbon sequestration is an important aspect of the management of perennial crops such as berry crops. Among the most effective methods for sequestration are the use of mineral products based on calcium hydroxide (e.g. fruit lime) and specific mulching technologies.

Fruit lime is a product characterized by a high content of calcium, magnesium and silica. It is widely used in orchards to regulate soil pH, which is essential for the absorption of nutrients by plants. In addition, lime helps retain carbon in the soil by stabilizing organic matter.

Benefits of using fruit lime:

- Regulate soil pH: Maintaining an optimal pH improves microbiological activity and carbon sequestration.
- Improve soil structure: Calcium promotes the aggregation of soil particles, which increases the soil's ability to retain carbon.
- Increase mineral content: High levels of calcium, magnesium and silica are essential for plant health and resistance to stress factors.

Mulching is a technique in which the soil around plants is covered with organic or inorganic materials. This not only helps retain moisture, but also significantly reduces erosion and increases the organic matter content of the soil.

Specific mulching technologies for berries:

- Organic mulches: The use of mulches made from plant materials such as straw, sawdust, and compost helps retain carbon in the soil. They decompose slowly, enriching the soil with organic matter.
- Inorganic mulches: Mulches made from plastic films or geotextiles can also be effective, as they prevent moisture loss and reduce weed growth, which in turn reduces the need for frequent tillage.

ADDITIONAL INFORMATION

Facilitating Elements:

- Access to high-quality fruit lime, which can enhance soil pH and promote microbial activity.

- Availability of organic and inorganic mulching materials to improve soil structure and moisture retention.
- Support from climate farm advisors providing advice on sustainable practices and soil management.
- Increased awareness and knowledge about the benefits of carbon sequestration in soil among farmers and other stakeholders.

Obstacles:

- High cost of implementing mulching techniques and purchasing fruit lime.
- Lack of access to resources and equipment for applying mulches and lime in some regions.
- Limited knowledge or skepticism among farmers about the long-term benefits of soil carbon sequestration.
- Potential environmental regulations or restrictions on the use of certain inorganic mulches and lime.

Future Actions/Research

- Conducting long-term studies to evaluate the effectiveness of various mulching materials and lime applications on soil health and carbon sequestration.
- Developing cost-effective methods for applying fruit lime and mulches to make them more accessible to small-scale farmers.
- Promoting the use of local and sustainable materials for mulching to reduce costs and environmental impact.
- Creating educational programs and workshops to train farmers on the benefits and techniques of soil carbon sequestration.

Messages to End-Users

- For Farmers: Implementing the use of fruit lime and mulching techniques can lead to healthier soils, increased crop yields, and long-term sustainability. Investing in these practices will benefit your farm's productivity and the environment.
- For Policymakers: Supporting and incentivizing sustainable agricultural practices such as soil carbon sequestration can contribute to climate change mitigation and improve food security.
- For Researchers: Continued research on the synergistic effects of different soil amendments and mulching techniques is crucial to optimize their use and improve soil health.

PHOTOS



Photo 1: Farm in Bulgaria



Photo 2 Farm in Bulgaria

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Media report and video by AGRI.BG for demonstration on 15.10.2024 on the topic: "Good practices for carbon retention in soil in permanent plants".

The name of the news: "Carbon quotas will provide an opportunity for additional support for farmers - Good practices for carbon retention in soil in perennial plants are demonstrated by a farm in the village of Dalbok Dol"

URL:

<https://agri.bg/novini/vieglerodnite-kvoti-shhe-dadat-viezmoznost-za-dopielnitelno-podpomagane-na-fermerite>

Title/Description

Carbon quotas will provide additional support for farmers – VIDEO

URL:

<https://www.youtube.com/watch?v=XDHtkX09eQU>

PRACTICE ABSTRACT NUMBER #79**SHORT TITLE IN NATIVE LANGUAGE / ENGLISH**

Modular Anaerobic Digestion Systems for Circular Agriculture

COUNTRY AND CLIMATIC ZONE

United Kingdom, NW Europe maritime climate

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Methane capture and biogas production for renewable energy
2. Improved nutrient recycling and organic fertiliser production
3. Compliant manure management and storage

PRODUCTION SYSTEM (IF RELEVANT)

Dairy, Pig, Poultry

THEMATIC AREA

Manure storage and spreading, Biogas production

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE / ENGLISH

Anaerobic digestion (AD) provides a sustainable solution for agricultural waste by capturing methane from slurry, reducing greenhouse gas emissions, and producing renewable energy. Farms benefit from biogas

generation for electricity and heat, while modular systems allow accessibility across sectors. AD also creates organic fertilisers rich in nitrogen, phosphorus, potassium, and sulphur, reducing dependence on synthetic inputs.

Biogas production efficiency ranges from 60% to 98%, with gases used in the green gas grid, transport, or on-site in methane-powered machinery. Combined heat and power generators maximise energy self-sufficiency. The byproduct, digestate, can be processed into organic fertilisers, typically containing 0.12–1.5% nitrogen, 0.04–0.26% phosphorus, and 0.12–1.15% potassium, with dry matter content from 1.5% to 45.8%. Processing can concentrate these nutrients to around 30% nitrogen, 15% phosphorus, and 15% potassium.

Scalable and adaptable, AD integrates one-stage, two-stage, or three-stage digestion to improve gas extraction and waste processing. Modular systems focus on single-phase digestion, achieving up to 95% methane extraction. While initial investment is higher than traditional slurry storage, AD is becoming more cost-effective through modular innovations and financial incentives. Economic viability is enhanced through energy sales, carbon credits, and rising green finance interest.

AD improves farm sustainability, reduces costs, and generates revenue. Customisable modular systems fit different herd sizes, infrastructure, and energy demands. Advisors support adoption through feasibility studies and carbon audits. Policymakers should expand incentives for AD adoption, supporting carbon sequestration and renewable energy. ROI is expected within four to ten years, potentially accelerated by carbon market opportunities. By adopting AD, farms cut methane emissions, enhance nutrient management, and contribute to a circular agricultural economy.

LONGER DESCRIPTION – IN NATIVE LANGUAGE / ENGLISH

Capturing Waste, Creating Value: How Modular Anaerobic Digestion Can Transform Farming and the Environment

Agriculture is a major source of methane emissions, largely from livestock and slurry storage. Methane is responsible for about 30% of global warming, yet policies to reduce emissions focus mainly on the energy sector, leaving agriculture under-addressed. Anaerobic digestion (AD) offers a circular

economy solution, capturing methane emissions while converting organic waste into biogas for electricity, heat and/or fuel. The modular design of some AD systems makes them accessible to farms of all sizes, mainly supporting dairy production, but could be available to other sectors. Beyond energy, AD provides a solution to compliant slurry and manure storage, producing a valuable organic fertiliser product.

Agricultural methane in the UK has decreased by 15% since 1990 and accounts for nearly half of the country's total methane output. While the IPCC Tier 2 model suggests a single UK dairy cow produces 38kg of methane per year from slurry, direct British measurements suggest it could be as high as 171.5kg per cow, highlighting the need for better mitigation strategies. (See *Figure 1*)

Modular AD systems provide a scalable, adaptable solution for reducing emissions and creating value from farm waste. These systems capture methane from slurry, producing biogas that can be used on-site, exported to the green gas grid, or converted into vehicle fuel, such as powering the New Holland T6 and T7 methane tractors. Gas extraction efficiency ranges from 60% to 98%, depending on the storage, digestion and extraction factors. Farms can integrate single, two-stage, or three-stage digestion processes, optimising gas yield and boosting energy efficiency up to 98%. (See *Figure 2*)

Nutrient management is vital for water quality, particularly in sensitive catchments such as the Wye Valley, where phosphorus pollution has pushed river ecosystems toward collapse. Agriculture is now responsible for 60-70% of phosphate loads in the catchment, largely from manure runoff.

Beyond energy, AD plays a key role in nutrient recovery. The digestate produced can be processed into organic fertilisers, reducing reliance on synthetic alternatives. On a fresh matter basis, digestate contains 0.12–1.5% total nitrogen, 0.04–0.26% phosphorus, and 0.12–1.15% potassium, with dry matter content ranging from 1.5% to 45.8%. Advanced processing can increase nutrient concentrations to 30% nitrogen, 15% phosphorus and 15% potassium, offering improved fertility and the potential for a marketable product.

Although AD systems require an initial investment, their long-term returns are compelling. Modular designs are making them more cost-effective, especially when supported by carbon credits and renewable energy incentives. Green finance is increasingly recognising AD as a sound investment, with projected returns within 4 to 10 years depending on farm

size and operational scale. However, policy barriers remain, with small-scale digesters and lagoon capture currently excluded from the UK Green Gas Support Scheme. Streamlining planning and permitting processes, alongside stable financial support, would accelerate adoption.

By integrating AD, farms can significantly cut methane emissions, increase manure/slurry storage capacity, generate renewable energy, improve nutrient management and protect waterways, all while enhancing individual farm profitability. Capturing methane from dairy slurry alone could cut UK methane emissions by a quarter, the equivalent of replacing 270 million litres of diesel, worth £406 million annually. As governments, farmers and industry seek solutions for climate resilience, modular AD stands as a proven and accessible tool for achieving a cleaner, more circular agricultural economy.

ADDITIONAL INFORMATION

- National Renewable Energy Laboratory (NREL): NREL offers extensive research and data on renewable energy technologies, including modular biogas systems.
- BiogasWorld: A comprehensive platform providing information on biogas projects, technologies, and suppliers, with a focus on modular solutions.
- American Biogas Council: An industry association that provides resources, case studies, and technical information on biogas production, including modular applications.
- European Biogas Association (EBA): EBA offers insights into biogas developments across Europe, including advancements in modular biogas technologies.
- International Fugitive Emissions Abatement Association (IFEAA): an organization dedicated to the assessment, reduction, and utilization of harmful fugitive emissions, such as methane, from various human activities. They coordinate the Net Zero Methane Hub in Cornwall, aiming to develop a new ecosystem that promotes the capture and use of net-zero fugitive methane in the region.

PHOTOS

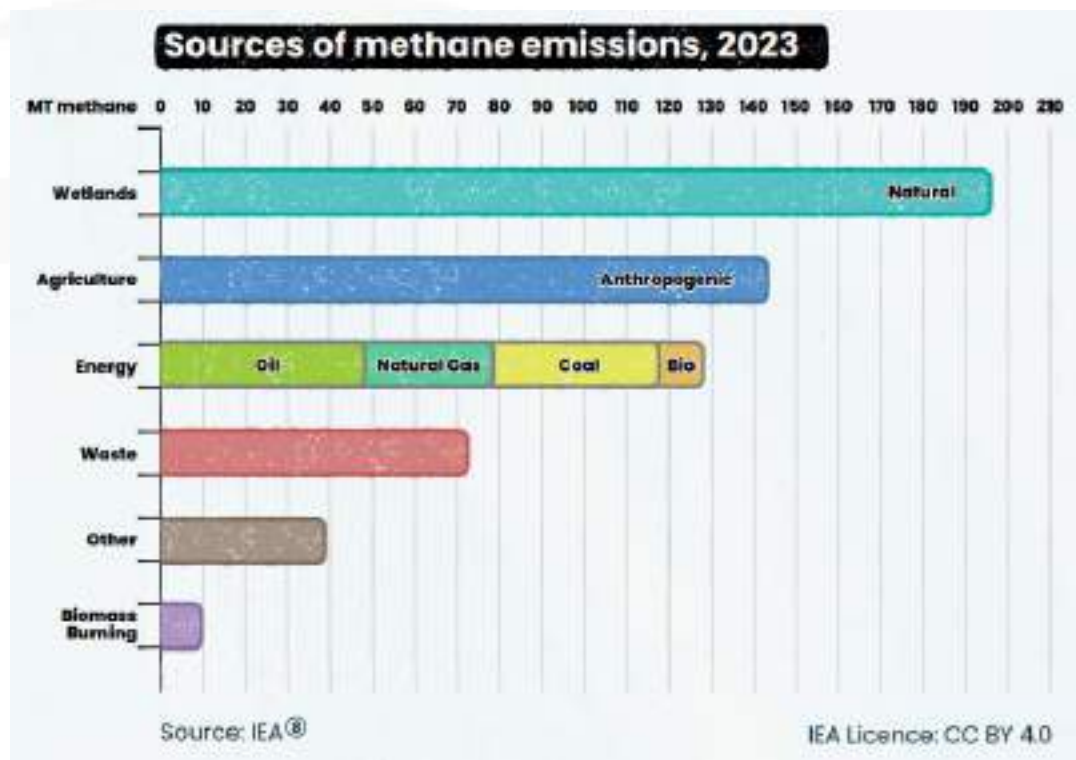


Figure 1: Global sources of methane emissions. IFEAA 2024



Figure 2: A circular process in theory. IFEAA 2024



Photo 1: Pilot Demo Farm in the UK

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

IFEAA Manure Emissions report

URL:

<https://www.ifeaa.com/ifeaa-manure-emissions-report/>

Title/Description

Innovation for Agriculture – Climate Smart Farming

URL:

<https://www.i4agri.org/climate-smart-farming>

Title/Description

Farm of the Future: Journey to Net Zero, Royal Agricultural Society of England, 2022

URL:

https://www.rase.org.uk/content/large/documents/reports/farm_of_the_future-journey_to_net_zero.pdf

PRACTICE ABSTRACT #80**SHORT TITLE IN NATIVE LANGUAGE**

Optimizarea ingestei de proteină la ovine – o măsură care asigură atât creșterea eficienței cât și reducerea emisiilor de gaze cu efect de seră pe litrul de lapte

SHORT TITLE IN ENGLISH

Optimisation of Crude Protein Intake in Sheep – a measure ensuring both increased efficiency as well as the reduction of the GHG emission of the milk production

COUNTRY AND CLIMATIC ZONE

Romania - continental temperate zone

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Increase the feeding efficiency
2. Increase the overall farm profitability
3. Reduce the carbon footprint / kg of milk

PRODUCTION SYSTEM

Low-input sheep milk production system

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Obiectivul implementării acestei măsuri a fost, printre altele, de a demonstra că reducerea amprente de carbon a producției de lapte poate fi obținută și fără a afecta profitabilitatea fermelor de ovine, mai ales în cadrul unor sisteme de producție a laptelui de ovine mai puțin intensive. În cadrul acestor sisteme de producție, mai ales în cazurile în care încărcătura de animale / hectar este redusă, fermierii nu acordă atenție optimizării rațiilor, în particular atingerii necesarului de proteină care să susțină producții ridicate de lapte / atingerii potențialului productiv al animalelor. În mod frecvent, în astfel de sisteme, producția de lapte este mai mică de 100 kg / cap / lactație, deși potențialul productiv al animalelor poate depăși 120 kg (populațiile respective fiind încă în curs de ameliorare genetică).

În acest context, una dintre măsurile implementate constă în alinierea aportului de proteină al rațiilor consumate la cerințele nutriționale ale animalelor, pe toată perioada anului, prin asigurarea de nutrețuri concentrate complementare. Există câteva astfel de perioade, când valoarea nutritivă a pajiștilor scade foarte mult sau când animalele necesită aporturi nutriționale mai ridicate (ex. vârful de lactație / pregătirea pentru montă).

Această măsură poate avea mai multe niveluri de implementare – de la simpla urmare a unor recomandări nutriționale (de a administra, în anumite perioade din an, un nutreț combinat generic specific ovinelor), la verificarea rațiilor consultând tabelele de valori nutritive pentru rumegătoare, mergând până la aplicarea nutriției de precizie. Avantajul constă în faptul că în cazul animalelor în lactație efectele se văd destul de rapid în creșterea producției zilnice de lapte. Pe de altă parte, costurile suplimentare (cu furajarea complementară) sunt acoperite de veniturile obținute de pe urma creșterii producției de lapte.

Principalii beneficiari sunt fermierii, dar și consultanții în nutriție, producătorii de furaje, etc.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The objective of implementing this measure was, among other things, to demonstrate that reducing the carbon footprint of milk production can also be achieved without affecting the profitability of sheep farms, especially within less intensive sheep milk production systems. Within these systems, particularly where the livestock load per hectare is low, farmers often do not focus on ration optimization, especially in ensuring the dietary protein

supply needed to support high milk yields or to reach the potential milk production of the animals.

Frequently, in such systems, milk production is less than 100 kg/head/lactation, although the genetic potential of sheep may exceed 120 kg (while the animals are still undergoing genetic improvement).

In this context, one of the implemented measures consists of aligning the protein intake of consumed diets with the nutritional requirements of the animals throughout the year, by providing complementary concentrated feeds. There are several such periods when the nutritional value of pastures is dramatically reduced or when sheep require higher nutritional intake (e.g., peak lactation or preparation for mating).

This measure can be implemented at several levels — from simply following basic nutritional recommendations (e.g., feeding a one-size-fits-all compound feed specific to sheep at certain times of the year), to checking the diets using ruminant feeding tables, and even up to applying precision feeding.

The advantage of the method lies in the fact that, for lactating animals, the effects are quickly noticeable, typically through increased daily milk production. On the other hand, the additional costs related to complementary feeding are offset by the increased income from the higher milk yields.

The main beneficiaries are farmers, but also nutrition consultants, feed producers, and others involved in livestock nutrition and management.

PHOTOS



Photo 1: Explaining the need to supplement the low-quality grassland



Photo 2: Low quality grassland - sheep grazing

PRACTICE ABSTRACT #81**SHORT TITLE IN NATIVE LANGUAGE**

Succession Pois-Colza : Amélioration des Performances et Réduction des Coûts de Production.

SHORT TITLE IN ENGLISH

Pea-Rapeseed Rotation: Improving Performance and Reducing Production Costs

COUNTRY AND CLIMATIC ZONE

France, oceanic and continental zones

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Improvement of soil fertility: Nitrogen fixation by peas increases mineral soil nitrogen for rapeseed and hence reduces GHG emissions
2. Improvement of rapeseed establishment and weed management
3. Increased rapeseed yield by 1.9 quintals per hectare

PRODUCTION SYSTEM (IF RELEVANT)

Crops

THEMATIC AREA/SECTOR

Proteins and oilseed crops sector

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Les essais de faisabilité de la culture du colza après un pois protéagineux ont montré plusieurs avantages pratiques pour les agriculteurs. Le pois fixe l'azote atmosphérique, enrichissant le sol pour le colza suivant. Cela permet de réduire les besoins en engrais azotés, diminuant ainsi les coûts de production et les émissions de gaz à effet de serre. Le colza valorise bien l'azote résiduel du pois, ce qui se traduit par une meilleure utilisation des ressources en nutriments et une croissance accrue.

Le pois laisse peu de résidus de culture, facilitant l'implantation du colza sans labour. Cette rotation permet une meilleure préparation du sol et réduit les risques de phytotoxicité par rapport à une culture précédente de blé. Les conditions de semis sont ainsi optimisées, favorisant une bonne levée du colza.

En termes de gestion des adventices, les repousses de céréales cultivées avant le colza peuvent nécessiter l'application d'un désherbant antigraminées spécifique, tandis que les repousses de pois sont généralement gélives et ne posent pas de problème majeur. La diversification de la rotation avec le pois permet également de mieux gérer l'enherbement à l'échelle de la rotation, grâce à un décalage des dates de semis et à l'utilisation de différentes molécules herbicides.

Les observations n'ont pas révélé de différence significative dans les niveaux d'attaque de sclérotinia entre les précédents pois et céréales, indiquant que la succession pois-colza n'augmente pas le risque de cette maladie. Cela permet de maintenir une bonne santé des cultures sans nécessiter de traitements fongicides supplémentaires.

Les résultats des essais montrent également que la dose d'engrais azoté nécessaire pour le colza est en moyenne réduite de 19 kg N/ha après un pois par rapport à une céréale à paille. Cette économie d'engrais, combinée à l'augmentation du rendement de 1.6 quintaux par hectare, contribue à améliorer la rentabilité de la culture du colza après un pois. Les agriculteurs peuvent ainsi bénéficier d'une réduction des coûts de production, d'une meilleure performance économique et d'une diminution de leurs émissions de gaz à effet de serre.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Feasibility trials of growing rapeseed after protein peas have demonstrated several practical advantages for farmers. Peas fix atmospheric nitrogen,

enriching the soil for rapeseed, which reduces the need for nitrogen fertilizers, thereby lowering production costs and GHG emissions. Rapeseed efficiently absorbs the residual nitrogen from peas, resulting in better nutrient utilization and enhanced growth.

Peas leave minimal crop residues, facilitating rapeseed planting without plowing. This rotation improves soil preparation and reduces the risk of phytotoxicity from herbicides, compared to a wheat predecessor. Optimized seeding conditions further promote good rapeseed emergence.

Regarding weed management, cereal regrowth before rapeseed may require a specific grass herbicide, whereas pea regrowth is frost-sensitive and does not pose a major issue. The diversification of rotations with peas also improves weed control at the rotation level, thanks to staggered sowing dates and the use of different herbicide molecules.

Observations revealed no significant differences in sclerotinia levels between pea and cereal precedents, indicating that the pea-rapeseed rotation does not increase disease risk. This helps maintain good crop health without requiring additional fungicide treatments.

Trial results also show that the nitrogen fertilizer requirement for rapeseed is, on average, reduced by 19 kg N/ha after peas compared to cereals. This fertilizer saving, combined with a yield increase of 1.6 quintals per hectare, enhances the profitability of growing rapeseed after peas. Farmers can thus benefit from lower production costs, improved economic performance, and reduced GHG emissions.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Les essais de faisabilité de la culture du colza après un pois protéagineux ont montré plusieurs avantages pratiques pour les agriculteurs. Le pois, en tant que légumineuse, fixe l'azote atmosphérique grâce aux bactéries symbiotiques. Cela enrichit le sol en azote, au bénéfice de la culture suivante, comme le colza. En conséquence, les besoins en engrais azotés sont réduits, ce qui diminue les coûts de production et les émissions de gaz à effet de serre. Le colza valorise efficacement l'azote résiduel du pois, permettant une meilleure utilisation des ressources en nutriments et favorisant une croissance accrue. Les essais ont montré que la dose d'engrais azoté nécessaire pour le colza est en moyenne réduite de 19 kg N/ha après un pois par rapport à une céréale à paille, tout en obtenant un rendement en graines supérieur.

Le pois laisse peu de résidus de culture, facilitant l'implantation du colza sans labour. Cette rotation permet une meilleure préparation du sol et

réduit les risques de phytotoxicité liés aux herbicides par rapport à une culture précédente de blé. Les conditions de semis sont ainsi optimisées, favorisant une bonne levée du colza. Les expérimentations ont montré que le colza cultivé après un pois produit 1.6 quintaux de plus par hectare comparé à un colza cultivé après une céréale à paille. Cette augmentation de rendement est due à une meilleure valorisation de l'azote et à des conditions de semis plus favorables.

En termes de gestion des adventices, les repousses de céréales cultivées avant le colza peuvent nécessiter l'application d'un désherbant antigraminées spécifique, tandis que les repousses de pois sont généralement gélives et ne posent pas de problème majeur. La diversification des cultures avec le pois permet également de mieux gérer l'enherbement à l'échelle de la rotation, grâce à un décalage des dates de semis et à l'utilisation de différentes molécules herbicides. Les observations ont montré que la succession pois-colza permet de réduire la pression des mauvaises herbes, notamment des graminées, et de limiter les interventions herbicides, ce qui contribue à une gestion plus durable des cultures.

Le sclérotinia est un pathogène commun aux deux cultures, mais les essais ont montré que le colza cultivé après un pois ne présente pas de risque accru de cette maladie par rapport à un colza cultivé après une céréale. Cela permet de maintenir une bonne santé des cultures sans nécessiter de traitements fongicides supplémentaires, réduisant ainsi les coûts et les impacts environnementaux liés à l'utilisation de produits phytosanitaires.

La réduction de la fertilisation azotée du colza après un pois, par rapport à une céréale à paille, combinée à l'augmentation du rendement, contribuent à améliorer la rentabilité de la culture. Les agriculteurs peuvent ainsi bénéficier d'une réduction des coûts de production et d'une meilleure performance économique.

En conclusion, la succession pois-colza présente des avantages agronomiques, économiques et environnementaux significatifs pour les agriculteurs, notamment en termes de fertilité du sol, de gestion des adventices, de rendement, de réduction des coûts de production et de diminution des émissions de gaz à effet de serre. Ces résultats encouragent l'adoption de cette pratique pour améliorer la durabilité et la rentabilité des systèmes de culture.

LONGER DESCRIPTION – IN ENGLISH

Feasibility trials of growing rapeseed after peas have demonstrated several practical advantages for farmers. Peas are legume crops that fix atmospheric nitrogen through symbiotic bacteria, increasing soil mineral nitrogen content and benefiting subsequent crops such as rapeseed. As a result, the need for nitrogen fertilizers is reduced, lowering production costs and GHG emissions. Rapeseed efficiently absorbs residual nitrogen from peas, improving nutrient utilization and promoting better growth. Trials have shown that the nitrogen fertilizer requirement for rapeseed is, on average, reduced by 19 kg N/ha after peas compared to cereals, while also achieving higher seed yields.

Peas leave fewer crop residues, facilitating rapeseed planting without plowing. This rotation enhances soil preparation and reduces the risk of phytotoxicity from herbicides, compared to a wheat predecessor. Optimized seeding conditions further support good rapeseed emergence. Experiments have shown that rapeseed grown after peas produces 1.6 quintals more per hectare than rapeseed following cereals. This yield increase results from better nitrogen utilization and more favorable seeding conditions.

Regarding weed management, cereal regrowth before rapeseed may require a specific grass herbicide, whereas pea regrowth is frost-sensitive and does not pose a major issue. Crop diversification with peas improves weed control at the rotation level due to staggered sowing dates and the use of different herbicide molecules. Observations indicate that the pea-rapeseed rotation reduces weed pressure, particularly from grasses, and limits herbicide interventions, contributing to more sustainable crop management.

Sclerotinia, a common pathogen affecting both crops, does not pose a higher risk when rapeseed follows peas instead of cereals. This ensures good crop health without requiring additional fungicide treatments, reducing costs and environmental impacts associated with phytosanitary products.

The trial results confirm that fertilizer savings, combined with increased yields, improve the profitability of growing rapeseed after peas. Farmers benefit from lower production costs, better economic performance, and reduced GHG emissions.

In conclusion, the pea-rapeseed rotation offers significant agronomic and economic advantages, particularly in terms of soil fertility, weed management, yield improvement, production cost reduction, and GHG

emissions mitigation. These results encourage the adoption of this practice to enhance the sustainability and profitability of cropping systems.

ADDITIONAL INFORMATION

While growing rapeseed after peas offers several benefits, there are also limitations and areas that require further investigation. One key concern is the potential for increased disease pressure, particularly from pathogens like sclerotinia, which can affect both peas and rapeseed. Although initial studies have not shown a significant increase in disease incidence, more research is needed to confirm these findings under various climatic conditions and over longer periods.

Another limitation is the variability in nitrogen availability. While peas improve soil mineral nitrogen content, the actual amount of nitrogen available to the following rapeseed crop can vary based on soil type and weather conditions. Further studies are needed to optimize nitrogen management practices to ensure consistent and efficient use of this nutrient, thereby maximizing GHG emissions reduction.

Weed management is another area that requires attention. Further trials are needed to assess the possibility of reducing specific grass herbicide applications when rapeseed follows a pea crop and to study the long-term effects on weed populations.

Finally, economic considerations such as input costs, market prices, and overall profitability of the rapeseed-pea rotation need to be thoroughly evaluated. Farmers require reliable economic data to make informed decisions about adopting this rotation in their cropping systems.

In conclusion, while the rapeseed-pea rotation shows great potential, further research is essential to address its limitations and develop comprehensive guidelines for farmers, ensuring sustainable implementation and optimal GHG emissions reduction.

PHOTOS



Photo 1: Pea

PRACTICE ABSTRACT #82**SHORT TITLE IN NATIVE LANGUAGE**

Slaucamo govju barības devas un amonjaka emisijas.

SHORT TITLE IN ENGLISH

Dairy Cow Feed Rations and Ammonia Emissions

COUNTRY AND CLIMATIC ZONE

Latvia - the temperate climate zone, specifically in the humid continental climate zone.

CONTACT

Silvija Dreijere (silvija.dreijere@lkkc.lv)

3 BENEFITS OF THE PRACTICE

1. Reducing nitrogen losses
2. Balancing feed rations
3. Ammonia emissions

PRODUCTION SYSTEM

Dairy cows

THEMATIC AREA

Livestock management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Saimniecībās, samazinot slāpekļa zudumus ganāmpulkā, palīdzam ne tikai vides saglabāšanai, bet arī uzlabojam saimniecības peļņas rādītājus.

Atgremotāji ne īpaši efektīvi izmanto ar barību uzņemto slāpekli. Ja barības devas ir ļoti precīzi sarēķinātas, tad 30 līdz 35 procenti no slāpekļa, kas ir barības olbaltumvielu sastāvā un neproteīna savienojumos, kļūst par piena sastāvdaļu. Pārējais slāpekļis no organisma tiek izvadīts pamatā ar urīnu un fēcēm. Apmēram 60 līdz 80 procenti no urīna slāpekļa ir urīnvielas formā.

Urīnvielas koncentrācija urīnā ir būtisks indikatorrādītājs amonjaka emisijām piena lopkopībā. Ar barības devām ir iespējams koriģēt gan urīna daudzumu, gan urīnvielas koncentrāciju urīnā, gan kopējo mēslu daudzumu. Ir pilnīgi skaidri jāsaprot, ka urīns un fēces atsevišķi emitē ļoti minimālus amonjaka daudzumus, bet tikai pēc nonākšanas uz grīdu virsmām novietnēs un abām šīm izdalījumu frakcijām fiziski sajaucoties notiek amonjaka izdalīšanās.

Ir arī papildu faktori, kas ietekmē amonjaka iztvaikošanu govju novietnēs. Tie ir temperatūra, gaisa plūsmas ātrums, pH, grīdas virsmu laukumu lielums, kūtsmēslu mitruma saturs un uzglabāšanas laiks. Piemēram, augsts pH un temperatūra veicina paaugstinātu amonjaka emisiju. Slaucamo govju kūtsmēslu pH parasti svārstās no 7,0 līdz 8,5, kas ļauj amonjakam diezgan ātri izdalīties atmosfērā.

Tiek uzskatīts, ka atmosfēras amonjaka un ķīmisko savienojumu nogulsņēšanās, kas rodas atmosfēras ķīmiskās reakcijās ar amonjaku (t.i., amonija aerosolu), veicina ūdens un augsnes paskābināšanos un eitrofikāciju. 1. attēlā parādīts slāpekļa cikls un ietekme gan uz ūdens, gan gaisa kvalitāti.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

On farms, reducing nitrogen losses in livestock not only helps to preserve the environment, but also improves the farm's bottom line.

Ruminant livestock are not very efficient at using the nitrogen they take up in feed. If rations are very precisely calculated, 30 to 35 percent of the nitrogen in feed proteins and non-protein compounds becomes a component of milk. The rest of the nitrogen is excreted from the body mainly in urine and faeces. About 60 to 80 per cent of urinary nitrogen is in the form of urea.

Urea concentration in urine is an important indicator of ammonia emissions in dairy farming. It is possible to adjust both the urine output, the urinary urea concentration and the total manure output with the feed ration. It must be clearly understood that urine and faeces separately emit very minimal quantities of ammonia, but only after they reach the floor surfaces in the housing and these two fractions of excreta physically mix, ammonia is released.

There are additional factors that influence the evaporation of ammonia in cow housing. These include temperature, air velocity, pH, size of floor surfaces, moisture content of manure and storage time. For example, high pH and temperature contribute to increased ammonia emissions. Dairy cow manure typically has a pH between 7.0 and 8.5, which allows ammonia to be released into the atmosphere quite quickly.

The deposition of atmospheric ammonia and chemical compounds resulting from atmospheric chemical reactions with ammonia (i.e. ammonium aerosol) is thought to contribute to water and soil acidification and eutrophication.

Thus, one solution is to balance feed rations as closely as possible to the amino acid needs of the cow: the amount of crude protein in the diets of high-yielding cows can be safely reduced, allowing farms to maintain high milk yields (above 35 kg per cow per day) while improving nitrogen use efficiency.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Saimniecībā, samazinot slāpekļa zudumus ganāmpulkā, palīdzam ne tikai vides saglabāšanai, bet arī uzlabojam saimniecības peļņas rādītājus.

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Ir divi veidi, kā mēs varam samazināt slāpekļa zudumus no govīm. Pirmais, spureklī dzīvojošajiem mikroorganismiem efektīvi “jāapēd” spureklī izmantojamais proteīns un slāpekļlis. Otrais, barības devas ir jāsabalansē maksimāli tuvu govju vajadzībām pēc aminoskābēm, lai tādējādi samazinātu kopējo proteīna daudzumu un attiecīgi arī samazinātu liekā slāpekļa daudzumu.

Barošana ar augstām proteīna devām ir nelabvēlīga ne tikai videi, bet arī dzīvniekiem. Pēc iespējas efektīvāka slāpekļa izmantošanās dzīvnieka organismā ir arī veids, kā samazināt piena ražošanas pašizmaksu. Ja aknas ir pārslogotas ar amonjaku, palielināsies urīnvielas līmenis asinīs, kā arī palielināsies piena urīnvielas (MUN) daudzums. Tas var nelabvēlīgi ietekmēt govju veselību un reprodukciju. Pārāk liela amonjaka daudzumu veidošanās govju organismā ir ēdināšanas rezultāts, kad pie spurekļa mikroorganismiem nonāk pārāk daudz slāpekļa un/vai proteīna. Lai no organisma izvadītu lieko slāpekli, ir nepieciešama papildus enerģija, kas attiecīgi var izraisīt izslaukuma samazināšanos un citu rādītāju pasliktināšanos. Liekais amonjaks nierēs un aknās tiek pārvērsts urīnvielā. Urīnviela ir mazs organisks savienojums, kas veidojas no oglekļa, slāpekļa, skābekļa un ūdeņraža. Pamatā tā tiek izvadīta no organisma ar urīnu, bet urīnvielas līmenim asinīs paaugstinoties, palielinās arī urīnvielas daudzums pienā.

Tieši tāpēc arī tiek noteikts urīnvielas daudzums pienā, lai varētu spriest par to, cik daudz no uzņemtā proteīna (slāpekļa) tiek zaudēts, jo netiek izmantots.

Sabalansējot barības devas pēc aminoskābju vajadzības, kopproteīna daudzumu augstākāgo govju barības devās pilnīgi droši var samazināt no 17,5 % uz 16,6%, tādējādi saimniecības sasniedz un notur augstus izslaukumus (virs 35 kg no govju dienā), kā arī uzlabo slāpekļa izmantošanās

efektivitāti. Ir arī otrs labums- kūtsmēslos samazinās slāpekļa daudzums un tas nozīmē, ka kūtsmēsļu izkliešanasai var iztikt ar mazāku hektāru daudzumu, lai nepārsniegtu pieļaujamās slāpekļa normas un hektāru.

Ļoti būtiska lieta, lai barības devā sekmīgi varētu samazināt kopproteīna līmeni, saimniecībā ēdināšanai ir jābūt precīzai un ir ļoti precīzi jāzina rupjās lopbarības ķīmiskais sastāvs jeb saimniecībā ir jābūt veiktām rupjās lopbarības analizēm.

LONGER DESCRIPTION – IN ENGLISH

On farms, reducing nitrogen losses in livestock not only helps to preserve the environment but also improves the farm's bottom line.

Ruminant livestock are not very efficient at using the nitrogen they take up in feed. If rations are very precisely calculated, 30 to 35 percent of the nitrogen in feed proteins and non-protein compounds becomes a component of milk. The rest of the nitrogen is excreted from the body, mainly in urine and faeces. About 60 to 80 percent of urinary nitrogen is in the form of urea.

Urea concentration in urine is an important indicator of ammonia emissions in dairy farming. It is possible to adjust both urine output, urinary urea concentration, and total manure output with the feed ration. It must be clearly understood that urine and faeces separately emit very minimal quantities of ammonia, but only after they reach the floor surfaces in housing and these two fractions of excreta physically mix is ammonia released.

There are additional factors that influence the evaporation of ammonia in cow housing. These include temperature, air velocity, pH, size of floor surfaces, moisture content of manure, and storage time. For example, high pH and temperature contribute to increased ammonia emissions. Dairy cow manure typically has a pH between 7.0 and 8.5, which allows ammonia to be released into the atmosphere quite quickly.

The deposition of atmospheric ammonia and chemical compounds resulting from atmospheric chemical reactions with ammonia (i.e. ammonium aerosol) is thought to contribute to water and soil acidification and eutrophication. Figure 1 shows the nitrogen cycle and its impact on both water and air quality.

There are two ways to reduce nitrogen losses from cows. First, the micro-organisms living in the rumen must effectively "consume" the protein and

nitrogen present. The second is to balance feed rations as closely as possible to the amino acid needs of the cow so that the total amount of protein is reduced, and the amount of excess nitrogen is correspondingly lowered.

Feeding high-protein diets is not only harmful to the environment but also to the animals. Making the most of nitrogen in the animal is also a way to reduce the cost of milk production. If the liver is overloaded with ammonia, blood urea levels will increase, as will the amount of milk urea (MUN). This can have adverse effects on cow health and reproduction. Excessive ammonia build-up in the cow results from overfeeding, when too much nitrogen and/or protein reaches the micro-organisms in the rumen. Additional energy is required to remove the excess nitrogen from the body, which can lead to a reduction in milk yield and other performance parameters. Excess ammonia is converted to urea in the kidneys and liver. Urea is a small organic compound formed from carbon, nitrogen, oxygen, and hydrogen. It is primarily eliminated from the body in the urine, but as blood urea levels rise, so does the amount of urea in milk.

This is why the amount of urea in milk is measured—to assess how much of the protein (nitrogen) intake is being lost due to inefficient utilization.

By balancing rations according to amino acid requirements, the amount of crude protein in the diets of high-yielding cows can be safely reduced from 17.5% to 16.6%, allowing farms to maintain high milk yields (above 35 kg per cow per day) while improving nitrogen use efficiency.

There is a second benefit: the amount of nitrogen in the manure is reduced, which means fewer hectares are needed for manure spreading to stay within nitrogen limits per hectare.

A very important factor in successfully reducing crude protein in the ration is accurate on-farm feeding and knowing the chemical composition of the forage very precisely—or conducting forage analyses on the farm.

PHOTOS

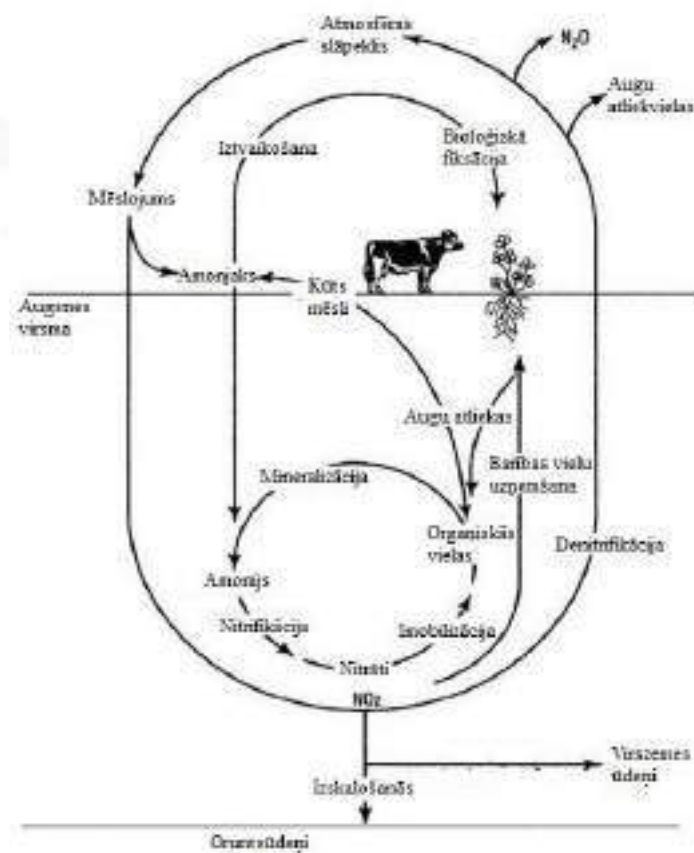


Figure 1: The nitrogen cycle and the impact on both water and air quality

PRACTICE ABSTRACT #83**SHORT TITLE IN NATIVE LANGUAGE**

Slaucamo govju barības devu bagātināšana ar taukvielām.

SHORT TITLE IN ENGLISH

Fat Supplementation of Dairy Cow Diets

COUNTRY AND CLIMATIC ZONE

Latvia - temperate climate zone, specifically in the humid continental climate zone.

CONTACT

Silvija Dreijere (silvija.dreijere@lkkc.lv)

3 BENEFITS OF THE PRACTICE

1. Feed enrichment
2. Reduction of methane emissions
3. Fats in dairy cow diets

PRODUCTION SYSTEM

Dairy cows

THEMATIC AREA

Livestock management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Barības bagātināšana ar taukvielām pamatojas uz atsevišķu barības sastāvdaļu, t.i. taukvielu (rapšu sēklas, linsēklas, saulespuķu eļļa, rapša eļļas), īpatsvara palielināšanu barībā 5 līdz 6% apmērā no sausas. Galvenā tauku ietekme izpaužas tā, ka ar taukiem barībā aizvieto citus enerģijas avotus, pamatā ogļhidrātus un samazina metāna veidošanos.

Zinātnieku pētījumos citās valstīs ar aitām, liellopiem un slaucamām govīm (Beauchemin et al., 2008), noskaidrots, ka katrs 1% tauku (uz sausi), samazina CH₄ emisiju par 2,2–7,3% apmērā:

- kokosriekstu eļļa par 7,3%;
- sojas un saulespuķu eļļa par 4,1%;
- linsēklu eļļa par 4,8%;
- rapšu eļļa par 2,5%;
- tauki (piesātinātās taukskābes) par 3,5%.

Sastādot barības devas (sk.1.attēlu) slaucamajām govīm, redzams, ka metāna emisiju samazinājumu par ~9% varam panākt iekļaujot rapšu sēklas vai rapšu eļļu, kas ir reāls risinājums ne tikai konvencionālajās, bet arī bioloģiskajās saimniecībās.

Samazinot mikrobu aktivitāti spureklī, samazinās kokšķiedras sagremošana un mainās gaistošo taukskābju (VFA) - etiķskābes (60-70 %), propionskābes (20-25 %) un sviestskābes (10-15 %) - profils. Disbalanss ietekmē piena tauku/proteīnu un metāna emisiju. Etiķskābes un propionskābes attiecība ietekmē ūdeņraža izmantošanu metāna ražošanai; tipiskā attiecība ir no 9:1 līdz 4:1. Pareizs barības sastāvs var samazināt metāna zudumus. Pētījumi liecina, ka 5 % tauku daudzums barības devā uzlabo izslaukumu laktācijas sākumā, un govīs var izmantot 0,45 g pievienoto tauku dienā. Uz graudiem balstītas barības devas ar taukiem saglabā enerģijas un kokšķiedras uzņemšanu. Tauku piedevas līdz 5 % ir efektīvas, jo īpaši lielos ganāmpulkos, kas sagrupēti pēc laktācijas fāzes. Tauku pievienošana samazina CH₄ emisijas - par 5% vairāk tauku samazina emisijas par 5%. Barības devu modelēšana liecina, ka rapšu eļļa samazina metānu par ~9%, piedāvājot daudzsološu stratēģiju gan bioloģiskajām, gan tradicionālajām saimniecībām, lai samazinātu SEG emisijas, vienlaikus saglabājot produktivitāti.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Fat enrichment involves increasing the proportion of certain feed ingredients—such as fatty substances (rapeseed, linseed, sunflower oil,

rapeseed oil)—to 5–6% of dry matter in the feed. The primary effect of fat supplementation is to replace other energy sources, mainly carbohydrates, and to reduce methane production.

Scientific studies on sheep, cattle, and dairy cows in other countries (Beauchemin et al., 2008) have shown that for every 1% increase in fat (on a dry matter basis), CH₄ emissions decrease by 2.2–7.3%:

- **Coconut oil:** 7.3% reduction
- **Soybean and sunflower oil:** 4.1% reduction
- **Linseed oil:** 4.8% reduction
- **Rapeseed oil:** 2.5% reduction
- **Fats (saturated):** 3.5% reduction

By formulating feed rations for dairy cows, it is evident that including rapeseed or rapeseed oil can reduce methane emissions by approximately 9%. This approach is a viable option not only for conventional farms but also for organic farms.

Reducing microbial activity in the rumen lowers fiber digestion and alters volatile fatty acid (VFA) profiles—acetic (60–70%), propionic (20–25%), and butyric acid (10–15%). Imbalances affect milk fat/protein and methane emissions. The acetic-to-propionic acid ratio influences hydrogen use for methane production; typical ratios range from 9:1 to 4:1. Proper feed composition can reduce methane losses. Studies show 5% dietary fat improves early lactation milk yield, with cows able to utilize 0.45 g/day of added fat. Grain-based diets with fat maintain energy and fiber intake. Supplementing up to 5% fat is effective, especially in large herds grouped by lactation phase. Fat enrichment reduces CH₄ emissions—1% more fat lowers emissions by 5%. Feed modeling shows rapeseed oil reduces methane by ~9%, offering a promising strategy for both organic and conventional farms to cut GHG emissions while maintaining productivity.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Barības bagātināšana ar taukvielām pamatojas uz atsevišķu barības sastāvdaļu, t.i. taukvielu (rapšu sēklas, linsēklas, saulespuķu eļļa, rapša eļļas), īpatsvara palielināšanu barībā 5 līdz 6% apmērā no sausas. Galvenā tauku ietekme izpaužas tā, ka ar taukiem barībā aizvieto citus enerģijas avotus, pamatā ogļhidrātus un samazina metāna veidošanos.

Ārvalstu zinātnieki pētījumos ir nonākuši pie vairākiem secinājumiem par metāna emisiju samazināšanas iespējām no liellopu zarnu trakta un kā

viens no risinājumiem tiek piedāvāts, lopbarības bagātināšana ar taukvielām.

Barības bagātināšanas ar taukvielām pamatā ir atsevišķu barības sastāvdaļu, tas ir taukvielu – dažādu augu eļļu (saulespuķu, rapša, linsēklu, kaņepju, kokvilnas un citas eļļas) īpatsvara palielināšanu barībā. Dzīvnieku ēdināšanas zinātnieki Latvijā iesaka pievienot augu eļļas spēkbarības maisījumiem vai pilnīgi samaisītai barības devai (TMR) slaucamām govīm, grūsnām telēm, vaislas telēm, 6–12 mēnešus veciem jaunlopiem, 3–6 mēnešus veciem teļiem 5% barības sausrnā, nobarojamiem un gaļas liellopiem 3% (Latvietis 1991,1998, 2013; Osītis 2000).

Zinātnieku pētījumos citās valstīs ar aitām, liellopiem un slaucamām govīm (Beauchemin et al., 2008), noskaidrots, ka katrs 1% tauku (uz sausrni), samazina CH₄ emisiju par 2,2–7,3% apmērā:

- kokosriekstu eļļa par 7,3%;
- sojas un saulespuķu eļļa par 4,1%;
- linsēklu eļļa par 4,8%;
- rapšu eļļa par 2,5%;
- tauki (piesātinātās taukskābes) par 3,5%.

Galvenā tauku ietekme izpaužas caur to, ka tauki barībā daļēji var aizstāt ogļhidrātus, kas dzīvnieku spureklī notiekošo bioloģisko procesu rezultātā tiek pārstrādāti, iegūstot enerģiju, un kā fermentācijas procesa blakusprodukts rodas CH₄. Savukārt tauki tiek pārstrādāti zarnās, kur CH₄ veidošanās nenotiek. Turklāt nepiesātinātās taukskābes, kas atrodas linsēklās, rapšu sēklās, saulespuķu sēklās, selektīvi iedarbojas uz spurekļa mikroorganismiem, samazinot to aktivitāti, tādējādi veicinot mazākas CH₄ emisijas.

Samazinoties mikroorganismu (infuzoriju, rauga sēņu, baktēriju) daudzumam un aktivitātei spureklī, samazinās apēstas barības šķiedrvielu (celuloze, hemiceluloze) pārstrāde spureklī. Netiek veidotas pareizās attiecībās gaistošās taukskābes (etiķskābe 60–70%, propionskābe 20–25%, sviestskābe 10–15%), kas ietekmē produkcijas ražošanu, dzīvnieka vielu maiņu un it īpaši atsaucas uz piena sastāva izmaiņām (var strauji pazemināties piena tauku, kā arī olbaltumvielu saturs pienā) (Latvietis, 1991.) Tas var izraisīt arī urīnvielas satura paaugstināšanos pienā.

Gaistošo taukskābju veidošanās mehānisms spureklī regulē pieejamo ūdeņradi sekojošai metāna ražošanai. Principāli, propionskābes frakcija, kas

tiek saražota spureklī, attiecībā pret etiķskābi ir galvenais ietekmējošais faktors. Ja etiķskābes attiecība pret propionskābi ir 5, tad enerģijas zudumi metānā ir 0%, ja visi ogļhidrāti tiek fermentēti etiķskābē un propionskābe netiek veidota, tad enerģijas zudumi metānā var būt 33%. Parasti etiķskābes: propionskābes attiecība ir aptuveni no 9–4 (Johnson and Johnson, 1995). Šo gaistošo taukskābju veidošanos mehānismu spureklī ietekmē barības līdzekļi barības devā, tāpēc barības līdzekļu izvēle un barības devu sastādīšana atbilstoši dzīvnieku vajadzībām, ir svarīgs metāna ierobežošanas pasākums.

Pētījumi, kas ilga vairākās laktācijās, parādīja, ka 5% tauku kopējā barības devas sausnā deva maksimālo piena produkcijas ieguvu agrā laktācijā (Palmquist, 1983). Papildus taukiem, kas ietilpst parastajos barības līdzekļos, govij jābūt spējīgai izlietot vēl papildus 0,45 g dienā tauku (Palmquist, 1983). Parasti svarīgākais viegli izmantojamais enerģijas avots slaucamām govīm ir graudi. Pievienojot barības devā cieti saturošiem graudu barības līdzekļiem taukus, var uzturēt augstu enerģijas koncentrāciju, vienlaicīgi arī augstu kokšķiedras patēriņu (Palmquist and Conrad, 1980). Tātad taukus var palielināt līdz 5% kopējā barības devas sausnā laktācijas sākumā, kad govīm parasti ir enerģijas deficīts, neatstājot negatīvu ietekmi uz govs vielmaiņu un produkcijas ražošanu. Tas var attaisnoties saimniecībās, kur govis grupē pēc laktācijas fāzēm, ganāmpulkos virs 50 govīm (projekta atskaite „Lauksaimniecības sektora SEG emisiju aprēķina metodoloģijas un datu analīzes ar modelēšanas rīku izstrāde, integrējot klimata pārmaiņas” Līguma Nr.2014/94).

Pasākuma ietekme uz SEG emisijām

Pētījumos ir pierādīts, ka, palielinot barības devas sausnā tauku īpatsvaru par 1% CH₄ emisijas samazinās par 5% (Grainger, Beauchemin, 2011). Sastādot barības devas (sk.1.attēlu) slaucamajām govīm, redzams, ka metāna emisiju samazinājumu par ~9% varam panākt iekļaujot rapšu sēklas vai rapšu eļļu, kas ir reāls risinājums ne tikai konvencionālajās, bet arī bioloģiskajās saimniecībās.

LONGER DESCRIPTION – IN ENGLISH

Fat enrichment involves increasing the proportion of certain feed ingredients, specifically fatty substances (rapeseed, linseed, sunflower oil, rapeseed oil), to 5–6% of dry matter in the feed. The primary effect of fat supplementation is to replace other energy sources, mainly carbohydrates, and to reduce methane production.

Research by international scientists has explored various strategies to reduce methane emissions from the intestinal tract of cattle, with one proposed solution being fat enrichment in feed through the inclusion of fatty acids.

Fat enrichment involves increasing the proportion of fatty acids in the diet by incorporating various vegetable oils (e.g., sunflower, rapeseed, linseed, hemp, cottonseed). Animal nutrition scientists in Latvia recommend adding vegetable oils to compound or complete mixed rations (TMR) at 5% of dry matter for dairy cows, pregnant heifers, breeding heifers, youngstock (6–12 months), and calves (3–6 months), and 3% for fattening and beef cattle (Latvian, 1991, 1998, 2013; Ositis, 2000).

Scientific studies on sheep, cattle, and dairy cows (Beauchemin et al., 2008) indicate that every 1% increase in fat (on a dry matter basis) reduces CH₄ emissions by 2.2–7.3%:

- **Coconut oil:** 7.3% reduction
- **Soybean and sunflower oil:** 4.1% reduction
- **Linseed oil:** 4.8% reduction
- **Rapeseed oil:** 2.5% reduction
- **Saturated fats:** 3.5% reduction

Fat supplementation partially replaces carbohydrates, which are fermented in the rumen, producing CH₄ as a by-product. In contrast, fat is processed in the intestine, where methane is not generated. Additionally, unsaturated fatty acids found in linseed, rapeseed, and sunflower seeds selectively inhibit certain microorganisms in the rumen, reducing their activity and thereby lowering CH₄ emissions.

The reduction in microbial activity (infusoria, yeast fungi, bacteria) in the rumen decreases fiber digestion (cellulose, hemicellulose), impacting the formation of volatile fatty acids (VFAs):

- **Acetic acid:** 60–70%
- **Propionic acid:** 20–25%
- **Butyric acid:** 10–15%

An imbalance in these VFAs affects production, metabolism, and milk composition, as milk fat and protein content can decrease rapidly (Latvian, 1991). The rumen fermentation mechanism regulates hydrogen availability for methane production. The acetic-to-propionic acid ratio is a key factor:

- If the ratio is 5:1, methane energy loss is 0%.

- If all carbohydrates ferment into acetic acid without propionic acid production, methane energy loss can reach 33%.
- Typical acetic-to-propionic acid ratios range from 9:1 to 4:1 (Johnson and Johnson, 1995).

Since the formation of VFAs is influenced by feed composition, proper diet formulation plays a crucial role in methane reduction strategies.

Impact on Milk Production and GHG Emissions

Long-term studies indicate that 5% fat in total dry matter optimizes milk production in early lactation (Palmquist, 1983). In addition to naturally occurring fats, cows can utilize an additional 0.45 g/day of fat (Palmquist, 1983).

The most accessible energy source for dairy cows is grain. Adding fat to starchy, grain-based diets maintains high energy levels while allowing for adequate fiber intake (Palmquist and Conrad, 1980). Fat supplementation up to 5% of dry matter at the start of lactation helps address energy deficits without negatively impacting metabolism and production. This strategy is particularly effective on farms grouping cows by lactation phase, especially in herds with more than 50 cows (Project report: "Development of a methodology for estimation of GHG emissions from the agricultural sector and data analysis with modeling tools integrating climate change" Contract No 2014/94).

Impact of Fat Enrichment on GHG Emissions

Studies have shown that increasing dietary fat by 1% reduces CH₄ emissions by 5% (Grainger, Beauchemin, 2011). Feed ration modeling (see Figure 1) suggests that incorporating rapeseed or rapeseed oil can lower methane emissions by ~9%, making it a viable solution for both conventional and organic farms.

PHOTOS

Barības līdzekļi, kg sausas						
Skābbarība, zāles (DDM-67%, prot.-18%, ADF-28%)	13,5	14	7	7	7	7
Skābbarība, kukurūzas (DDM-68%)			7	7	7	7
Tritikāle	7,2	6,5	5	4	4	4
Rapšu rauši	1,3	1,2	1,9	2,5	2	2
Sojas spraukumi	0,5	0,9	1,5	1,5	1,4	1,7
Tauki (LipitecBovi)				0,25		
Rapšu sēklas					0,7	
Rapšu eļļa						0,3
Rezultāti						
Izslaukums, kg EKP gadā	10000	10000	10000	10000	10000	10000
Izslaukums, kg EKP dienā	35,3	35,3	35,1	35,3	35,3	35,2
Slāpeklis ar urīnu, g/d	217,7	234,4	191,3	206	196,9	197,5
Metāns g/d	520	518	517	485	477	476
Metāns MJ/d	29	29	29	27	27	26
Metāns MJ/kg EKP	0,82	0,83	0,82	0,77	0,76	0,76

Figure 1: Feed rations for dairy cows (in Latvian)

PRACTICE ABSTRACT #84**SHORT TITLE IN NATIVE LANGUAGE**

Estrategias de manejo sostenible del suelo para mejorar la fertilidad y la eficiencia en el uso del agua en agricultura

SHORT TITLE IN ENGLISH

Sustainable Soil Management Strategies to Improve Fertility and Water Efficiency in Agriculture

COUNTRY AND CLIMATIC ZONE

Spain, Mediterranean and Semi-arid Climate

CONTACT

Eduardo Crisol-Martinez, Head of Research at CIT COEXPHAL
(ecrisol@coexpthal.es)

3 BENEFITS OF THE PRACTICE

1. Improved soil fertility & structure
2. Enhanced water retention & efficiency
3. Reduction of soil degradation & erosion

PRODUCTION SYSTEM

Arable and horticultural farming

THEMATIC AREA

Soil health and biodiversity, water management, crops management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

El manejo inadecuado del suelo contribuye a su degradación y a un uso ineficiente del agua en la agricultura. Esta práctica propone estrategias sostenibles para mejorar la fertilidad y la retención de agua, asegurando una mayor productividad y sostenibilidad a largo plazo. El estudio destaca los beneficios del uso de enmiendas orgánicas, reducción del laboreo y cultivos de cobertura. Estas técnicas aumentan la materia orgánica, mejoran la estructura del suelo y optimizan la infiltración de agua, reduciendo la erosión y la necesidad de insumos químicos. Los agricultores pueden aplicar estas técnicas para mejorar el rendimiento de sus cultivos, reducir costes y fortalecer la resiliencia climática.

El manejo sostenible del suelo es clave para la adaptación al cambio climático en la agricultura. Las prácticas de laboreo reducido, enmiendas orgánicas y cultivos de cobertura permiten incrementar la retención de agua en el suelo, reducir la erosión y mejorar la biodiversidad microbiana. Estas estrategias han demostrado ser efectivas en sistemas mediterráneos y semiáridos, donde el agua es un recurso limitado. Su adopción puede traducirse en un ahorro en insumos, mayor estabilidad en los rendimientos y una mejora en la resiliencia de los cultivos ante eventos climáticos extremos. Además, estas prácticas contribuyen a la mitigación del cambio climático al incrementar la captura de carbono en el suelo.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Poor soil management leads to degradation and inefficient water use in agriculture. This document presents sustainable strategies to improve fertility and water retention, ensuring higher productivity and long-term sustainability. The study highlights the benefits of using organic amendments, reduced tillage, and cover crops. These techniques increase organic matter, improve soil structure, and enhance water infiltration, reducing erosion and the need for chemical inputs. Farmers can adopt these methods to improve crop yields, reduce costs, and strengthen climate resilience.

Sustainable soil management is essential for climate adaptation in agriculture. Reduced tillage, organic amendments, and cover crops enhance water retention, reduce erosion, and improve microbial biodiversity. These strategies have proven effective in Mediterranean and semi-arid systems where water is a limiting factor. Their adoption can lead

to lower input costs, more stable yields, and increased crop resilience against extreme weather events. Additionally, these practices contribute to climate change mitigation by increasing soil carbon sequestration.

ADDITIONAL INFORMATION

Facilitating elements include availability of organic amendments, farmer training, and policy incentives for sustainable soil management. Barriers might include initial investment costs, lack of know-how – particularly for conventional farms. Future research should focus on region-specific adaptation of these practices and their economic benefits.

PHOTOS



Photo 1: Soils with low content of organic matter might be compacted, forcing crop roots to become more horizontal, thus reducing their potential to absorb water and nutrients across the soil profile.



Photo 2: Soil profiling is a key step to acquiring knowledge about the soil and helping farmers with decision making.

PRACTICE ABSTRACT #85**SHORT TITLE IN NATIVE LANGUAGE**

Einsatz von Pflanzenkohle in deutschen Betrieben – Vorteile für Klima, Boden- und Tiergesundheit

SHORT TITLE IN ENGLISH

Use of Biochar in German Farms - Benefits for Climate, Soil and Animal Health

COUNTRY AND CLIMATIC ZONE

Germany, warm-temperate mid-latitude climate zone

CONTACT

Jana Bolduan (jana.bolduan@gruenlandzentrum.de)

3 BENEFITS OF THE PRACTICE

1. GHG Reduction & Carbon Storage: CO₂ sequestration in soil, biochar as a carbon sink.
2. Soil Fertility Enhancement: Improved structure, aeration, water retention, nutrient availability, higher yields.
3. Animal Health Optimization: Feed and bedding additive benefits—reduces toxins, enhances hygiene, supports hoof health.

PRODUCTION SYSTEM

All production systems

THEMATIC AREAS

Soil health and biodiversity, herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Pflanzenkohle ist ein poröses, kohlenstoffreiches Material, welches entsteht, wenn pflanzliche Biomasse unter Luftabschluss bei sehr hohen Temperaturen erhitzt wird (Pyrolyse). Während dieses Prozesses wird ein großer Teil des Kohlenstoffs, der ursprünglich in den Pflanzen gebunden war, nicht in die Atmosphäre als CO₂ freigesetzt, sondern bleibt in der Pflanzenkohle viele Jahre stabil gebunden. So kann sie aktiv zum Klimaschutz beitragen und die Klimabilanz von landwirtschaftlichen Betrieben optimieren.

Die Bodenfruchtbarkeit spielt für die Ertragsstabilität eine entscheidende Rolle. Pflanzenkohle kann hierzu positiv beitragen, indem sie die Wasserspeicherung fördert sowie die Bodenbelüftung optimiert. Außerdem kann Pflanzenkohle Nährstoffe an sich binden und so zu einer höheren Nährstoffverfügbarkeit beitragen. Dies kann die Auswaschung von Nährstoffen verringern und den Bedarf an synthetischen Düngemitteln reduzieren. Eine praxistaugliche Möglichkeit zur Ausbringung von Pflanzenkohle ist die Nutzung als Güllezusatz.

Ein weiterer Vorteil des Einsatzes von Pflanzenkohle ist die Optimierung der Nutztiergesundheit. Pflanzenkohle kann als Futtermittelzusatz verwendet werden, um den Verdauungstrakt der Tiere zu unterstützen. Sie bindet Toxine, Schadstoffe und überschüssige Gase im Magen-Darm-Trakt. Dies kann Erkrankungen vorbeugen und die allgemeine Gesundheit der Tiere fördern. Pflanzenkohle kann auch als Einstreu z.B. in der Milchviehhaltung verwendet werden. Durch ihre Fähigkeit, Feuchtigkeit und Schmutz zu absorbieren, bleiben die Liegeflächen so trockener. Dies kann das Wachstum von Bakterien und anderen Krankheitserregern hemmen und somit das Risiko von Infektionen oder Hautproblemen verringern. Zudem trägt eine trockene und saubere Einstreu zur Vorbeugung von Klauenerkrankungen bei.

Insgesamt sollte ein besonderes Augenmerk auf die Herkunft, Herstellung sowie Qualität der Pflanzenkohle gelegt werden, damit sich die beschriebenen Vorteile entfalten können.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Biochar is a porous, carbon-rich material that is produced when plant biomass is heated at very high temperatures in the absence of air (pyrolysis). During this process, a large proportion of the carbon that was originally

bound in the plants is not released into the atmosphere as CO₂ but remains stably bound in the biochar for many years. In this way, it can actively contribute to climate protection and optimize the carbon footprint of agricultural farms.

Soil fertility plays a decisive role in yield stability. Biochar can make a positive contribution to this by promoting water retention and optimizing soil aeration. In addition, biochar can bind nutrients and so contribute to higher nutrient availability. This can reduce the leaching of nutrients and lower the need for synthetic fertilizers. One practical way of applying biochar is to use it as a manure additive.

One advantage of using biochar in cattle farming is the optimization of animal health. Biochar can be used as a feed additive to support the animals' digestive tract. It binds toxins, harmful substances and gases in the gastrointestinal tract. This can prevent illness and promote the general health of the animals. Biochar can also be used as bedding, e.g. in dairy farming. Due to the ability of biochar to absorb moisture and dirt, the lying surfaces remain drier. This can inhibit the growth of bacteria and other pathogens and thus reduce the risk of infections or skin problems. In addition, dry and clean bedding helps to prevent claw diseases.

Overall, special attention should be paid to the origin, production and quality of biochar so that the benefits described can unfold.

PHOTOS



Photo 1: Biochar from <https://block-pflanzenkohle.de/>



Photo 2: Biochar from <https://german-biochar.org/pflanzenkohle/>

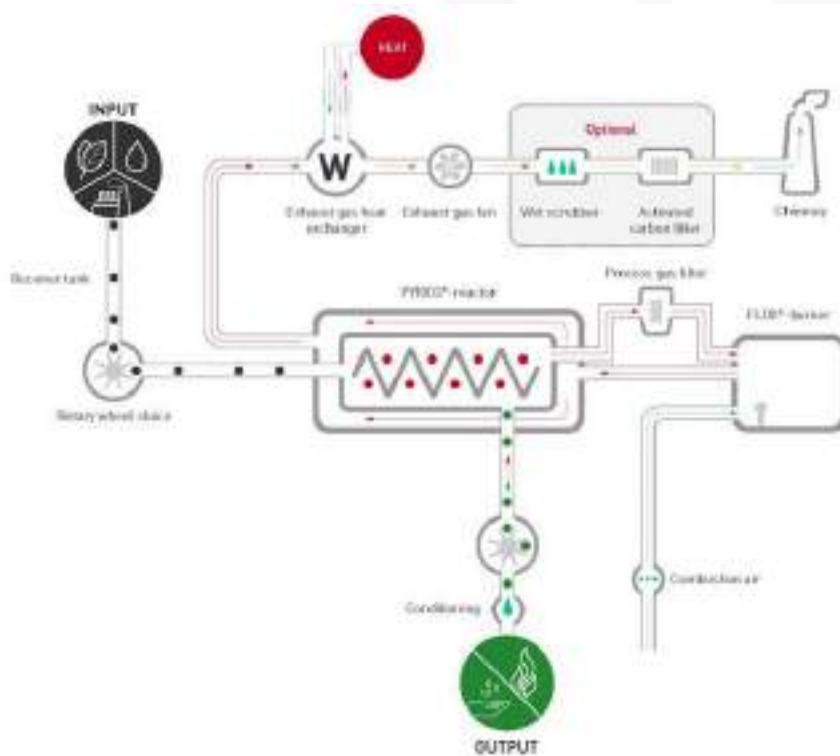


Photo 3: Example of one pyrolysis technique: <https://pyreg.com/de/unsere-technologie-alt/>



Photo 4: Example of one pyrolysis technique: <https://pyreg.com/de/unsere-technologie-alt/>

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

CFD webinar biochar

URL:

<https://www.youtube.com/watch?v=hEacHJIFStI>

Title/Description

General information about German biochar

URL:

<https://german-biochar.org/pflanzenkohle/>

Title/Description

Examples of pyrolysis

URL:

<https://www.3r-systems.de/>, <https://pyreg.com/applications/biochar/>

Title/Description

Consulting biochar in Germany

URL:

<https://biochar-zero.com/de/>

Title/Description

Farmer Mathis Block using biochar

Mathis Block runs a dairy farm in northern Germany together with his brother. After taking over the farm, the brothers began to focus more intensively on sustainable and innovative solutions in agriculture. They came across the production and use of biochar - a topic that still fascinates them today and is successfully integrated into the farm.

URL:

<https://block-pflanzenkohle.de/>

PRACTICE ABSTRACT #87**SHORT TITLE IN ENGLISH**

Reducing the Age of Slaughter to Mitigate GHG Emissions and Increasing Farm Profitability

COUNTRY AND CLIMATIC ZONE

Ireland

CONTACT

John Greaney (john.greaney@teagasc.ie)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Reduction of GHG emissions
2. Increased farm profitability
3. Reducing the age of slaughter

PRODUCTION SYSTEM (IF RELEVANT)

Beef

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

One of the key mitigation measures gaining popularity among beef pilot demo farmers in Ireland is reducing the age of slaughter. This action not only lowers total farm GHG emissions but also allows farmers to increase

profitability by selling animals earlier. At a recent farm walk, Gareth Peoples set a goal to reduce the slaughter age from 27 months to 24 months.

Reducing slaughter age by three months can cut methane emissions by approximately 19 kg per animal over its lifetime. Since methane is more harmful than CO₂, this reduction is a valuable climate achievement.

Gareth explained that achieving greater weights at younger ages depends on several factors. Hitting key targets at weaning, yearling, and finishing stages ensures animals stay on track for optimal performance. He emphasized the importance of selecting dairy beef calves with higher genetic merit, using the Dairy Beef Index to purchase better-quality stock, focusing on carcass weight and conformation.

Another major advantage is the cost savings associated with earlier finishing. Farmers benefit from lower feed costs and reduced enteric fermentation emissions. To ensure continuous animal growth, farmers must focus on calf rearing, housing, and spring grassland management.

The demo event in Donegal highlighted the importance of adaptation and mitigation measures for reducing on-farm emissions. It also reinforced the value of knowledge sharing and collaboration in advancing sustainable agriculture through climate-smart farming.

Upcoming events in Ireland and across Europe will allow farmers to exchange insights, learn from each other, and work collectively toward a more resilient, climate-smart agricultural sector.

PHOTOS



Photo 1: Dairy Beef 500 Walk in Donegal, Ireland



Photo 2: Dairy Beef 500 Walk in Donegal, Ireland

Source: Teagasc

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Dairy Beef 500 Walk

URL:

<https://climatefarmdemo.eu/spring-walk-donegal-ireland/>

PRACTICE ABSTRACT #89**SHORT TITLE IN NATIVE LANGUAGE**

Il sovescio: misura ambientale per la produzione di frutta sostenibile.

SHORT TITLE IN ENGLISH

Green Manure: Environmental Measure for Sustainable Fruit Production

COUNTRY AND CLIMATIC ZONE

Italy and Mediterranean area

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Farm production efficiency
2. Environmental sustainability
3. Mitigation strategies

PRODUCTION SYSTEM

Fruit and vegetables production

THEMATIC AREA/SECTOR

Fruits sector, soil health and biodiversity

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Fra le pratiche agronomiche usate per aumentare la fertilità, migliorare la struttura del suolo, migliorare la biodiversità e diminuire l'impatto

ambientale dei sistemi agricoli c'è il sovescio che viene definito come letame verde, perché può, appunto, sostituire le deiezioni animali nella concimazione organica dei terreni coltivati. Questa pratica agronomica viene utilizzata nell'orticoltura per contrastare il deteriorarsi della fertilità. Il sovescio è una tecnica che consiste nella semina di specifiche erbacee intercalari in rotazione con colture ad alto reddito. Lo scopo è quello di interrare le intercalari e migliorare così le performance produttive della coltura orticola successiva in rotazione oppure di un frutteto o di un vigneto. La funzione fondamentale del sovescio è comunque l'aumento di sostanza organica nel suolo, conseguente all'interramento della massa vegetale, con tutti i benefici che ne derivano. La massima utilità di questa pratica si ottiene utilizzando leguminose, graminacee o grano saraceno che assorbono azoto; miscugli che abbiano cicli biologici di durata molto simile in modo tale da avere una fioritura omogenea, miscugli che abbiano una trinciatura grossolana i cui residui siano lasciati essiccare in campo prima dell'interramento in modo tale da apportare una levata quantità di sostanza organica nel terreno. L'osservazione di queste semplici "regole" unita ad una precisa programmazione permette alle aziende di apportare al terreno grandi quantità di sostanza organica di qualità elevata. Il terreno così si arricchisce di tutti quei fattori che ne vanno a comporre la fertilità biologica a tutto vantaggio delle aziende che possono disporre di un substrato su cui produrre con migliori risultati. La scelta oculata della composizione del sovescio consente poi di preparare, già in questa fase, un substrato più "accogliente" per la coltura che lo seguirà.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Among the agronomic practices used to increase fertility, improve soil structure, enhance biodiversity and reduce the environmental impact of agricultural systems, green manure plays a key role. It is referred to as green manure because it can replace animal waste in the organic fertilization of cultivated land. This practice is widely used in horticulture to counteract the deterioration of soil fertility.

Green manure involves sowing specific intercalary herbaceous plants in rotation with high-income crops. The goal is to bury these plants to improve the productive performance of the next horticultural crop, orchard, or vineyard. However, its primary function is to increase organic matter in the soil by incorporating the plant mass, with all the resulting benefits.

The maximum benefit of this practice is achieved by using legumes, grasses, or buckwheat, which effectively absorb nitrogen. Ideal seed mixtures should have biological cycles of similar duration to ensure uniform flowering. Additionally, mixtures with coarse shredding should be used, with residues left to dry in the field before burial, maximizing the organic matter contribution to the soil.

Following these simple guidelines, combined with careful planning, allows farms to add large quantities of high-quality organic material to the soil. This enriches the soil with key biological fertility factors, benefiting farms by providing a more productive substrate.

A carefully chosen green manure composition also helps prepare a more favorable growing environment for the next crop, ensuring better agricultural results.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Fra le pratiche agronomiche usate per aumentare la fertilità, migliorare la struttura del suolo, migliorare la biodiversità e diminuire l'impatto ambientale dei sistemi agricoli c'è il sovescio che viene definito come letame verde, perché può, appunto, sostituire le deiezioni animali nella concimazione organica dei terreni coltivati. Questa pratica agronomica viene utilizzata non solo nelle aziende agricole convenzionali e biologiche, ma riscuote un grande successo anche nelle aziende che producono frutta per contrastare il deteriorarsi della fertilità. Il sovescio consiste nell'alternare la coltivazione di normali colture a coltivazioni di famiglie vegetali specifiche che presentano particolari caratteristiche e che vengono trinciate per poi essere interrate, permettendo così l'aumento della fertilità del terreno. Con questa tecnica si riesce ad apportare una notevole quantità di sostanza organica nel terreno quando non è possibile utilizzare il letame. I benefici che si possono ottenere dalla pratica del sovescio sono:

- una migliore gestione dell'azoto attraverso i noduli radicali, in particolar modo quelli delle leguminose, viene fissato l'azoto atmosferico (N₂) e reso direttamente utilizzabile dalla pianta;
- rende il terreno più soffice e lavorabile;
- consente un maggiore accumulo di acqua e nutrienti nel terreno;
- contribuisce a mantenere la stabilità strutturale del terreno e lo preserva dall'erosione e dagli agenti atmosferici grazie allo strato superficiale formato dai vegetali e all'azione dell'apparato radicale nel sottosuolo.

- Oltre al controllo delle malerbe, le colture da sovescio, fungono da fitofarmaci naturali contro microrganismi patogeni, grazie a sistemi naturali di difesa rilasciati dall'apparato radicale grazie alla biofumigazione che consiste nel rilascio di molecole biocide, che non vanno ad intaccare la salubrità della pianta, a differenza dell'agricoltura intensiva che utilizza pesticidi con conseguente rilascio di ammoniaca nell'aria.
- Il sovescio svolge inoltre un'azione estetica, infatti al momento della fioritura, se viene effettuata una semina con più essenze, possiamo osservare i vari colori dei fiori delle varie tipologie di piante;
- un'azione melifera perché alcune essenze svolgono una importante attrazione verso insetti utili come le api.

Le specie vegetali più comuni per la semina dei sovesci sono le seguenti categorie:

- Leguminose (trifoglio, veccia, fava, lupinella, pisello proteico) che apportano azoto grazie alla simbiosi radicale con i batteri azotofissatori;
- graminacee (orzo, segale, avena, festuca) che assorbono azoto o il grano saraceno.

Una buona pratica di sovescio che viene fatta grazie alla presenza di varietà nel miscuglio con cicli biologici di durata molto simile in modo tale da avere una fioritura omogenea, ad una trinciatura grossolana e ad un'essiccazione dei residui prima dell'interramento consente di ottenere un buon apporto di sostanza organica nel terreno che dipende inoltre dal rapporto C/N. L'osservazione di queste semplici "regole" unita ad una precisa programmazione permette alle aziende di apportare al terreno grandi quantità di sostanza organica di qualità elevata. Il terreno così si arricchisce di tutti quei fattori che ne vanno a comporre la fertilità biologica a tutto vantaggio delle aziende che possono disporre di un substrato su cui produrre con migliori risultati. La scelta oculata della composizione del sovescio consente poi di preparare, già in questa fase, un substrato più "accogliente" per la coltura che lo seguirà.

LONGER DESCRIPTION – IN ENGLISH

Among the agronomic practices used to increase fertility, improve soil structure, enhance biodiversity, and reduce the environmental impact of agricultural systems, green manure plays a key role. It is called green manure because it can replace animal waste in the organic fertilization of cultivated land. This practice is used not only on conventional and organic

farms but is also widely adopted in fruit-producing farms to counteract soil fertility loss.

Green manure involves alternating normal crops with specific plant families that have particular characteristics. These plants are chopped and buried, enriching soil fertility. This technique allows for a significant increase in organic matter when manure is not available.

The benefits of green manure include:

- **Better nitrogen management:** Root nodules, especially those of legumes, fix atmospheric nitrogen (N₂), making it directly available to plants.
- **Improved soil structure:** Makes the soil softer and more workable while increasing water and nutrient retention.
- **Erosion prevention:** Enhances structural stability and protects against erosion and weathering, thanks to the surface layer of plants and the root system in the subsoil.
- **Natural pest control:** Green manure crops act as natural pesticides by releasing biocidal molecules (biofumigation) from their roots, unlike intensive agriculture, which relies on chemical pesticides that release ammonia into the air.
- **Weed suppression:** Helps control weed growth by competing for resources.
- **Aesthetic and ecological benefits:** During flowering, mixed-species sowing creates colorful landscapes, while honey-producing plants attract beneficial insects such as bees.

The most used **green manure plants** belong to these categories:

- **Legumes** (clover, vetch, broad bean, sainfoin, protein pea) provide nitrogen through root symbiosis with nitrogen-fixing bacteria.
- **Grasses** (barley, rye, oats, fescue) and buckwheat help absorb nitrogen from the soil.

A good green manure practice involves selecting varieties with similar biological cycles to ensure uniform flowering. Proper shredding and drying of residues before burial maximizes the organic matter supply, which also depends on the carbon-to-nitrogen (C/N) ratio.

Following these simple principles, combined with precise planning, allows farms to enrich the soil with large quantities of high-quality organic matter. This enhances biological fertility, providing farmers with a more productive substrate for future crops. The careful selection of green

manure composition ensures that the soil is well-prepared for the next crop, creating a more favorable growing environment right from the start.

PRACTICE ABSTRACT #96**SHORT TITLE IN NATIVE LANGUAGE**

Adoptarea agro-silviculturii prin plantarea de arbori in fermele vegetale înființate in câmp deschis

SHORT TITLE IN ENGLISH

Adopting Agroforestry by Planting Trees in Open-field Vegetal Farms

COUNTRY AND CLIMATIC ZONE

Romania - continental temperate zone

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Biodiversity & Pest Control: beneficial insects, birds, wildlife, natural pest control, reduce chemical pesticides
2. Soil Health: tree roots, soil stabilization, erosion prevention, water retention, drought resilience, organic matter, fertile soil, crop productivity
3. Carbon Footprint Reduction & Climate Resilience: carbon storage, climate change mitigation, extreme-weather resilience, sustainable farming, agroforestry

PRODUCTION SYSTEM

Agricultural and horticultural crops in open field

THEMATIC AREA

Soil health and biodiversity

Water management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Agroforestry a aparut ca o solutie viabila pentru imbunatatirea utilizarii durabile a terenurilor, promovand in acelasi timp conservarea mediului si rezilienta economica.

Prin integrarea arborilor si a culturilor, fermierii pot optimiza productivitatea terenurilor, imbunatati sanatatea solului si contribui la atenuarea schimbarilor climatice.

Agroforestry imbunatateste sanatatea solului si retentia apei prin stabilizarea terenului cu ajutorul radacinilor arborilor, reducerea eroziunii si cresterea infiltrarii apei. Materia organica din frunzele cazute imbogateste solul, sporind fertilitatea si productivitatea culturilor. De asemenea, sustine biodiversitatea si controlul natural al daunatorilor, oferind habitat pentru insecte benefice, pasari si polenizatori, reducand astfel dependenta de pesticide chimice.

Ca element-cheie in definirea importantei acestei masuri, si datorita dorintei infocate a fermierului de a-si reduce emisiile de carbon, i-a fost acordat acestuia (companiei fermierului) un certificat de sustenabilitate emis de FEPR (atasat la acest raport).

Astfel, castigatorii acestei masuri sunt fermierul, mediul inconjurator si viitorul in sine. Agroforestry este o strategie puternica pentru agricultura durabila, echilibrand perfect productivitatea, inovatia si conservarea mediului.

Folosind „Farm Carbon Calculator” si simuland care ar fi emisiile estimate de CO₂ dupa implementarea masurii in cauza, rezultatul initial a fost redus la jumatate!

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Agroforestry has emerged as a viable solution for enhancing sustainable land use while promoting environmental conservation and economic resilience.

By integrating trees and crops, farmers can optimize land productivity, improve soil health, and contribute to climate change mitigation.

Agroforestry improves soil health and water retention by stabilizing the soil with tree roots, reducing erosion, and increasing water infiltration. Organic matter from leaf litter enriches the soil, enhancing fertility and crop yields. It also enhances biodiversity and pest control by providing habitat for beneficial insects, birds, and pollinators, reducing reliance on chemical pesticides due to natural pest control.

As a key element in defining the significance of this measure, and due to the farmer's desire to reduce carbon emissions, a certificate of sustainability was awarded to the farmer (the farmer's company), issued by FEPPA (attached to this report).

With that said, the winners of this measure are the farmer, the environment, and the future itself. Agroforestry is a strong strategy for sustainable agriculture, as it perfectly balances productivity, innovation, and environmental conservation.

Using the **Farm Carbon Calculator** and simulating the estimated CO₂ release after implementing this measure, the result was halved!

PHOTOS



Photo 1: Audit AgroBrava



Photo 2: Certificate awarded by FEPRA to Agro Brava S.R.L. for reducing 6.86 tonnes of CO₂ emissions in 2024 through packaging waste recycling. The recognition highlights the company's contribution to environmental sustainability. Issued on January 21, 2025.



PRACTICE ABSTRACT #97**SHORT TITLE IN NATIVE LANGUAGE**

Implementarea pășunatului rotațional în cadrul unui sistem low input de producție a laptelui de oaie

SHORT TITLE IN ENGLISH

Implementing Rotational Grazing Within a Low-input Sheep Milk Production System

COUNTRY AND CLIMATIC ZONE

Romania - continental temperate zone

CONTACT

Catalin Dragomir (catalin.dragomir@ibna.ro)

3 BENEFITS OF THE PRACTICE

1. Increase the overall biomass production & better control on the feeding strategies
2. Increase the overall farm profitability and resilience
3. Climate-friendly technique

PRODUCTION SYSTEM

Low-input sheep milk production system

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Obiectivul implementării acestei măsuri a fost, printre altele, de a demonstra că pășunatul prin rotație, folosind gardul electric, are multiple avantaje și în sectorul creșterii ovinelor, într-un sistem low-input de producere a laptelui de oaie.

Pe lângă faptul că aplicarea pășunatului prin rotație este o măsură prietenoasă cu clima, conducând la reducerea amprente nete de carbon, aduce și avantaje din punct de vedere economic și al creșterii rezilienței fermei. Evident, măsura presupune o investiție inițială (achiziția gardului electric), asimilarea de noi cunoștințe privind managementul pășunatului, etc.

Avantajele sunt însă multiple: de la creșterea producției de biomasă / hectar, un mai bun control al furajării animalelor (ex. pe categorii), evitarea supra-pășunatului, etc. – elemente direct legate de eficiența fermei, la avantaje pe termen lung.

Printre acestea se enumeră o mai bună rezistență a pășunii la factorii secetă, o îmbunătățire a calității solului, o influență pozitivă asupra biodiversității, etc.

Pe măsură ce fermierii dobândesc experiență, această măsură poate avea mai multe niveluri de implementare – de la simpla aplicare, empirică, bazate pe copierea unor modele (de exemplu, de la alți fermieri) sau pe examinarea vizuală a pășunilor, la planificarea riguroasă însoțită de estimări ale producției de biomasă și/sau analize biochimice ale acestora în vederea estimării valorii nutritive.

Principalii beneficiari sunt fermierii, dar și consultanții agricoli (specializați în nutriție, managementul pajiștilor, etc.)

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The objective of implementing this measure was, among other things, to demonstrate that rotational grazing using electric fencing offers multiple advantages for the sheep farming sector, particularly in a low-input system for sheep milk production.

In addition to being a climate-friendly measure that reduces the net carbon footprint, rotational grazing also provides economic benefits and enhances farm resilience. While it requires an initial investment (e.g., purchasing

electric fencing) and the assimilation of new knowledge regarding grazing management, the advantages are numerous.

These benefits include increased biomass production per hectare, better control of animal feeding (e.g., by category), and the prevention of overgrazing—factors directly linked to farm efficiency. In the long term, rotational grazing also improves pasture resistance to drought, enhances soil quality, and positively influences biodiversity.

As farmers gain experience, this measure can be implemented at different levels, ranging from simple, empirical applications—such as copying models from other farmers or visually assessing pastures—to rigorous planning that includes biomass production estimations and biochemical analyses to determine nutritional value.

The primary beneficiaries are farmers, as well as agricultural consultants specializing in nutrition, grassland management, and related fields.

PHOTOS



Photo 1: Sheep grazing within lots of delimited by electric fence

PRACTICE ABSTRACT #98**SHORT TITLE IN NATIVE LANGUAGE**

Lönsamma klimatåtgärder på mjölkgård

SHORT TITLE IN ENGLISH

Profitable Climate Actions on Dairy Farms

COUNTRY AND CLIMATIC ZONE

Sweden and Nordic cluster

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Improved milk yields and feed ration
2. Less feed waste
3. Better growth and health of the animals

PRODUCTION SYSTEM (IF RELEVANT)

Dairy cattle

THEMATIC AREA

Herd Management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Åtgärder som är bra för miljön och klimatet är också ofta bra för gårdens ekonomi. Det handlar om att hushålla med resurser och vara så effektiv som

möjligt i sin produktion. Greppa Näringen har gjort klimatberäkningar med verktyget Vera klimatkollen på en mjölkgård för att se vad olika alternativ har för effekt på gårdens klimatpåverkan och ekonomi.

Den mjölkgård som använts i klimatberäkningarna har konventionell drift med nedanstående produktion och nyckeltal (alternativ 1).

- 200 kor
- 240 ha åkermark (varav vall och åkerbete 170 ha)
- 50 ha naturbetesmark
- Vall, spannmål och helsädesensilage (havre/ärt)
- Tjurkalvar samt en del av spannmålen och halmen säljs

I alternativ 2 är soja- och palmprodukter utbytta mot mer egenproducerat foder som ger lägre klimatavtryck. De inköpta fodermedlen är totalt sett lägre då mer ensilage och spannmål ges till korna.

I alternativ 3 är bättre tillväxt, hälsa och skötsel i fokus. Detta ger lägre rekryteringsprocent, inkalvningsålder och kalvdödlighet.

I alternativ 4 med högre mjölkavkastning genom bättre management. höjs produktionen till 12 000 kg ECM per ko och år. Korna äter mer ensilage, men i övrigt är foderstaten och nyckeltalen oförändrade.

Alternativ 5 med minskning av foderspill och överutfodring av grovfoder och HP-massa, från 15 % till 5 %. Gården köper in mindre HP-massa och odlar mindre ensilage och helsäd. På den åkermarken odlas i stället raps och åkerbönor till avsalu.

Alternativ 6, 7 och 8 kombinerar flera scenario. Modelleringen visar att störst betydelse har förbättrad mjölkavkastning och foderstat, mindre foderspill samt bättre tillväxt och hälsa hos djuren.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Measures that benefit the environment and climate often improve farm economics by optimizing resource use and efficiency. Greppa Näringen conducted climate calculations using the Vera Klimatkollen tool on a dairy farm to assess the impact of different strategies on climate and economy.

The modeled farm has conventional production with:

- 200 cows
- 240 ha arable land (170 ha grassland/field pasture)
- 50 ha natural pasture

- Grassland, cereals, and whole-crop silage (oats/peas)
- Bull calves and some grain/straw sold

Feed Ration (kg DM/day)

- Ley & whole-crop silage: 10.5
- Beet pulp (molasses dried): 3.6
- Grain: 1.7
- Concentrate/protein mix: 4.3
- ExPro (rapeseed protein): 1.6

Key Figures:

- Milk yield: 10,000 kg ECM
- Young heifers: 130 kg
- Old heifers: 65 kg
- Bull calf sale age: 2 weeks
- Calving age: 27 months
- Recruitment rate: 35%
- Calf mortality: 5%
- Calving interval: 13.2 months
- Milk delivered: 92%
- Forage waste: 15%

Alternative Scenarios

1. Option 2: Replaces soya/palm products with more self-produced feed, lowering the farm's carbon footprint.
2. Option 3: Focuses on better animal growth, health, and management, reducing recruitment rates, calving ages, and calf mortality.
3. Option 4: Increases milk yield to 12,000 kg ECM per cow with improved management, using more silage but maintaining feed ratios.
4. Option 5: Reduces feed wastage from 15% to 5%, decreasing HP pulp purchases. The freed land is used to grow rapeseed and field beans for sale.
5. Options 6, 7, 8: Combine multiple strategies.

The greatest impacts come from higher milk yields, improved feed conversion, reduced feed waste, and better animal growth and health.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

I Sverige används två olika verktyg, Vera Klimatkollen och Agrosfär, för att göra klimatberäkningar inom projektet Climate Farm Demo. Greppa Näringen som utvecklat Vera Klimatkollen har tagit fram ett antal scenarier

för en mjölkgård för att ta reda på om åtgärder som är bra för klimatet också är bra för gårdens ekonomi.

Den mjölkgård som använts i modelleringen har konventionell drift med nedanstående produktion och nyckeltal (alternativ 1).

- 200 kor
- 240 ha åkermark (varav vall och åkerbete 170 ha)
- 50 ha naturbetesmark
- Vall, spannmål och helsädesensilage (havre/ärt)
- Tjurkalvar samt en del av spannmålen och halmen säljs

I alternativ 2 är soja- och palmprodukter med höga klimatavtryck utbytt mot mer egenproducerat foder som ger lägre klimatavtryck. De inköpta fodermedlen är totalt sett lägre då mer ensilage och spannmål ges till mjölkarna. I detta alternativ odlas det mer vall och mindre havre och vârvete. Foderstaten är beräknad för att kunna ge samma mjölkavkastning som den ursprungliga foderstaten. Det ekonomiska resultatet jämfört med grundalternativet är ungefär detsamma, vilket betyder att man genom fodret kan få samma produktion och ekonomi men ha en betydligt lägre klimatpåverkan.

I alternativ 3 är bättre tillväxt, hälsa och skötsel i fokus. Detta ger lägre rekryteringsprocent, inkalvningsålder och kalvdödlighet. För att enklare kunna skilja mellan rekryteringsdjurens och slaktdjurens klimatavtryck säljer gården alla kvigkalvar som inte rekryteras. Totalt finns det då 75 yngre kvigor och 45 äldre kvigor. Detta ger lägre rekryteringsprocent (30 %), inkalvningsålder (24 mån) och kalvdödlighet (2 %). Det går färre djur till kadaver men även färre djur till slakt då de blivande slaktkvigorerna säljs när de är små. Intäkterna från slaktdjuren är lägre, men man sparar in på foder, byggnader och arbete. Om gården har dåligt med plats åt ungdjuren lönar det sig att sälja fler som små. Mer halm och ensilage säljs också.

Alternativ 4 med högre mjölkavkastning genom bättre management. Mjolkproduktionen höjs till 12 000 kg ECM per ko och år. Korna äter mer ensilage, men i övrigt är foderstaten och nyckeltalen oförändrade. Gården odlar 112 ton ts mer grovfoder och odlar i stället 30 ton mindre höstvet och 30 ton mindre vârvete jämfört med grund alternativet. Eftersom det odlas mer grovfoder och mer spannmål behålls minskar intäkten men intäkterna för mjölken ökar.

Alternativ 5 med minskning av foderspill och överutfodring av grovfoder och HP-massa, från 15 % till 5 %. Gården köper in 40 ton mindre HP-massa och odlar 127 ton ts mindre ensilage samt 12 ton ts mindre helsäd. På den

frigjorda åkermarken odlas i stället 21 ton rapsfrö och 22 ton åkerbönor till avsalu, vilket ger gården 127 tkr i extra intäkt. Mindre förluster från insatsvarorna ger även ett lägre klimatavtryck på slut produkterna.

Alternativ 6, 7 och 8 kombinerar flera scenario. Modelleringen visar att störst betydelse har förbättrad mjölkavkastning och foderstat, mindre foderspill samt bättre tillväxt och hälsa hos djuren. Bäst är effekten när åtgärderna kombineras. I tabellen visas klimatavtryck, antal ungdjur och ekonomiskt resultat för olika förändringar i produktionen.

LONGER DESCRIPTION – IN ENGLISH

In Sweden, two different tools, Vera Klimatkollen and Agrosfär, are used to perform climate calculations within Climate Farm Demo. Greppa Näringen, the developer of Vera Klimatkollen, has modeled several scenarios for a dairy farm to determine whether measures that benefit the climate are also economically advantageous for the farm.

The dairy farm used in the modeling has conventional farming with the following production and key figures (Option 1):

- 200 cows
- 240 ha arable land (of which 170 ha is grassland and field pasture)
- 50 ha natural pasture
- Grassland, cereals, and whole-crop silage (oats/peas)
- Bull calves and part of the grain and straw sold

Key Figures and Feed Ration (kg DM/day)

- **Milk production:** 10,000 kg ECM
- **Ley & whole-crop silage:** 10.5
- **Beet pulp (molasses dried):** 3.6
- **Grain:** 1.7
- **Concentrate & protein mix:** 4.3
- **ExPro (rapeseed protein):** 1.6
- **Young heifers:** 130 kg
- **Old heifers:** 65 kg
- **Bull calf sale age:** 2 weeks
- **Calving age:** 27 months
- **Recruitment rate:** 35%
- **Calf mortality:** 5%
- **Calving interval:** 13.2 months
- **Milk delivered:** 92%
- **Forage wastage:** 15%

Alternative Scenarios *(see Table 1)*

1. **Option 2:** Replaces soya and palm products with more self-produced feed, which has a lower carbon footprint. The overall quantity of purchased feed is reduced as cows receive more silage and cereals. More ley is grown, while less oats and spring wheat are cultivated. The feed ration is formulated to maintain the same milk yield as the baseline. The economic outcome remains almost unchanged, meaning that production and profitability are maintained, but with a significantly lower climate impact.
2. **Option 3:** Focuses on improved growth, health, and management, leading to lower recruitment rates, reduced calving ages, and lower calf mortality. To distinguish between the climate footprint of replacement heifers and slaughter animals, the farm sells all heifer calves that are not recruited. This results in 75 younger heifers and 45 older heifers, reducing the recruitment rate to 30%, calving age to 24 months, and calf mortality to 2%. Fewer animals go to carcass and slaughter since future slaughter heifers are sold at a younger age. While income from slaughtering animals decreases, savings are made on feed, buildings, and labor. If the farm has limited space for young animals, selling more animals earlier can be beneficial. More straw and silage are also sold.
3. **Option 4:** Increases milk yield to 12,000 kg ECM per cow per year through better management. Cows consume more silage, but the feed ration and key figures remain unchanged. The farm grows 112 tonnes (t) more forage, while producing 30 t less winter wheat and 30 t less spring wheat compared to the baseline. Since more forage is grown and more cereals are retained, total income decreases, but increased milk income compensates for this.
4. **Option 5:** Reduces feed wastage and overfeeding of forage and beet pulp from 15% to 5%. The farm purchases 40 t less beet pulp and cultivates 127 t less silage and 12 t less whole-crop silage. Instead, 21 t of rapeseed and 22 t of field beans are grown on the freed-up arable land for sale, generating an additional SEK 127,000. Reducing input losses also lowers the farm's carbon footprint on the final products.
5. **Options 6, 7, and 8:** Combine multiple scenarios. The most significant impacts result from improved milk yields, better feed conversion, reduced feed waste, and enhanced animal growth and health.

PHOTOS

Scenario	1	2	3	4	5	6	7	8
Milk, kg CO ₂ e / kg ECM	0,98	0,95	0,94	0,87	0,97	0,78	0,96	0,81
Live and slaughter animals, kg CO ₂ e / kg live weight	7,18	6,96	6,67	6,15	7,07	5,40	7,14	5,78
Purchased feed, kg CO ₂ e / kg	0,36	0,25	0,36	0,36	0,38	0,28	0,36	0,28
Farm total CO ₂ e, t	2220	2119	2097	2281	2202	1998	2217	2 123
Number of young animals	195	195	120	195	195	120	178	178
Economic result compared to scenario 1, öre/kg ECM		0	10	54	7	57	25	72
Economic result compared to scenario 1, thousand SEK		-4,5	185	1 192	127	1 266	453	1 599

Table 1: The table with the carbon footprint, number of young animals, and economic outcomes for various production changes. (in English)

Alternativ	1	2	3	4	5	6	7	8
Mjölk, kg CO ₂ e / kg ECM	0,98	0,95	0,94	0,87	0,97	0,78	0,96	0,81
Liv- och slaktdjur, kg CO ₂ e / kg levande vikt	7,18	6,96	6,67	6,15	7,07	5,40	7,14	5,78
Inköpt foder, kg CO ₂ e / kg	0,36	0,25	0,36	0,36	0,38	0,28	0,36	0,28
Gårdens totala CO ₂ e, ton	2220	2119	2097	2281	2202	1998	2217	2 123
Antal ungdjur (ungdjursplatser)	195	195	120	195	195	120	178	178
Ekonomiskt resultat jfr med alt 1, öre/kg ECM		0	10	54	7	57	25	72
Ekonomiskt resultat jfr med alt 1, tkr totalt		-4,5	185	1 192	127	1 266	453	1 599

Table 2: The table with the carbon footprint, number of young animals, and economic outcomes for various production changes. (in Swedish)

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Add text here.

URL:

<https://greppa.nu/aktuellt/nyheter/arkiv---nyheter/2024-11-08-klimatatgarder-pa-mjolkgardar-ar-lonsamma>

PRACTICE ABSTRACT #99**SHORT TITLE IN NATIVE LANGUAGE**

De voordelen van groenbemesters

SHORT TITLE IN ENGLISH

The Benefits of Cover Crops

COUNTRY AND CLIMATIC ZONE

All countries and climatic zones in Europe.

Measures and results are in Dutch context

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Soil health
2. Climate mitigation
3. Water adaptation

PRODUCTION SYSTEM

Land-based sectors

THEMATIC AREA

Soil health and biodiversity

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Groenbemesters zijn gewassen die worden geplant om de bodemkwaliteit te verbeteren en de landbouwproductiviteit te verhogen. Ze worden vaak gebruikt tijdens braakliggende periodes, zoals in de winter of aan het einde van het groeiseizoen, om te voorkomen dat de grond leeg blijft en erosie plaatsvindt¹. Groenbemesters bieden tal van voordelen voor zowel de bodem als het klimaat.

Groenbemesters verrijken de bodem met voedingsstoffen, zoals stikstof, wat essentieel is voor de groei van gewassen. Ze kunnen ook organisch materiaal toevoegen aan de bodem, wat de bodemstructuur verbetert. Dit helpt bij het verbeteren van de waterretentiecapaciteit van de bodem, waardoor de bodem beter bestand is tegen droogte en extreme regenval. Bovendien kunnen groenbemesters de groei van onkruid onderdrukken door de bodem te bedekken en de competitie aan te gaan met ongewenste planten. Dit vermindert de noodzaak voor chemische onkruidbestrijdingsmiddelen, wat gunstig is voor het klimaat.

Een ander belangrijk voordeel van groenbemesters is dat ze bodemerosie helpen voorkomen. Het wortelstelsel van groenbemesters houdt de bodem stevig op zijn plaats, waardoor erosie wordt voorkomen¹. Dit is vooral belangrijk in gebieden met hellingen of waar de bodem gevoelig is voor erosie door wind of water. Door erosie te verminderen, helpen groenbemesters ook bij het behoud van de bodemvruchtbaarheid op de lange termijn.

Groenbemesters bevorderen ook de biodiversiteit. Het planten van verschillende soorten groenbemesters kan gunstig zijn voor bestuivende insecten en het aantrekken van natuurlijke vijanden van plagen. Dit kan helpen bij het verminderen van de afhankelijkheid van chemische bestrijdingsmiddelen en het bevorderen van een gezonder ecosysteem.

Wat betreft de voordelen voor het klimaat, spelen groenbemesters een cruciale rol in zowel klimaatmitigatie als klimaatadaptatie. Door koolstof vast te leggen in de bodem, helpen groenbemesters bij het verminderen van de hoeveelheid koolstofdioxide (CO₂) in de atmosfeer. Dit draagt bij aan de vermindering van de broeikasgasemissies en helpt bij het bestrijden van klimaatverandering. Bovendien kunnen groenbemesters stikstof binden, wat de uitstoot van lachgas, een krachtig broeikasgas, vermindert.

Groenbemesters dragen ook bij aan klimaatadaptatie door de bodemgezondheid te verbeteren. Een gezondere bodem met meer organisch materiaal en een beter bodemleven kan meer water vasthouden, wat essentieel is voor de veranderende klimaatomstandigheden. Dit helpt bij het verminderen van de impact van extreme weersomstandigheden, zoals droogte en overstromingen, op de landbouwproductiviteit. Bovendien draagt een gezondere bodem bij aan een duurzame voedselproductie op de lange termijn.

Er zijn verschillende soorten groenbemesters die kunnen worden gebruikt, afhankelijk van de specifieke behoeften van de grond en gewassen. Enkele populaire typen groenbemesters zijn klaver, boekweit, winterrogge, phacelia en mosterd. Klaver is bijvoorbeeld bekend om zijn vermogen om stikstof te fixeren en de bodemstructuur te verbeteren, terwijl boekweit snel groeit en onkruid kan onderdrukken. Winterrogge is ideaal voor het onderdrukken van onkruid en het verbeteren van de bodemstructuur, terwijl phacelia bestuivende insecten aantrekt en de bodemstructuur verbetert. Mosterd kan schadelijke ziektes in de bodem verminderen en de biodiversiteit vergroten.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Cover crops improve soil quality and boost agricultural productivity. They are often planted during fallow periods, like winter or post-harvest, to prevent bare soil and reduce erosion. Cover crops offer numerous benefits for soil and climate.

They enrich soil with nutrients like nitrogen, add organic matter, and enhance soil structure. This improves water retention, making soil more resilient to drought and heavy rainfall. Cover crops also suppress weeds by covering the soil and competing with unwanted plants, reducing the need for herbicides.

Another key advantage is erosion prevention. Cover crop roots anchor soil, preventing erosion, especially on slopes or areas prone to wind and water erosion. By reducing erosion, they help maintain long-term soil fertility.

Cover crops promote biodiversity by attracting pollinators and pest predators, reducing pesticide reliance, and supporting a healthier ecosystem.

They also aid in climate mitigation and adaptation. By sequestering carbon in the soil, they reduce CO₂ levels and lower greenhouse gas emissions.

Additionally, they fix nitrogen, reducing nitrous oxide emissions, a potent greenhouse gas.

Healthier soil with more organic matter retains water better, helping farms withstand extreme weather. This reduces the impact of droughts and floods on agricultural productivity and contributes to long-term sustainable food production.

Different cover crops serve specific needs. Clover fixes nitrogen and improves soil structure, buckwheat grows quickly and suppresses weeds, winter rye enhances weed control and soil structure, phacelia attracts pollinators, and mustard reduces soil diseases while boosting biodiversity.

LONGER DESCRIPTION – IN ENGLISH

Cover crops are plants grown to improve soil quality and increase agricultural productivity. They are often used during fallow periods, such as in winter or at the end of the growing season, to prevent the soil from remaining bare and to reduce erosion. Cover crops offer numerous benefits for both the soil and the climate.

Cover crops enrich the soil with nutrients, such as nitrogen, which is essential for plant growth. They also add organic matter to the soil, improving its structure. This enhances the soil's water retention capacity, making it more resilient to drought and heavy rainfall. Additionally, cover crops suppress weed growth by covering the soil and competing with unwanted plants. This reduces the need for chemical herbicides, which benefits the climate.

Another key advantage of cover crops is that they help prevent soil erosion. Their root systems hold the soil firmly in place, preventing erosion. This is especially important in areas with slopes or where the soil is prone to erosion by wind or water. By reducing erosion, cover crops also help maintain soil fertility in the long term.

Cover crops promote biodiversity. Planting different types can benefit pollinating insects and attract natural enemies of pests. This helps reduce reliance on chemical pesticides and promotes a healthier ecosystem.

Regarding climate benefits, cover crops play a crucial role in both climate mitigation and adaptation. By sequestering carbon in the soil, they help reduce the amount of carbon dioxide (CO₂) in the atmosphere, lowering greenhouse gas emissions and combating climate change. Additionally, cover crops fix nitrogen, reducing nitrous oxide emissions, a potent greenhouse gas.

Cover crops also contribute to climate adaptation by improving soil health. Healthier soil with more organic matter and better microbial activity retains more water, essential for changing climate conditions. This helps reduce the impact of extreme weather events, such as droughts and floods, on agricultural productivity. Moreover, healthier soil supports long-term sustainable food production.

Various types of cover crops can be used depending on soil and crop needs. Popular options include clover, buckwheat, winter rye, phacelia, and mustard. Clover fixes nitrogen and improves soil structure, buckwheat grows quickly and suppresses weeds, winter rye enhances weed control and soil structure, phacelia attracts pollinators, and mustard reduces soil diseases while boosting biodiversity.

PHOTOS



Photo 1: Attendees examining cover crops in the field during a farm demo event.



Photo 2: An aerial view of a field trial plot system, with numerous experimental parcels of varying crops which got different treatments and/or sowing dates.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Video of demo event in the Netherlands on green manure.

URL:

[Green manure to improve soil health & quality | Climate Farm Demo event at Hemus Farm, NL](#)

4.7 “Cross-Cutting Topics”: A Collection of Practice Abstracts

A total of 28 Practice Abstracts are categorised under Cross-Cutting Topics. These Practice Abstracts are diverse and cover a wide range of themes, presenting relevant insights into various aspects of climate-smart farming, farm demonstrations, and their broader impacts. The heterogeneity of the PAs reflects the interdisciplinary nature of the project, addressing multiple dimensions of sustainable farming and climate mitigation and adaptation.

PRACTICE ABSTRACT #1**SHORT TITLE IN ENGLISH**

Reducing Greenhouse Gas and Ammonia Emissions from Cattle Housing

COUNTRY AND CLIMATIC ZONE

All countries and climatic zones in Europe

CONTACT

Federico Dragoni (fdragon@atb-potsdam.de)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Emission mitigation
2. Increased animal welfare
3. Increased resilience to extreme weather conditions (e.g. heatwaves)

PRODUCTION SYSTEM (IF RELEVANT)

Dairy and beef cattle

THEMATIC AREA

Manure storage and spreading

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Reducing emissions from barns is a key environmental and welfare goal. Cattle housings emit methane (CH₄), ammonia (NH₃), and nitrous oxide (N₂O), in large part due to manure. NH₃ volatilizes easily due to soluble N and pH > 7.

Barn Emissions: Key Factors

1. Housing and Floors

- In loose housing, bedding reduces NH_3 but may increase N_2O due to nitrification and denitrification
- Solid and slatted floors have similar emissions; earthen floors have the highest N_2O emissions

2. Environment

- On average, NH_3 rise by ~ 0.037 g/livestock unit/day for each $+1^\circ\text{C}$ temperature increase (See Çinar et al. (2023))
- Farms in wet climates emit less NH_3 than those in dry climates

3. Diet

- Overfeeding protein increases N excretion, mostly as urea, causing NH_3 and N_2O emissions. Dairy cattle generally emit more N_2O than beef cattle due to high N diet
- Low starch increases N losses; balanced energy-protein ratios reduce emissions.

Recommendations for Farmers

1. Optimized Barns

- Avoid earthen floors; solid/slatted floors are equally viable if kept sufficiently clean
- Cubicles with frequent manure removal, minimizing the time the urease enzyme of the feces converts urine urea to NH_3 , balance emissions and operations (see videos)
- Use animal-friendly cleaning to increase cleaning and minimize injury
- Minimize barn manure storage to lower CH_4

2. Climate Control

- Maintain good control over energy consumption (except for natural ventilation) to keep a low carbon footprint
- Insulate roofs and provide shade to reduce heat in summer
- Focus on NH_3 mitigation and N_2O reduction in dry and wet climates respectively

3. Adjust Diets

- Reduce protein (CP) to 12–14% for dairy cattle and 10–12% for beef cattle, ensuring balanced energy and aminoacids
- Adopt precision feeding to match CP intake to herd needs
- Use high-quality forage and test feed regularly to ensure high N assimilation and digestibility, reducing N and CH_4 emissions.

LONGER DESCRIPTION

Reducing emissions from cattle barns is crucial for mitigating climate change and meeting environmental policy goals. Animal housings are major sources of methane (CH_4), ammonia (NH_3), and nitrous oxide (N_2O), the latter two coming primarily from manure. NH_3 volatilizes easily due to manure's soluble nitrogen and above-neutral pH.

Key Factors Influencing Emissions

1. Housing Systems

- In loose housings, deep litter bedding reduces NH_3 emissions but may increase N_2O due to nitrification and denitrification.
- Cubicle housings are recommended for balancing emissions and operational efficiency, provided frequent manure removal and cleaning practices are implemented.

2. Floor Types

- Solid and slatted floors have comparable emissions, making either a viable option depending on farm logistics and operations.
- Different mitigation measures exist for different floors. A common operating principle is promptly draining the liquid phase, minimizing the time the urease enzyme of the feces hydrolyses the urine's urea to NH_3 (see videos).
- Earthen floors originate the highest N_2O emissions.

3. Environmental Conditions

- On average at global level, NH_3 emissions rise by ~ 0.037 g/livestock unit/day for each 1°C increase in barn temperature. For 100 livestock units (LU), this adds 3.7 g/day per 1°C .
- Farms in wet climates tend to emit less NH_3 compared to dry climates. Tailored mitigation strategies are necessary for different climates.

4. Animal Diets

- Overfeeding CP increases N excretion, increasing NH_3 and N_2O emissions. Dairy cattle generally emit more N_2O than beef cattle due to higher dietary N
- Ensuring a balanced energy-to-protein ratio can mitigate emissions by enhancing N assimilation. For instance, insufficient dietary starch can lead to higher nitrogen losses and indirectly higher NH_3 and N_2O emissions.

Recommendations for Farmers to reduce ammonia (NH_3) and nitrous oxide (N_2O) emissions from cattle housings

1. Optimize Housing and Flooring

- For cubicle housing, prioritize regular manure removal to limit anaerobic decomposition and reduce N₂O and NH₃ emissions.
- For loose housing, use sufficient bedding material and remove saturated bedding promptly to minimize N₂O emissions.
- Avoid earthen floors; solid or slatted floors are viable depending on farm logistics.
- Frequent manure removal reduces the ammonia pool available for volatilization. This is done by varying the cleaning frequency of manure scrapers or cleaning robots, although this can come with some risk of injury to the animals. Use animal-friendly cleaning systems (e.g., low V-blade scrapers, robots with appropriate sensing technologies).

2. Enhance Climate Control and adopt climate-specific strategies

- Install fans and/or misting systems to maintain barn temperatures as close as possible to the optimal ranges for emissions and animal welfare (10-20 °C), especially during summer or in warm climates.
- Automated climate control systems help maintain steady conditions, reducing emission spikes during heatwaves.
- Ensure barns are well ventilated to minimize heat accumulation.
- Provide shade or insulate roofs to reduce the heat load in barns, especially in regions with high solar radiation.
- In temperate dry regions, focus mostly on solutions to mitigate NH₃ volatilization. In wetter climates, target mostly practices that reduce N₂O emissions (e.g., preventing anaerobic conditions and increasing the removal frequency and aeration of manure).

3. Adjust Animal Diets

- Reduce crude protein (CP) levels to 12–14% for dairy cattle and 10–12% for beef cattle, ensuring balanced energy and amino acids. Studies show a 15–20% reduction in nitrogen excretion when CP is reduced from 18% to 14% in dairy cow diets.
- Use high-quality forages and test feed regularly to optimize protein levels.
- Adopt precision feeding strategies: divide the herd into groups based on nutrient requirements, allowing precise CP intake to match specific needs, including rumen-protected amino acids, to optimize N absorption and minimize N excretion.

Recommendations for Farmers to reduce methane (CH₄) emissions from cattle housing

Housing CH₄ emissions mainly originate from the enteric fermentation taking place in the animals. The housing itself has effect mostly on manure-related CH₄ emissions.

- Minimize manure storage time in barns and pits.
- Improve feed digestibility to reduce enteric CH₄ emissions.

PHOTOS

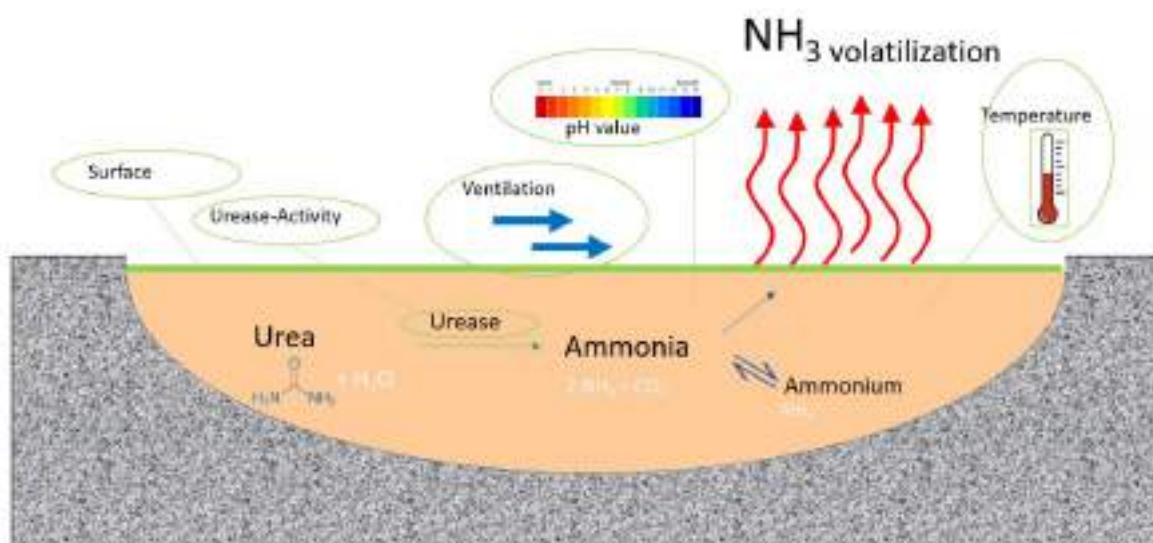


Figure 1: Drivers of ammonia emissions in livestock housings. Minimizing the time the urease of the feces hydrolyses the urine's urea is key to reducing the emissions of NH₃. Courtesy of D. Janke (ATB)



Figure 2: Example of cubicle housing with slatted floor. From “Ammoniak-Emissionsminderung – perforierte Böden mit Dichtungsklappen für Milchviehställe“ (KTBL; see videos)



Figure 3: Example of loose housing with earthen floor. Photograph by F. Dragoni

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Çinar, G., Dragoni, F., Ammon, C., Belik, V., van der Weerden, T. J., Noble, A., ... & Amon, B. (2023). Effects of environmental and housing system factors on ammonia and greenhouse gas emissions from cattle barns: A meta-analysis of a global data collation. *Waste Management*, 172, 60-70.

URL:

<https://doi.org/10.1016/j.wasman.2023.09.007>

Title/Description

The terms used are consistent with the glossary of the Recycling Agricultural, Municipal and Industrial Residues in Agriculture Network (RAMIRAN):

URL:

https://ramiran.uvlf.sk/doc11/RAMIRAN%20Glossary_2011.pdf

Title/Description

EmiMin project - Ammonia emission reduction - flooring for solid paved dairy barns - Video

URL:

<https://www.youtube.com/watch?v=MrOxXbQtso8>

Title/Description

EmiMin project - Ammonia emission reduction - perforated floors with slit sealing flaps for dairy barns Video

URL:

https://www.youtube.com/watch?v=XTb4_eyesf4

PRACTICE ABSTRACT #3

SHORT TITLE IN ENGLISH

Thematic Online Events to Boost Knowledge Exchange on Climate Smart Farming and Advice Across Europe.

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Thematic knowledge exchange
2. Climate Smart Farming
3. Promote Climate Smart Advice

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

To facilitate knowledge exchange on climate smart farming practices and climate smart advice, the ClimateFarmDemo project has identified 19 thematic areas on which good practices can be exchanged between actors across the different national networks. 12 thematic areas focus on adaptation and mitigation of climate change, with topics ranging from energy management, manure management, over crops management and soil health to agroforestry. The other 7 thematic areas focus on agricultural sectors, namely pig, poultry, arable, fruit, vegetable, protein and oil seed, and organic sector.

Each thematic area is represented by a thematic leader, selected based on their expertise on the topic. The thematic leaders are responsible for the organization of online or in-person knowledge exchange events. Together with the Climate Smart Advisors project, which also appointed thematic leaders according to the 12 adaptation and mitigation thematic areas, the aim is to organize least 2 online thematic knowledge exchange events per year. These events can be dedicated to consortium members only or be opened to a wider farmer and advisors' audience. They usually include a presentation of an expert or a testimony from a practitioner combined with

an interactive session to facilitate discussion between the participants and the experts.

The knowledge exchange events are announced:

- on the events calendar on the ClimateFarmDemo website (<https://climatefarmdemo.eu/cfd/en/#/events>),
- through social media and via the external newsletter (subscribe here for receiving the project's newsletter: <https://climatefarmdemo.eu/category/updates/newsletter/>).

The knowledge exchange events are recorded and made publicly available on the FarmDemo YouTube Channel: <https://www.youtube.com/watch?v=I7Z63eiDNmo&list=PLOYrtkIDkcdTCsFpsc0I8Pq88gMGYLVVV>.

PHOTOS



Photo 1: 12 Adaptation and Mitigation Thematic Areas – Climate Farm Demo



Photo 2: 12 Agricultural Sector Thematic Areas – Climate Farm Demo

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Climate Farm Demo events calendar

URL:

<https://climatefarmdemo.eu/cfd/en/#/events>

Title/Description

Farm Demo YouTube Channel

URL:

<https://www.youtube.com/@FarmDemo>

PRACTICE ABSTRACT #4**SHORT TITLE IN ENGLISH**

A Climate Lighthouse Farm Network to Inspire AKIS Actors to Transition to Climate Proof Agricultural Systems

COUNTRY AND CLIMATIC ZONE

EU

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Inspiration for the agricultural actors to transition to climate proof agricultural systems
2. Increased visibility of climate-smart farming practices
3. Improved visibility for Lighthouse farms

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Lighthouse Farms as defined in the Global Network of Lighthouse Farms are “*successful exemplars of disruptively innovative farming systems (...) that are proving to be economically, environmentally and socially sustainable and as such already rising to the multiple challenges of a shared future that is food secure, nutritious, sustainable and resilient* (Valencia, 2022).” Lighthouse Farms aim to inspire all actors in the food system to imagine new visions for the future and are actively participating in research and innovation. Climate Lighthouse Farms are specifically focused on contributing to climate change adaptation and mitigation.

ClimateFarmDemo will develop a network of climate lighthouse farms. The project developed 3 pillars for defining a climate lighthouse farm:

1. **Climate Smart Farming (CSF) System.** They are a front-runner in CSF systems, and they are commercially viable through farming-related activities.
2. **Demonstration and Communication.** They are willing and interested in sharing narratives, pictures, videos about their farming systems to all actors and they are open to hosting visitors on their farm.
3. **Co-innovation and Research.** They are willing to participate in research consortia and projects, publish anonymized data, support master / doctoral studies on their farm, and have knowledge in research co-development.

To develop the network, candidate lighthouse farms will be selected by regional actors in 2025. They will participate in a training program to develop the necessary skills for being a climate lighthouse farm. After training, they can choose to join the climate lighthouse farm network.

Climate lighthouse farms will be connected to the Global Network of Lighthouse Farmers. Two lighthouse farms from this Global Network are a partner in Climate Farm Demo:

- La Junquera in Spain
(<https://www.lighthousefarmnetwork.com/lighthouse-farms/la-junquera>)
- Grand Farm in Austria
(<https://www.lighthousefarmnetwork.com/lighthouse-farms/grand-farm>).

PHOTOS



Figure 1: Icon produced for Lighthouse Farm to be used in Climate Farm Demo project

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Website of the Global Lighthouse Farm Network.

URL:

<https://www.lighthousefarmnetwork.com/>

Title/Description

Website of Grand Farm

URL:

<https://grandfarm.com/>

Title/Description

Website of La Junquera

URL:

<https://www.lajunquera.com/>

PRACTICE ABSTRACT #5**SHORT TITLE IN ENGLISH**

1500 Pilot Demo Farms are Engaged to Implement Climate Smart Farming Practices and Share their Experiences in the Climate Farm Demo Network

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Accelerated adoption of climate smart farming practices
2. Increased visibility of these practices towards farmers
3. A solid demonstration network available to advisors and farmers beyond the project end

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

An EU-wide network of 1460 pilot demonstrations farms have been set up to accelerate the adoption of Climate Smart Farming (CSF) practices. The network covers 26 EU countries and 4 pedo-climatic areas in Nordic, oceanic, continental and mediterranean clusters. A diversity of agricultural sectors is represented, ranging from animal husbandry and mixed farming systems to specialised arable and horticulture crops, including organic farms. The aim of the Climate Farm Demo network is to:

- increase implementation of climate adaptation and mitigation measures on European farm
- organise 4,500 on-farm demo events reaching 150,000 farmers
- engage 250,000 actors in peer-to-peer learning activities

The farmers will be supported in their endeavours by a Climate Farm Advisors. At the start of the project each Pilot Demo Farm was audited for its climate impact. Based on the audit results, the Climate Farm Advisors and farmers developed a climate adaptation and mitigation plan, which set

the course for implementing climate smart farming practices during the project lifetime. Each year, the farm's progress will be evaluated, and the plans will be updated. In a period of 6 years, each farm will organise 3 demonstration events to showcase their experiences with the implementation of climate smart farming practices with a broader audience of farmers and other stakeholders.

The farms in the network can be consulted on a map on the project's webpage: <https://climatefarmdemo.eu/cfd/en/#/farms>. Farms can be filtered on country, farm type, production system and the thematic areas they are taking measure in. The map is an interesting tool be used by any organisation or person interested in visiting farms engaged in the implementation of climate smart farming practices in their own country or abroad. In this way, the network aims to connect to wider audience outside the consortium.

LONGER DESCRIPTION – IN ENGLISH

An EU-wide network of 1460 pilot demonstration farms have been set up to accelerate the adoption of Climate Smart Farming (CSF) practices. The network covers 26 EU countries and 4 pedo-climatic areas in Nordic, oceanic, continental and mediterranean clusters. A diversity of agricultural sectors is represented, ranging from animal husbandry and mixed farming systems (65% of the farms in the network) to specialised arable (18%) and horticulture crops (17%), including organic farms (28%). The aim of the Climate Farm Demo network is to:

- increase implementation of climate adaptation and mitigation measures on European farm
- organise 4,500 on-farm demo events reaching 150,000 farmers
- engage 250,000 actors in peer-to-peer learning activities

The number of farms per country, differs according to the total carbon emissions produced by agricultural activities in each country. Countries with high emissions (Germany, France, UK, Poland, Spain, and Italy) have recruited approximately 130 farms. Countries with middle high emissions (Belgium, Greece, Ireland, The Netherlands, Romania) recruited approximately 60 farmers. The countries with low emissions recruited 25 farms. The network consists of both commercial pilot demo farms and experimental farms. Out of this group of pilot demonstration farms, a lighthouse farm network will be developed (see Practice Abstract #4).

The farmers will be supported in their endeavours by a Climate Farm Advisors. At the start of the project each Pilot Demo Farm as audited for its

climate impact. Based on the audit results, the Climate Farm Advisors and farmers developed a climate adaptation and mitigation plan, which sets the course for implementing climate smart farming practices in the coming year. The farms show interest in a wide variety of thematic areas, ranging from energy management, over forage production to agroforestry and landscape management. Each year, the farm's progress towards climate smart farming will be evaluated and the plans will be updated. In a period of 6 years, each farm will organise 3 demonstration events to showcase their experiences with the implementation of climate smart farming practices with a broader audience of farmers and other stakeholders.

The farms in the network can be consulted on a map on the project's webpage: <https://climatefarmdemo.eu/cfd/en/#/farms>. Farms can be filtered on country, farm type, production system and the thematic areas they are taking measure in. The map is an interesting tool be used by any organisation or person interested in visiting farms engaged in the implementation of climate smart farming practices in their own country or abroad. In this way, the network aims to connect to wider audience outside the consortium.

PHOTOS



Photo 1: Farm Demo Event in Ireland – CFD Annual Meeting

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

Map of pilot demonstration farms engaged in the ClimateFarmDemo network

URL:

<https://climatefarmdemo.eu/cfd/en/#/farms>

PRACTICE ABSTRACT #6**SHORT TITLE IN NATIVE LANGUAGE**

Minskade miljöpåverkan genom biogasproduktion och efterföljande rötrestbehandling.

SHORT TITLE IN ENGLISH

Reduced Environmental Impact through Biogas Production and Subsequent Digestate Treatment

COUNTRY AND CLIMATIC ZONE

Sweden, Nordic cluster

CONTACT

Anders Johansson (Anders.johansson@agrovast.se)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Digestate treatment
2. Improved nutrient recycling
3. Nutrient reallocation

PRODUCTION SYSTEM (IF RELEVANT)

Animal husbandry, Biogas production

THEMATIC AREA

Biogas Production

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Biogasproduktion från gödsel minskar effektivt växthusgasutsläpp inom jordbruket och stödjer en cirkulär ekonomi genom näringsåtervinning, där livscykelanalyser visar en 80 % minskning av utsläppen jämfört med konventionell gödselhantering.

Vidare påpekar Lima et al. (2025) att lämplig hantering och behandling av rötresten ger ytterligare möjligheter att minska miljöpåverkan. Separering av rötresten, där flytgödsel delas upp i en kväverik (N) vätskefraktion och en fosforrik (P) fast fraktion, möjliggör en mer precis näringsanpassning och underlättar omfördelning av den fasta P-rika fraktionen till fosforfattiga fält, vilket minskar näringsförluster och vattenföroreningar.

Studien utvärderade sex olika scenarier för gödselhantering ur ett miljöperspektiv. Dessa inkluderade ett referensscenario, som representerar nuvarande praxis där rötrest sprids lokalt i Kalmarregionen, samt ett Separeringsscenario, där de separerade vätske- och fastfraktionerna också används lokalt. Dessutom undersöktes fyra alternativa scenarier där den fasta fraktionen transporteras till andra regioner.

Studien visar en nettominskning av klimatpåverkan (GWP) med 26,4 % för separeringsscenariot jämfört med referensscenariot. Dessutom tyder resultaten på att separeringsprocessen kan möjliggöra transport av den fasta fraktionen över avstånd på upp till cirka 250 km utan att öka den miljömässiga belastningen jämfört med referensscenariot. Samtidigt möjliggörs en omfördelning av näringsämnen till andra avrinningsområden, vilket bidrar till att minska övergödningen i Östersjön.

Den separeringsmetod som utvärderas i denna studie baseras på pågående försök vid More Biogas AB:s anläggning, där preliminära resultat från separeringseffektivitet uppnådd genom skruvpress och dekantercentrifugbehandlingar har använts. Studien utvärderade även torkning och betonade att valet av uppvärmningsmetod är avgörande för miljöpåverkan och relevans.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Biogas production from manure effectively reduces GHG emissions in agriculture and supports a circular economy through nutrient recycling, with life-cycle assessment (LCA) studies showing an 80% reduction in emissions compared to conventional manure management practices.

Furthermore, Lima et al. (2025) highlights that appropriate handling and treatment of digestate offer additional opportunities to further mitigate environmental impacts. Digestate separation, which divides slurry into an N-rich liquid fraction and a P-rich solid fraction, allows for more precise nutrient application and facilitates the redistribution of the solid P-rich fraction to P-deficient fields, reducing nutrient loss and water contamination.

The study evaluated six manure management scenarios for environmental assessment. These included a Baseline scenario, representing current practices where slurry digestate is applied locally in the Kalmar region, Sweden, and a Separation scenario, where the phase separated liquid and solid fractions are also applied locally. Additionally, four alternative scenarios explored the transport of the solid fraction to other regions.

The study demonstrates a net reduction of 26.4% in climate impact (GWP) for the Separation scenario compared to Baseline. Additionally, the findings suggest that the separation process can facilitate the transport of the solid fraction over distances of up to approximately 250 km without increasing the environmental burden relative to Baseline scenario. Simultaneously, it enables nutrient redistribution to other catchment areas, helping to mitigate eutrophication in the Baltic Sea.

The separation method evaluated in this study is based on ongoing trials at the More Biogas AB plant, utilising preliminary results on separation efficiencies achieved through screw press and decanter centrifuge treatments. The study also evaluated drying, highlighting that the choice of heating method is crucial for environmental impact and relevance.

ADDITIONAL INFORMATION

Referenced publication contains process schemes and graphs.

([Comparative analysis of manure treatment scenarios on climate change and eutrophication in the Baltic Sea](#))

Equipment used at More Biogas AB plant:

- Stallkamp PSS2.2 – 400 press screw separator ([Stallkamp press screw separators](#))
- Alfa Laval Aldec 30 decanter centrifuge ([ALDEC | Alfa Laval](#))

Publication appendix “Supplementary materials” contains information on waste streams composition, separation efficiency etc. ([1-s2.0-S0921344924006086-mmcl.docx](#))



PHOTOS

Photo 1: Alfa Laval Aldec decanter at More Biogas AB

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

Comparative analysis of manure treatment scenarios on climate change and eutrophication in the Baltic Sea

Lima, P.D.M., Edström, M., Aronsson, H., Nordberg, Å., & Sindhøj, E., 2025. Comparative analysis of manure treatment scenarios on climate change and eutrophication in the Baltic Sea. *Resources, Conservation and Recycling*, 212, p. 108017.

URL:

https://www.sciencedirect.com/science/article/pii/S0921344924006086?ref=pdf_download&fr=RR-2&rr=905fdcf55c91be4e

PRACTICE ABSTRACT #12**SHORT TITLE IN NATIVE LANGUAGE**

Réduire les émissions de GES liées au bâtiment en poules pondeuses par la mise en place de pratiques liées aux consommations d'énergie et à la gestion des effluents

SHORT TITLE IN ENGLISH

Reducing GHG emissions in laying hens buildings, with practices related to energies consumptions and manure management

COUNTRY AND CLIMATIC ZONE

France, temperate climate

CONTACT

Enora Caron (caron@itavi.asso.fr)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Reducing GHG emissions
2. Reducing ammonia emissions
3. Improving working conditions

PRODUCTION SYSTEM (IF RELEVANT)

Laying hens

THEMATIC AREA/SECTOR

Poultry productions, Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

La réglementation européenne fixe des objectifs de réduction des émissions de Gaz à Effet de Serre (GES) de 55% d'ici à 2030 et l'atteinte de la neutralité carbone pour 2050. Chacun des secteurs d'activité doit s'engager dans cette réduction et mettre en place des pratiques pour réduire ses contributions. L'aviculture est un secteur d'élevage particulièrement peu émissif. En France, l'aviculture représente 0,5% des émissions de GES de l'élevage. Les principales sources d'émissions de GES sur une exploitation avicole sont limitées à la fermentation des effluents, à la combustion des énergies fossiles et à la production d'ammoniac (NH₃) qui par recombinaison, donne du protoxyde d'azote (N₂O), un GES au fort pouvoir réchauffant. Des simulations de réduction de l'empreinte carbone de systèmes de poules pondeuses ont été réalisées à l'aide de l'outil CAP'2ER®.

Les consommations d'énergies peuvent être réduites en mettant en place de l'éclairage LED ou en maîtrisant mieux ses consommations grâce à l'installation d'un compteur. Les réductions de GES estimées vont de 0,2 à 2%.

Les pratiques liées à la gestion des effluents sont le pré-séchage des fientes en bâtiment avec évacuation fréquente sur tapis, et la mise en place d'un tunnel de séchage extérieur. Ces techniques permettent de sécher rapidement les fientes, évitant les émissions de polluants atmosphériques, notamment du N₂O ou du NH₃. Les réductions de GES espérées vont de 3 à 10% pour le pré-séchage en bâtiment et de 7 à 29% pour le tunnel de séchage extérieur.

Des techniques intermédiaires jouant plutôt sur les émissions de NH₃ ont aussi été simulées, puisqu'elles permettent aussi de réduire les émissions de N₂O. Ce sont le lavage d'air et la brumisation. La mise en place de ces leviers permet de réduire l'empreinte carbone de 2 à 19%.

Ces techniques sont aussi à repositionner dans le contexte de l'exploitation, le système d'élevage (pondeuses en cages ou au sol par ex), et les possibilités d'investissement de l'éleveur.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

European regulations set targets for reducing greenhouse gases (GHG) emissions by 55% by 2030 and to reach carbon neutrality by 2050. Each of

the sectors of activity must commit to this reduction and put in place practices to reduce their contributions. Poultry farming is a particularly low-emission livestock sector. In France, poultry farming accounts for 0.5% of GHG emissions from livestock farming. The main sources of GHG emissions on a poultry farm are limited to the fermentation of manure, the combustion of fossil energies and the production of ammonia which, through recombination, gives nitrous oxide, a GHG with a strong warming power. Simulations have been carried out for the reducing of the carbon footprint of several layers systems, through the tool CAP'2ER®.

Energy consumption can be reduced by installing LED lighting or by better controlling consumption through the installation of a meter. Estimated GHG reductions range from 0.2 to 2%.

Practices related to manure management include the pre-drying of manure in buildings with frequent evacuation on a manure belt, and the installation of an outdoor drying tunnel. These techniques make it possible to quickly dry the droppings, avoiding the emission of atmospheric pollutants, in particular nitrous oxide or ammonia. The expected GHG reductions range from 3 to 10% for pre-drying in buildings and from 7 to 29% for the outdoor drying tunnel.

Intermediate techniques that affect ammonia emissions have also been simulated, since they also reduce nitrous oxide emissions. These are air washing and misting. The implementation of these levers makes it possible to reduce the carbon footprint by 2 to 19%.

These techniques also need to be repositioned in the context of the farm, the farming system (e.g. layers in cages or on the ground), and the farmer's investment possibilities.

ADDITIONAL INFORMATION

The implementation of such levers must be in accordance with the farmer's objectives and resources.

Please feel free to reach out if you need complementary information. Lots of techniques are also listed in this document:

- *Santonja G.G., Georgitzikis K., Scalet B.M., Montobbio P., Roudier S., Delgado Sancho L., 2017. Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry or Pigs; pp 898. EUR 28674 EN; doi:10.2760/020.*

PHOTOS



Photo 1: A multi-level poultry cage system with mechanisms for collecting eggs and removing manure efficiently.

PRACTICE ABSTRACT #13**SHORT TITLE IN NATIVE LANGUAGE**

Identificación de recursos, capacidades, colaboraciones e innovaciones en laboratorios vivientes para una agricultura climáticamente inteligente

SHORT TITLE IN ENGLISH

Identification of Resources, Capabilities, Collaborations, and Innovations in Living Labs for Climate-Smart Farming

COUNTRY AND CLIMATIC ZONE

Spain, Almeria – Mediterranean

CONTACT

Cynthia Giagnocavo (cgiagnocavo@ual.es)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Increase the knowledge and skills of Living Lab actors by exploring, identifying, and fostering future resources and capabilities.
2. Establish and redefine objectives based on available and missing resources, capabilities, collaborations, and innovations (RCCIs)
3. Facilitate the creation and adoption of climate smart solutions as well as problem solving, innovating, and scaling.

PRODUCTION SYSTEM

Agricultural production systems

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Con el objetivo de ayudar a los Laboratorios vivientes (LLs) a establecer una estrategia común y un plan de acción, CFD ha desarrollado una hoja de ruta basada en cinco pasos:

- 1) La definición de los límites del LL en cuanto a propósito, objetivos, actividades, etc.,
- 2) La identificación del problema central que el LL abordará,
- 3) El análisis de las partes interesadas,
- 4) La identificación de los recursos, capacidades, colaboraciones e innovaciones (RCCI) y la evaluación de las condiciones para crear un LL
- 5) El desarrollo de un plan de acción para abordar las carencias y oportunidades identificadas.

El resultado de seguir esta hoja de ruta es conseguir una estrategia de trabajo y un plan de acción “vivo” y flexible para cada LL.

El paso 4 se llevó a cabo en talleres locales a través de preguntas dirigidas a los actores de cada laboratorio viviente. Estas preguntas exploraban la disponibilidad de recursos tangibles e intangibles, incluidos los recursos humanos, financieros y tecnológicos, así como las capacidades de adaptación y absorción. Además, permitieron evaluar la habilidad del LL para incrementar las capacidades que se identificaron como necesarias. Este paso se centra en fortalecer a los actores de los laboratorios vivientes mediante la identificación y el análisis de recursos, capacidades, colaboraciones e innovaciones (RCCI). El enfoque mejora la comprensión de cómo los recursos y las capacidades influyen en la resolución de problemas, la innovación y la escalabilidad de la agricultura climáticamente inteligente. Se basa en teorías como las capacidades dinámicas y la visión basada en los recursos, la identificación de RCCI permite alinear los objetivos con los recursos disponibles y aquellos que aún faltan. También ayuda a los laboratorios vivientes a establecer planes de acción eficaces para la co-creación, la innovación y la transición hacia prácticas climáticamente inteligentes. Este método cierra la brecha entre las capacidades que se tienen actualmente y los resultados deseados, garantizando estrategias sólidas para hacer frente a los retos climáticos.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

To help Living Labs (LL) set up and develop a common strategy and an action plan, CFD has developed a roadmap. It is based on five steps:

- 1) Defining the boundaries of the LL in terms of purpose, objectives, activities, etc.,
- 2) Identifying the central problem that the LL will address,
- 3) Stakeholder analysis and engagement,
- 4) Identifying resources, capabilities, collaborations, and innovations (RCCI), and the assessment of conditions for setting up a LL,
- 5) Developing an actionable plan to address the identified gaps and opportunities.

The outcome of this roadmap is a living working strategy and action plan especially tailored for each LL.

Step 4 was carried out in a local workshop for each LL through a series of targeted questions directed at Living Lab actors. These questions explored the availability of tangible and intangible resources, including human, financial, and technological resources, as well as adaptive and absorptive capabilities. Additionally, they assessed the living lab's current ability to scale or identify capabilities that are still needed.

This step focuses on empowering living lab actors by identifying and analysing resources, capabilities, collaborations, and innovations (RCCI). The approach enhances the understanding of how resources and capabilities influence problem-solving, innovation, and scaling in climate-smart agriculture. Grounded in theories like dynamic capabilities and the resource-based view, RCCI identification supports the alignment of objectives with available and missing resources. It also enables LLs to establish effective action plans for co-creation, innovation, and transitioning to climate-smart practices. This method bridges gaps between current capacities and desired outcomes, ensuring robust strategies for addressing climate challenges.

PHOTOS

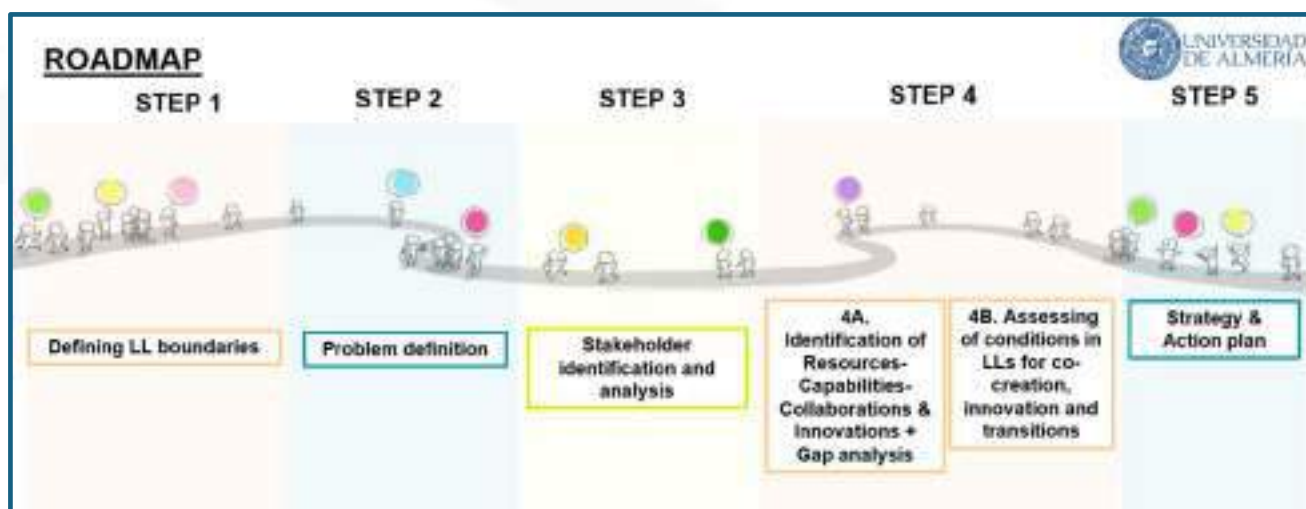


Photo 1: University of Almeria – Living Lab Roadmap



Photo 2: Workshop in Almeria - Identifying resources, capabilities, collaborations, and innovations (RCCI), and the assessment of conditions for setting up a LL



Photo 3: Workshop in Almeria - Identifying resources, capabilities, collaborations, and innovations (RCCI), and the assessment of conditions for setting up a LL

PRACTICE ABSTRACT #16**SHORT TITLE IN ENGLISH**

Agronomic methods for producing productive arable crops with low carbon emissions

COUNTRY AND CLIMATIC ZONE

United Kingdom, NW Europe maritime climate

CONTACT

Pete Berry (pete.berry@adas.co.uk), Ben Hague (ben.hague@adas.co.uk)

3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Reduce GHG emissions associated with arable crop production
2. Improve nitrogen use efficiency of crop production
3. Reduce energy use associated with cultivations

PRODUCTION SYSTEM (IF RELEVANT)

Arable crop rotations

THEMATIC AREA

Crops Management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE / ENGLISH

For typical cereal and oilseed rape crops 40-50% of greenhouse gas (GHG) emissions are associated with nitrogen (N) fertiliser, 15% with the application

of organic materials, 13-20% with field operations (such as cultivations), and 12-24% with the decomposition of crop residues.

Nitrogen fertiliser

N fertilizer is the greatest source of GHG emissions for most arable crops. Therefore, approaches that maximise the efficiency of N use and support high crop productivity must be prioritized. These include:

- Create a N management plan
- Cover crops to reduce the risk of nitrate leaching
- Estimate/measure the soil N supply to help estimate how much N fertilizer to apply
- Use N fertilizer products produced with low GHG emissions associated with manufacture
- Use fertilizer efficiency additives including urease/nitrification inhibitors

Cultivations

Cultivations represent between ~5% and ~50% of total GHG emissions per ha. A cultivation system involving plough, power harrow, drill, roll produces >200 kg CO₂/ha on a loam soil. By contrast, direct drilling produces <50 kg CO₂/ha. Soil type has a large effect on GHG emissions, e.g. ploughing clay soil requires 70% more energy than loamy soil.

Adopting low intensity cultivations, e.g. direct drilling, may not be appropriate for all soil types and farming systems. Farmers should introduce new cultivation systems gradually and test they are appropriate for their farm.

Actions

- Prioritise efficient use of N fertilizer
- Adopt low intensity cultivations but take care to ensure they are appropriate for your farm

LONGER DESCRIPTION – IN NATIVE LANGUAGE / ENGLISH

Greenhouse gas (GHG) emissions associated with arable crop production include carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄). Emissions of these GHGs have been calculated in terms of equivalent (e) emissions of CO₂e after accounting for the greater global warming effects of N₂O and CH₄.

GHG emissions can be separated into seven categories associated with crop production:

1. **field operations** (e.g. cultivations),
2. embedded emissions associated with **seeds sown**,
3. manufacture of **non-nitrogen fertiliser**,
4. manufacture of **agro-chemicals**,
5. manufacture of **nitrogen (N) fertiliser**,
6. **N₂O emissions** associated with N fertiliser and organic material applications
7. **crop residue decomposition** after harvest

Farm operations include the combustion of fossil fuels and electricity used in crop production, e.g., for cultivations, application of crop inputs and grain drying. The manufacture of inputs such as ag-chemicals and non-N fertilisers uses energy and produces CO₂. The manufacture of N fertilisers also produces N₂O emissions through the conversion of ammonia to nitric acid. The application of N fertiliser sources (either organic or synthetic), and decomposition of crop residues left in the field after harvest, produce N₂O emissions as bacteria in the soil mineralises the N.

For typical cereal and oilseed rape crops grown in the UK, 40-50% of GHG emissions are associated with N fertiliser, 15% with the application of organic materials, 13-20% with field operations such as cultivations, and 12-24% associated with the decomposition of crop residues. See Figure 1 for example using winter wheat.

For pulse crops, such as beans or peas, 43% of GHG emissions are associated with field operations and 33% associated with the decomposition of crop residues.

Nitrogen fertiliser

For arable crops, excluding pulses, by far the greatest source of GHG emissions are associated with the use of N fertiliser. Therefore, developing crop management methods that maximise the efficiency of N use whilst also enabling high crop productivity must be prioritized. Approaches for achieving this include:

- Create a N management plan for your crop
- Minimise the risk of nitrate leaching by using cover crops before spring sown crops
- Estimate, or measure, the N supply in the soil to help estimate how much N fertilizer to apply

- Use N fertilizer products with low embedded carbon emissions associated with manufacture
- Appropriate use of fertilizer efficiency additives including urease inhibitors and nitrification inhibitors

Cultivations

Another area where GHG emissions can be potentially reduced is by adopting different cultivation methods. GHG emissions associated with cultivations could represent anything between ~5% and ~50% of total GHG emissions per ha. A cultivation system involving plough, power harrow, drill, and rolling has been estimated to produce GHG emissions of at least 200 kg CO₂e/ha for a loam soil. By contrast, strip tillage or direct drilling has been estimated to produce less than 50 kg CO₂e/ha (Figure 2). Soil type also has a large effect on GHG emissions associated with cultivations, e.g. ploughing clay soil requires 70% more energy than loamy soil.

It should be recognized that adopting low intensity cultivations such as direct drilling may not be appropriate for all soil types and farming systems. Farmers should introduce new cultivation systems gradually and test if they are appropriate for their farm.

Actions

- Prioritise efficient use of N fertilizer to minimize GHG emissions associated with crop production for all crops, except legumes
- Adopting lower intensity cultivations can also reduce GHG emissions for all crops. Any new cultivations should be introduced gradually to make sure they are appropriate for your farm

ADDITIONAL INFORMATION

The information for this Practice Abstract was generated by the Yield Enhancement Network project called YEN Zero <https://yen.adas.co.uk/>

PHOTOS

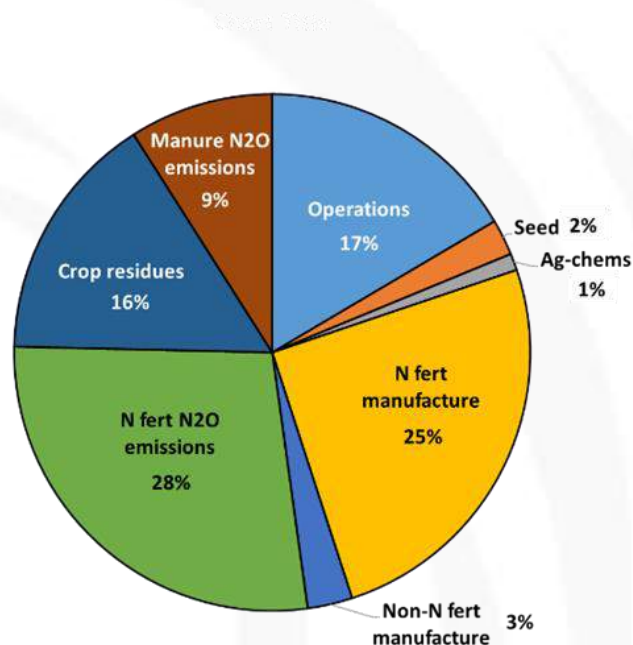


Figure 1. Carbon footprint of typical UK winter wheat crop grown for feed

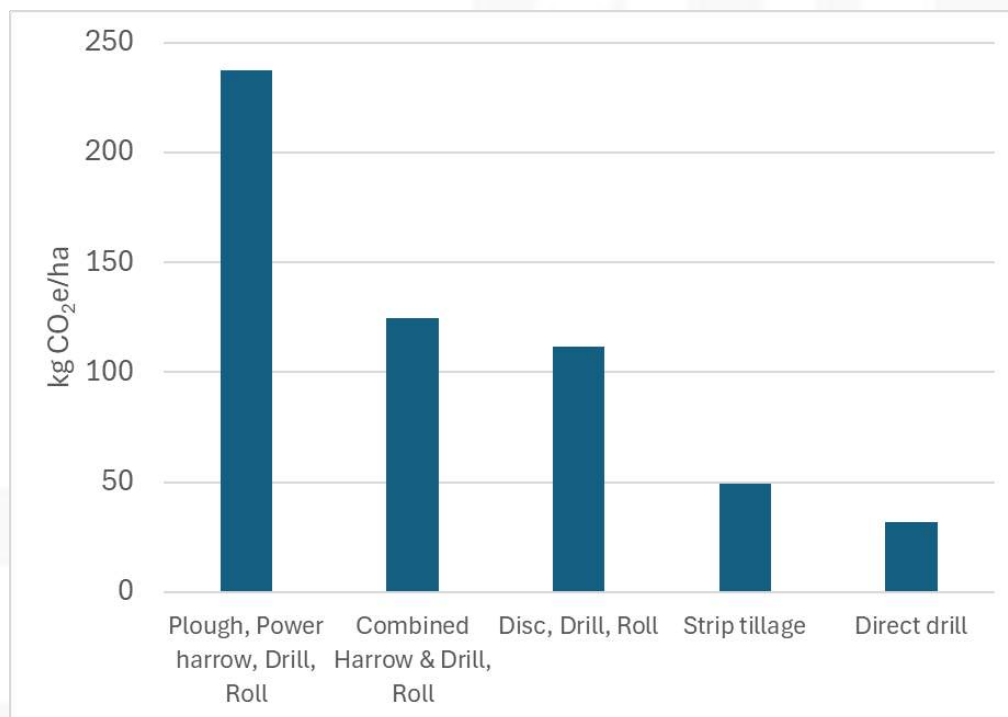


Figure 2. Estimate of GHG emissions (kg CO₂e/ha) associated with cultivation practices on a loamy soil. Williams et al (2006).

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Visit the website for the Yield Enhancement Network (YEN) to learn more about a network for learning about reducing the carbon footprint of crop production through a network called YEN Zero.

URL:

<https://yen.adas.co.uk/projects/yen-zero>

PRACTICE ABSTRACT #31**SHORT TITLE IN ENGLISH****Ten Steps to Organising a Demo Event**

This Practice Abstract guides National Coordinators and Climate Farm Advisors—regardless of their experience—in planning and delivering a successful demo event.

COUNTRY AND CLIMATIC ZONE

Ireland, mild temperate oceanic – PA relevant for all climatic zones

CONTACT

John Greaney (John.greaney@teagasc.ie)

3 BENEFITS OF THE PRACTICE

1. To ensure demo events are delivered successfully
2. To make National Coordinators and Climate Farm Advisors aware of the steps involved in delivering demo events
3. To meet the objectives of the event (learning outcomes)

PRODUCTION SYSTEM

All

THEMATIC AREA

All

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Having identified the objectives for your demo event, and established an organizing group, consulted with the host farmer and other stakeholders the next step for the advisor is to consider the various practical steps required to deliver the demo event. This practice abstract will provide guidance to all advisors from registering to reporting on demo events.

1. Step 1. Identifying your focus- define why you are organizing an event
2. Step 2. Build your team- it is impossible to cover all aspects of the farm event by yourself
3. Step 3. Consider your target audience- In the lead up to the event you should anticipate who will be the audience
4. Step 4. Select/discuss topics with your host farmer- Ideally the topic is something the farmer has excelled at and will stand out on the day
5. Step 5. Register the event on the project website
6. Step 6. Define your content- Discuss with the farmer. Use research findings to reinforce on farm situations/experiences
7. Step 7. Complete a Health and Safety Check- Walk the farm prior to the event and complete a checklist.
8. Step 8. Ensure you have informative board- Focus on 2-3 learning outcomes/key messages
9. Step 9. Advertise your event with location, time and topics- Local papers/radio, messages to existing clients or farmers in the locality.
10. Step 10. Complete your final checks- sound check, practice dry run, know when to interact with audience at certain stops and identify opportunities to break the groups into small numbers to make farmers more comfortable.

PHOTOS

Photo 1: Farm Demo Event in Ireland

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

ClimateFarmDemo- Demo Design Guide for On-farm Demonstrations

URL:

<https://zenodo.org/records/13939148>

PRACTICE ABSTRACT #32**SHORT TITLE IN ENGLISH**

Involving the Host Farmer in Demo Events

COUNTRY AND CLIMATIC ZONE

Ireland, mild temperate oceanic

CONTACT

John Greaney (John.greaney@teagasc.ie)

3 BENEFITS OF THE PRACTICE

1. Leveraging host farmer experience
2. Facilitating audience–farmer interaction
3. Supporting host farmer comfort and confidence

PRODUCTION SYSTEM

N/A

THEMATIC AREA

N/A

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH**1. How can best use be made of the host farmer's experiences?**

The host farmer should be front and center during a farm event. Ideally, appoint a facilitator to guide the conversation. In discussion with the host farmer, explore the success of climate solutions adopted, issues

encountered, and the pros and cons of technologies used. For example, consider a farmer using protected urea. Ask:

- Where did they first hear about it?
- Did they research it before use?
- Has it changed their previous practices?
- Main advantages/disadvantages?
- Cost–benefit outcome?
- What advice would they give to others?

2. How can you create opportunities for audience involvement?

A farm walk is more impactful when participants can:

- Ask the host farmer questions
 - Share their own experiences
- This may involve allocating time for Q&A, small group discussions, group exercises, or informal knowledge exchange—e.g., over a cup of tea.

3. Is the host farmer comfortable speaking at the event?

Research shows that ‘other farmers’ are a primary source of information for farmers. Whether introverted or extroverted, it’s crucial to assess the host farmer’s comfort level with public speaking. While confident speakers make facilitation easier, it’s not essential. As a facilitator, your role is to guide the conversation, extracting insights and relaying key messages through the farmer.

Events have a greater impact when participants can relate to the host farmer’s system and experience. Ideally, the host farmer should help select the topic, ensuring they are confident and knowledgeable when presenting.

LONGER DESCRIPTION – IN ENGLISH

1. How can best use be made of the host farmer’s experiences?

It is vital the host farmer is placed front and center when hosting an event on farm. Ideally, appoint a facilitator to ask questions of the host farmer. In discussion with the host farmer consider the success of adopting particular climate solutions that have worked well for him/her over the last number of years, problems and solutions encountered on the far, along with the positive and negative side effects of technology.

For example, take a farmer who has started using a different fertilizer product (protected urea) on his/her farm. Talk through the mitigation action with him or her following a series of questions:

1. Where did they first come across the action?
2. Did they do any research on the product before using it on their farm?
3. Has it changed the way they previously farmed?
4. What is the main advantage or disadvantage of using the product?
5. What is the cost benefit?
6. What would you say to someone who has never used the product?

2. How can you create opportunities for audience involvement?

The success of a farm walk can be greatly improved by actively giving participants the opportunity to (1) ask questions of the host farmer and (2) share their experiences with the audience. This might involve allocating adequate time for a “Q&A session” with the host farmer, organising discussions with smaller numbers of participants, organising group exercises with small groups or creating opportunities for more informal knowledge exchange, e.g., over a cup of tea.

3. Is the host farmer comfortable speaking at the event?

All the academic literature suggests ‘other farmers’ are farmers’ most frequently reported sources of information. While it does not make a difference if a farmer is an extrovert or an introvert when it comes to hosting an event on a farm it is extremely important to know how comfortable he/she is with public speaking to relay on-farm messages. Whilst it makes the job of the advisor a lot easier if the farmer in question can handle the pressure of speaking in front of an audience it is not a necessity as it is your job as the facilitator to probe and extract the information, relaying the messages through the farmer in question.

Ensuring farmers can relate their farming system to what the host farmer is trying to achieve has more impact, operating under the same ‘real life’. Ideally the farmer hosting should suggest what they wish to showcase prior to the event as they will ultimately be more comfortable speaking about the topic or measure in question.

PHOTOS



Photo 1: Demo Farm Event in Ireland – Climate Farm Demo



Photo 2: Audience involvement at on-farm event in Ireland

Source: TEAGASC

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Climate Farm Demo Design Guide

URL:

<https://zenodo.org/records/13939148>

PRACTICE ABSTRACT #39**SHORT TITLE IN NATIVE LANGUAGE**

Danmark's CO₂-afgift på landbrugsproduktion - hvad betyder det for de danske landmænd?

SHORT TITLE IN ENGLISH

Denmark's Carbon Tax – What does it Mean for the Danish Farmers?

COUNTRY AND CLIMATIC ZONE

Denmark, north temperate zone

CONTACT

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BENEFITS OF THE PRACTICE

1. Emissions reduction toward climate neutrality
2. Adoption of sustainable, climate-smart farming
3. Green tax reinvestment in eco-friendly technologies
4. Peatland restoration, afforestation, and carbon conservation

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN DANISH

Danmark er i gang med at implementere den første klimaafgift i verden, der er målrettet landbrugets udledninger. Politikken, som efter planen skal træde i kraft i 2030, er et centralt element i Danmarks klimastrategi og målet om at opnå CO₂-neutralitet i 2050. Nogle af de vigtigste aspekter er:

- **Tidslinje for implementering:** Afgiften vil blive indført i 2030 med en indledende sats på 300 danske kroner (ca. 43 dollars) pr. ton CO₂-ækvivalent udledning. Denne sats er sat til at stige til 750 kroner (ca. 107 dollars) pr. ton i 2035.

- **Afgiftens anvendelsesområde:** Afgiften gælder for udledninger fra husdyr i forhold til staldsystem, race, antal og deraf udledninger fra dyrenes fordøjelse og gødning. Landmændene får et fradrag på 60 % af afgiften, hvilket effektivt reducerer den oprindelige sats til 120 kroner pr. ton i 2030 og stiger til 300 kroner pr. ton i 2035. Indtægterne vil blive afsat til en fond, der støtter landbrugssektorens grønne omstilling. Forstyrrelse af kulstofrige jorde håndteres særskilt, hvor der pålægges en afgift pr. ton CO₂e hvis den enkelte bedrift ikke indgår i relevante udtagningsprojekter.
- **Supplerende miljøinitiativer:** Danmark planlægger at genoprette 140.000 hektar drænet tørvemose, der i øjeblikket bruges til landbrug, og etablere 250.000 hektar ny skov inden 2045. Denne indsats har til formål at øge biodiversiteten og binde kulstof, hvilket bidrager til landets miljømål. I denne sammenhæng spiller de tidligere politiske aftaler om at fordoble det økologiske landbrugsareal en vigtig rolle, da økologisk produktion i sine visioner og principper er en løsning på mere bæredygtige og klimavenlige landbrugssystemer.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Denmark is in the process of implementing the first climate tax in the world targeting agricultural emissions. The policy, scheduled to take effect in 2030, is a key element of Denmark's climate strategy and its goal of achieving carbon neutrality by 2050. Some key aspects are:

- **Implementation timeline:** The tax will be introduced in 2030, with an initial rate of 300 Danish kroner (~EUR40) per ton of CO₂ equivalent emissions. This rate is set to increase to 750 kroner (~EUR 100) per ton by 2035.
- **Scope of the tax:** The tax applies to emissions from livestock in relation to housing system, breed, number and hence emissions from animal digestion and manure spreading. Farmers involved in climate-friendly practices will receive a deduction of 60% of the tax, effectively reducing the initial rate to 120 kroner (~EUR 60) per ton in 2030 and increasing to 300 kroner per ton in 2035. The revenue will be allocated to a fund that supports the green transition of the agricultural sector. Disturbance of carbon-rich soils will be handled separately, with a tax per ton CO₂e being imposed if the individual farm is not included in relevant set-aside projects.

- **Complementary environmental initiatives:** Denmark plans to restore 140,000 ha of drained peatlands currently used for agriculture and establish 250,000 ha of new forest by 2045. These efforts aim to enhance biodiversity and sequester carbon, contributing to the country's environmental goals. In this context the previous political agreements for doubling the organic agricultural land play an important role, as organic production in its visions and principles is a solution for more sustainable and climate-friendly farming systems.

LONGER DESCRIPTION – IN DANISH

Implementeringen af klimaafgiften er en del af en række mål i den grønne trepartsaftale. Den grønne trepartsaftale er en aftale mellem regeringen, Landbrug & Fødevarer og Danmarks Naturfredningsforening, NNF, Dansk Metal, Dansk Industri og Kommunernes Landsforening. Aftalen blev indgået og vedtaget af Folketinget i november 2024.

Aftalen har været en proces baseret på Danmarks forpligtelse i klimaloven fra 2020 til at reducere udledningen af drivhusgasser (GHG) med 70 % inden 2030 (sammenlignet med 1990-niveauet) og opnå netto-nul inden 2050. Landbruget spiller en central rolle i denne indsats med mål om at reducere udledningen af drivhusgasser i sektoren for landbrug, skovbrug og anden arealanvendelse (AFOLU) med 55-65 % inden 2030 og at reducere kvælstofafstrømningen med 13.780 tons inden 2027 i overensstemmelse med EU's vandrammedirektiv.

Aftalen sætter følgende overordnede konkrete mål:

- Mindst 390.000 ha landbrugsjord, dvs. 15 % af det nuværende landbrugsareal, skal omlægges fra landbrug til skov, vådområder og natur.
- At 140.000 ha klimabelastende lavbundsjord (vådområder, enge og moser) omlægges til natur.
- Der skal plantes 250.000 ha ny skov, hvoraf 100.000 ha skal være urørt skov.
- At 20 % af Danmarks natur skal være fredet i 2030.
- At der indføres en CO₂-afgift på landbrugsproduktion, som træder i kraft i 2030, hvor landmændene skal betale 120 kr. pr. ton udledt CO₂, stigende til 300 kr. pr. ton udledt CO₂ i 2035. Det anslås, at aftalen har potentiale til at reducere CO₂-udledningen med mellem 1,8 og 2,6 millioner tons CO₂ i 2030.
- At det økonomiske grundlag for, at landmænd kan investere i at omstille sig til plantebaseret fødevarerproduktion, styrkes. Frem til

2030 vil der blive afsat 420 millioner kroner til Fonden for Plantebaserede Fødevarer, hvilket bringer den samlede fond op på 1,1 milliarder kroner og gør den permanent, ifølge »Den Grønne Trepert«.

Konsekvenserne for landmændene

CO₂-landbrugsafgiften vil primært være rettet mod udledninger fra husdyr, især kvæg og svin, da det er dem, der produceres mest af. Derfor skal landmændene indberette antallet af husdyr, kategoriseret efter type og produktionsformål, foderforbrug, herunder import, praksis for håndtering af gødning og brug af gødning.

Beregningen af udledningen fra den enkelte bedrift kan i høj grad baseres på oplysninger, som landmændene allerede er forpligtet til at indberette til husdyrregistret og i forbindelse med kvælstofforordningen. Dataene aggregeres derefter til den nationale drivhusgasopgørelse.

Et af de værktøjer, som landmænd kan bruge til at beregne og styre gårdens drivhusgasudledning, er ESGreen Tool, der er udviklet af SEGES Innovation. Værktøjet beregner metan, lattergas og kuldioxid. Derudover beregnes en relativ kulstofbalance, der angiver mængden af kulstof, der er lagret på landbrugsjorden. En mere detaljeret beskrivelse af dette værktøj findes i Practice Abstract #38 i denne serie.

Det forventes, at en stor del af planlægningen og implementeringen af de foreslåede ændringer i arealanvendelsen i Danmark vil blive udført af kommunerne i samarbejde med landmændenes organisationer og de kompetente civilsamfundsorganisationer. Planerne, som forventes at være færdige ved udgangen af 2025, skal dække de politiske ambitioner. En vurdering af konsekvenserne af de foreslåede ændringer i arealanvendelsen vil blive foretaget i 2026. Afhængigt af resultaterne kan der i 2027 indføres yderligere regulerende foranstaltninger, f.eks. kvoter for kvælstofudledning, for at gennemtvinge forureningsreduktioner, hvis den frivillige indsats ikke slår til. Strategien vil blive gennemgået yderligere og justeret efter behov i 2029 og hvert tredje år derefter.

LONGER DESCRIPTION – IN ENGLISH

The implementation of the climate tax is part of a series of goals set in the Green Tripartite Agreement. The Green Tripartite Agreement is an agreement between the government, the Danish Agriculture & Food Council and the Danish Society for Nature Conservation, NNF, Dansk Metal, Dansk Industri and the National Association of Municipalities. The agreement was reached and adopted by the Danish Parliament in November 2024.

The agreement has been a process based on Denmark's 2020 Climate Act commitment to a 70% reduction in greenhouse gas (GHG) emissions by 2030 (compared to 1990 levels) and achieving net zero by 2050. Agriculture plays a pivotal role in this effort, with targets to reduce GHG emissions in the Agriculture, Forestry, and Other Land Use (AFOLU) sector by 55-65% by 2030 and to cut nitrogen runoff by 13,780 tons by 2027, in line with the EU Water Framework Directive.

The agreement sets the following overall concrete goals:

- At least 390,000 ha of agricultural land, i.e. 15% of the current agricultural area, is to be converted from agriculture to forest, wetlands and nature.
- That 140,000 ha of climate-impacting lowland soils (wetlands, meadows and bogs) are converted to nature.
- That 250,000 ha of new forest will be planted, of which 100,000 ha will be untouched forest.
- That 20% of Denmark's nature should be classified as protected areas by 2030.
- That the CO₂ tax on agricultural production is imposed, and it will come into force in 2030, where EUR16 per ton of emitted CO₂ will be paid by farmers, increasing to EUR40 per ton of emitted CO₂ in 2035. It is estimated that the agreement has the potential to reduce CO₂ emissions in the range of 1.8 million to 2.6 million tons of CO₂ in 2030.
- That the financial foundation for farmers to invest in converting to plant-based food production is strengthened. Until 2030, EUR56 million will be allocated to the Fund for Plant-based Food, bringing the total fund to EUR147 million and making it permanent, according to the "Green Tripartite".

The impact on the farmers

The CO₂ agricultural tax will primarily target emissions from livestock, particularly cattle and pigs as these are the most produced. Therefore, farmers will be required to report the number of livestock, categorized by type and production purpose; feed consumption including imports; manure management practices and fertilizer usage.

The calculation of the emissions from the individual farm can be based to a considerable extent on information that farmers are already obliged to report to the livestock register and in connection with the nitrogen regulation. The data is then aggregated into the national GHG inventory.

One of the tools that farmers can use to calculate and manage the GHG emissions of the farms is ESGreen Tool developed by SEGES Innovation. The tool calculates methane, nitrous oxide and carbon dioxide. Additionally, a relative carbon balance is calculated, indicating the amount of carbon stored on the farmland. A more detailed description of this tool is available in **Practice Abstract #38 of this series**.

It is expected that much of the planning and implementation of the proposed land use changes in Denmark will be done by municipalities in collaboration with the farmer organizations and the competent civil society organizations. The plans, that are expected to be finalized by the end of 2025, must cover the political ambitions. An assessment of the impact of these proposed land use changes will be performed in 2026. Depending on findings, additional regulatory measures, such as nitrogen emission quotas, may be introduced in 2027 to enforce pollution reductions if voluntary efforts fall short. The strategy will be further reviewed and adjusted as needed in 2029 and every three years thereafter.

ADDITIONAL INFORMATION

- **Economic burden on farmers:** Farmers, especially those in livestock production, will face higher expenses due to the tax. Even with the 60% deduction, costs will rise significantly by 2035. Larger, industrial farms may absorb the costs more easily, while smaller farms may struggle financially.
- **Potential shift to more intensive farming models:** in case of increased costs, farmers might intend to increase productivity per animal (e.g., higher milk yields per cow) to offset smaller herd sizes.
- **Competitiveness concerns:** Danish agricultural products may become more expensive compared to imports from countries without a similar carbon tax. If Danish farmers are forced to scale down or close, production might shift to countries with weaker climate regulations, leading to no net global reduction in emissions.
- **Potential rise in food prices:** The increased costs for farmers may be passed on to consumers, leading to higher prices for meat, dairy, and other agricultural products. This could especially affect lower-income households.
- **Lower investment for plant-based foods:** The focus on livestock farming would result in higher investment technologies from the state for bringing forward the goals of the climate agenda. Meanwhile the incentives for plant-based food gets very low.

PHOTOS

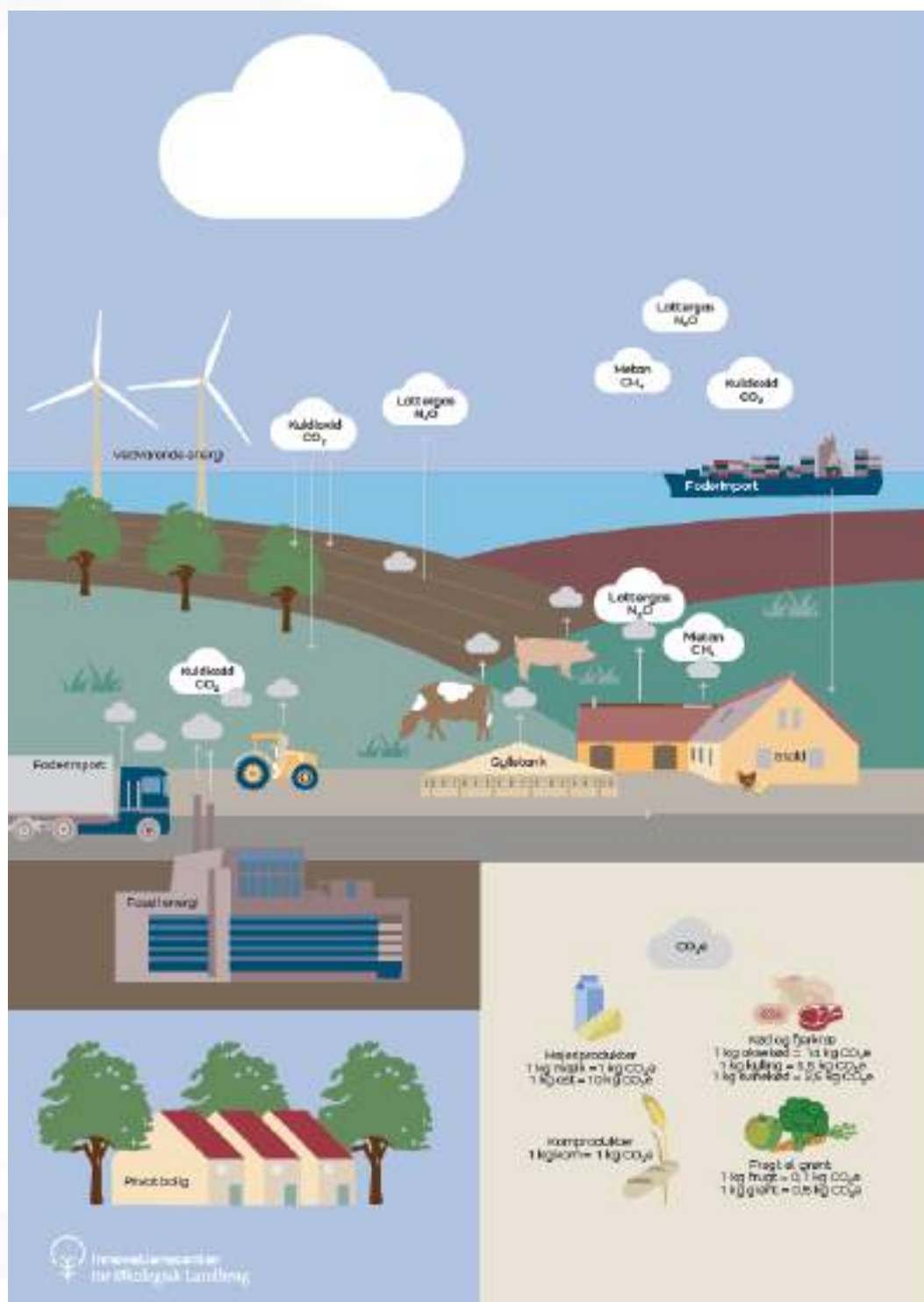


Figure 1: The emission sources of nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2) in the context of agriculture, that the climate tax will target from 2030 in Denmark

Figure 1 shows the emission sources of nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2) in the context of agriculture, that the climate tax will target from 2030 in Denmark. Primarily cattle and pig producers will be targeted. It also shows the emissions calculated for different products: measured in CO_2 equivalents (CO_2e : 1 kg of milk = 1 kg CO_2e ; 1 kg of cheese = 10 kg CO_2e ; 1 kg of beef = 14 kg CO_2e ; 1 kg of chicken = 5.5 kg CO_2e ; 1

kg of pork = 2.5 kg CO₂e; 1 kg of grain = 1 kg CO₂e; 1 kg of fruit = 0.1 kg CO₂e; 1 kg of vegetables = 0.5 kg CO₂e. (Eva Krebs – Innovationscenter for Økologisk Landbrug, 2023)

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Den grønne trepart

URL:

<https://faktalink.dk/emner/den-gronne-trepart>

PRACTICE ABSTRACT NUMBER #42**SHORT TITLE IN NATIVE LANGUAGE**

Ψηφιακά Αποθετήρια Γνώσης (Digital Repositories) και εργαλεία υπολογισμού άνθρακα για την Κλιματικά Ευφυή Γεωργία.

SHORT TITLE IN ENGLISH

Digital Repositories and Carbon Tools for Climate Smart Agriculture

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Importance of Digital Repositories for EU agricultural sector
2. Enhanced adoption through accessible knowledge on Climate-Smart Farming and Carbon Tools

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Καθώς η γεωργία αντιμετωπίζει αυξανόμενες προκλήσεις λόγω της κλιματικής αλλαγής, η ανάγκη για λήψη αποφάσεων βάσει δεδομένων γίνεται πιο κρίσιμη από ποτέ. Οι απογραφές και βάσεις δεδομένων εργαλείων άνθρακα διαδραματίζουν βασικό ρόλο στην υιοθέτηση της Κλιματικά Ευφυούς Γεωργίας (Climate-Smart Farming - CSF), παρέχοντας δομημένες, προσβάσιμες και επιστημονικά τεκμηριωμένες πληροφορίες σχετικά με το ανθρακικό αποτύπωμα, τις εκπομπές αερίων του θερμοκηπίου (Greenhouse Gasses - GHG) και τις στρατηγικές μετριασμού. Αυτά τα εργαλεία υποστηρίζουν τους αγρότες, τους ερευνητές, τους φορείς χάραξης πολιτικής και τις αγροτικές επιχειρήσεις στην εφαρμογή βιώσιμων γεωργικών πρακτικών, τη βελτιστοποίηση της χρήσης των πόρων και τη μείωση των περιβαλλοντικών επιπτώσεων του τομέα.

Ένα από τα κύρια οφέλη των βάσεων δεδομένων εργαλείων άνθρακα είναι η ικανότητά τους να τυποποιούν και να συγκεντρώνουν πληροφορίες. Αυτές οι πλατφόρμες

συγκεντρώνουν δεδομένα για τις εκπομπές άνθρακα από διαφορετικά γεωργικά συστήματα, τύπους εδαφών, ποικιλίες καλλιεργειών και στρατηγικές διαχείρισης κτηνοτροφίας. Παρέχοντας φιλικά προς τον χρήστη περιβάλλοντα εργασίας και προσαρμόσιμα μοντέλα, επιτρέπουν στους ενδιαφερόμενους να αξιολογήσουν το ανθρακικό αποτύπωμα των γεωργικών δραστηριοτήτων, να συγκρίνουν στρατηγικές μετριασμού και να λαμβάνουν τεκμηριωμένες αποφάσεις προσαρμοσμένες στις τοπικές συνθήκες.

Επιπλέον, αυτές οι βάσεις δεδομένων υποστηρίζουν τη λήψη αποφάσεων σε επίπεδο αγροκτήματος, παρέχοντας παρακολούθηση σε πραγματικό χρόνο, προγνωστικά μοντέλα και ανάλυση σεναρίων. Οι αγρότες μπορούν να χρησιμοποιούν εργαλεία λογιστικής άνθρακα για να αξιολογούν τον αντίκτυπο των πρακτικών όπως η καλυπτική καλλιέργεια, η ακριβής λίπανση, η συντηρητική κατεργασία εδάφους και η αγροδασοπονία στην δέσμευση άνθρακα και τη μείωση των εκπομπών. Αυτά τα εργαλεία μπορούν να υποστηρίξουν τους αγρότες της ΕΕ στη βελτίωση της χωρικής ακρίβειας του ισοζυγίου άνθρακά τους και να επιτρέψουν την παρακολούθηση εκπομπών σε πραγματικό χρόνο.

Σε ένα ευρύτερο πλαίσιο, οι απογραφές εργαλείων άνθρακα μπορούν επίσης να συμβάλουν στη διαμόρφωση πολιτικών και στη δημιουργία αγορών άνθρακα. Οι κυβερνήσεις και οι ρυθμιστικοί φορείς χρησιμοποιούν αυτά τα εργαλεία (κυρίως σε περιφερειακό επίπεδο) για να παρακολουθούν την πρόοδο προς τους κλιματικούς στόχους, να σχεδιάζουν συστήματα εμπορίας άνθρακα και να επιβάλλουν πρότυπα βιωσιμότητας στη γεωργία. Παράλληλα, οι αγροτικές επιχειρήσεις και οι φορείς της εφοδιαστικής αλυσίδας μπορούν να αξιοποιήσουν τα δεδομένα άνθρακα για να εφαρμόσουν συστήματα επισήμανσης άνθρακα, να προωθήσουν τη βιώσιμη προμήθεια πρώτων υλών και να ενισχύσουν τη διαφάνεια των περιβαλλοντικών τους πρακτικών.

Συνολικά, οι απογραφές και βάσεις δεδομένων εργαλείων άνθρακα αποτελούν κρίσιμους παράγοντες για την CSF, ενισχύοντας μια κουλτούρα κοινωνικές ευθύνης, καινοτομίας και βιωσιμότητας. Παρέχοντας ακριβή και αξιοποιήσιμα δεδομένα άνθρακα, αυτά τα εργαλεία δίνουν τη δυνατότητα στον γεωργικό τομέα να προχωρήσει προς χαμηλών εκπομπών, κλιματικά ανθεκτικά συστήματα παραγωγής τροφίμων, εξασφαλίζοντας τόσο περιβαλλοντικά όσο και οικονομικά οφέλη για τις μελλοντικές γενιές.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

As agriculture faces increasing challenges from climate change, the need for data-driven decision-making has become more crucial than ever.

Carbon tool inventories and databases play a key role in enabling Climate-Smart Farming (CSF) by providing structured, accessible, and scientifically validated information on carbon footprints, GHG emissions, and mitigation strategies. These tools support farmers, researchers, policymakers, and agribusinesses in implementing sustainable practices, optimizing resource use, and reducing agriculture's environmental impact.

Carbon tool databases are key to standardize and centralize information. These platforms compile data on carbon emissions across farming systems, soil types, crop varieties, and livestock management. They help assess agricultural carbon footprints, compare mitigation strategies, and support data-backed decisions suited to local conditions.

These inventories also aid farm-level decisions through real-time monitoring, predictive modeling, and scenario analysis. Farmers can evaluate the impact of practices on carbon sequestration and GHG reduction. Such tools enhance spatial accuracy and enable tracking of emissions in real time.

On a broader scale, carbon tools support policy development and market incentives. Governments use them—mainly at regional levels—to track climate goals, design carbon credit systems, and enforce sustainability standards. Agribusinesses use carbon data for labeling, sustainable sourcing, and transparency.

Ultimately, carbon inventories are key enablers of CSF, fostering accountability, innovation, and sustainability. These tools empower agriculture to shift toward low-emission, climate-resilient food systems, delivering both environmental and economic benefits. CFD has undertaken to compile such a list of existing tools in Europe. This database is available on the CFD website and will be available during 2025 on the 'Farming for Climate' platform.

LONGER DESCRIPTION – IN ENGLISH

As agriculture faces increasing challenges from climate change, the need for data-driven decision-making has become more crucial than ever. Carbon tools inventories and databases play a key role in enabling Climate-Smart Farming (CSF) by providing structured, accessible, and scientifically validated information on carbon footprints, greenhouse gas (GHG) emissions, and mitigation strategies. These tools support farmers, researchers, policymakers, and agribusinesses in implementing sustainable

agricultural practices, optimizing resource use, and reducing the sector's environmental impact.

One of the main benefits of carbon tools databases is their ability to standardize and centralize information. These platforms compile data on carbon emissions across different farming systems, soil types, crop varieties, and livestock management strategies. By offering user-friendly interfaces and customizable models, they allow stakeholders to assess the carbon footprint of agricultural operations, compare mitigation strategies, and make data-backed decisions tailored to local conditions.

Furthermore, these inventories support farm-level decision-making by offering real-time monitoring, predictive modeling, and scenario analysis. Farmers can use carbon accounting tools to evaluate the impact of cover cropping, precision fertilization, conservation tillage, and agroforestry on carbon sequestration and emission reduction. These tools can ultimately support EU farmers to enhance spatial accuracy of their carbon balance and enable real-time tracking of emissions.

From a broader perspective, carbon tools inventories can potentially also contribute to policy development and market incentives. Governments and regulatory bodies use these tools (primarily on regional levels) to track progress toward climate commitments, design carbon credit systems, and enforce sustainability standards in agriculture. Additionally, agribusinesses and supply chain actors can leverage carbon data to implement carbon labeling schemes, promote sustainable sourcing, and enhance their environmental transparency.

Ultimately, carbon inventories and databases serve as critical enablers of CSF, fostering a culture of accountability, innovation, and sustainability. By equipping stakeholders with accurate and actionable carbon data, these tools empower the agricultural sector to transition toward low-emission, climate-resilient food production systems, ensuring both environmental and economic benefits for future generations.

CFD has undertaken to compile such a list of existing tools in Europe. This database is available on the CFD website and will be available during 2025 on the 'Farming for Climate' platform.

PRACTICE ABSTRACT #43**SHORT TITLE IN ENGLISH**

Storytelling for Impact – A Narrative-Based Communication Approach in Climate Farm Demo

COUNTRY AND CLIMATIC ZONE

N/A

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Stronger stakeholder engagement through relatable and structured storytelling
2. Improved communication of climate-smart farming outcomes across all CFD actors
3. Enhanced uptake of innovations via accessible, audience-tailored narratives

THEMATIC AREA

N/A

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

In the Climate Farm Demo, Dissemination, Exploitation and Communication (DEC) play an important role in communicating climate-smart farming practices. To support this, a storytelling-based approach has been developed to turn complex research and data into compelling, relatable stories that resonate with farmers, advisors, policymakers, and the public.

This method helps present real-life impacts of climate-smart practices, making the benefits more accessible and engaging. The approach is structured around three main components:

Step 1: Identify Relevant Information (See Message Box)

Use the Message Box to define key elements of your story:

- **Audience** – Who are you trying to reach?
- **Problem** – What challenge are they facing?
- **So what?** – Why does this matter to them?
- **Solution** – What climate-smart practice or innovation helps?
- **Benefit** – What difference does this solution make?

Step 2: Build the Narrative (4-Step Story Structure)

Craft a powerful story using these elements:

- **Setting** – What is the current situation or knowledge level?
- **Characters** –
 - *Villain*: e.g., climate change, extreme weather
 - *Victim*: e.g., the farmer or ecosystem under threat
 - *Hero*: e.g., a climate-smart solution like no-till or cover cropping
- **Plot** – Describe how the villain affects the victim using real evidence.
- **Moral** – Show how the solution (hero) helps and share a clear takeaway.

Step 3: Structure the Story for Engagement

Organize your story to maximize impact:

- **Section 1:** Introduce the problem and the characters
- **Section 2:** Share who, where, when, and the solution
- **Section 3:** Provide background and key evidence
- **Section 4:** Conclude with how the issue is solved and what action is needed

This storytelling method has been integrated into DEC training and support materials within CFD to strengthen demonstration events and farmer engagement. Stories make technical solutions personal and memorable helping inspire real change on farms across Europe.

LONGER DESCRIPTION – IN ENGLISH

Effective communication is critical for the success of the Climate Farm Demo (CFD) project. It ensures that climate-smart farming practices, results and outcomes are accessible and compelling to all relevant stakeholders. To support this goal, CFD has introduced a narrative-based storytelling

approach to enhance how project partners, including farmers and advisors, communicate project findings and results.

This storytelling method provides a structured way to translate technical knowledge, field experiences, and scientific results into narratives that resonate with diverse audiences, including farmers, advisors, policymakers, industry representatives, and the general public. By doing so, it strengthens dissemination, knowledge exchange, and stakeholder engagement across the CFD network.

Why Use Storytelling?

Storytelling helps make complex information more accessible and memorable. Climate-smart farming practices often involve technical terms, long-term impacts, and systemic changes. Presenting them through real-world stories increases understanding and relevance, while fostering emotional connection and motivation to act.

The storytelling approach supports:

- Improved engagement at demonstration events and workshops
- Greater learning retention through relatable examples
- Stronger alignment between science and practice
- Enhanced dissemination of project outcomes to a wider audience

Step 1: Identifying Relevant Information Using the Message Box

The Message Box is a communication tool that helps structure key messages clearly. It supports project actors in identifying:

- **Audience** – Who needs to hear this (e.g., farmers, advisors, policymakers)?
- **Problem** – What challenge does the audience face?
- **So what?** – Why does this issue matter to them?
- **Solution** – What practice, innovation, or result addresses the challenge?
- **Benefit** – What is the value or positive outcome for the audience?

This structure ensures that stories are grounded in real concerns and demonstrate clear value.

Step 2: Building the Narrative Using a Four-Element Framework

A compelling narrative is more than a set of facts. It involves characters, tension, resolution, and a clear message. This approach uses four key components:

- **Setting** – The current situation and assumptions of the audience
- **Characters** – Identifying the:
 - *Villain* (e.g., climate stress, soil degradation)
 - *Victim* (e.g., farmers, land, biodiversity)
 - *Hero* (e.g., a climate-smart solution, research insight, or practice)
- **Plot** – The problem as experienced by the victim, supported by data or testimonials
- **Moral** – The conclusion, highlighting how the solution (hero) creates positive change

Step 3: Structuring the Story for Dissemination

Stories developed using this approach can be used across multiple communication formats:

- Field stories and articles
- Practice Abstracts
- Video scripts
- Policy briefs
- Social media posts
- Reports and presentations

The story is structured into:

- **Section 1: Introduction** – Present the problem and the key actors
- **Section 2: Description** – Detail the situation, location, and solution
- **Section 3: Context and Evidence** – Present the background and supporting findings
- **Section 4: Resolution** – Highlight outcomes, key lessons, and a call to action

Inserting quotes from farmers or advisors helps humanise the message and increases trust in the story.

Relevance Across the Climate Farm Demo Network

This approach can be used by all project actors in any project to communicate their results effectively. Whether for scientific dissemination, public outreach, or policy influence, narrative-based storytelling strengthens impact and ensures that messages reach and resonate with the right audiences.

This method also supports the core aims of CFD:

- Encouraging adoption of climate-smart practices

- Fostering peer learning and advisor engagement
- Supporting transparent and inclusive communication
- Linking local experiences with European-level impact

Conclusion

Narrative-based storytelling offers a practical and powerful tool for disseminating Climate Farm Demo outcomes. By combining scientific rigour with personal experience, this approach helps build bridges between knowledge holders and knowledge users. As climate-smart farming becomes increasingly important, the ability to communicate clearly, credibly, and meaningfully is essential.

By adopting this storytelling method, project partners not only increase visibility of their results but also support a culture of engagement, innovation, and sustainability within European agriculture.

PHOTOS



Photo 1: Message box - a communication tool that helps structure key messages clearly

This is only an example targeting general public, with hypothetical issue

PRACTICE ABSTRACT NUMBER #46**SHORT TITLE IN NATIVE LANGUAGE**

Verringerung der Ammoniakemissionen durch Optimierung der Futterrationen von Milchkühen

SHORT TITLE IN ENGLISH

Reducing Ammonia Emissions by Optimizing the Feed Rations of Dairy cows

COUNTRY AND CLIMATIC ZONE

Luxembourg, Continental Europe

CONTACT

Rocco Lioy (rocco.lioy@convis.lu)

3 BENEFITS OF THE PRACTICE

1. Ammonia emissions
2. Optimization of protein content in ration
3. Protein autonomy

PRODUCTION SYSTEM

Dairy cattle

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Die Optimierung der Rohproteinaufnahme bei Milchkühen (siehe Abbildung 3, Maßnahme 16 in der CFD-AMM-Bibliothek) ist ein wichtiger Hebel zur Verringerung der Ammoniak- und Treibhausgasemissionen.

Im Rahmen des Projektes AUTOPROT (www.autoprot.eu) wurde festgestellt, dass ein beträchtlicher Teil des Proteins, das im Betrieb erzeugt und verfüttert wird, von der Milchviehherde nicht verwertet wird. Dieses nicht verwertete Eiweiß ist von großer Bedeutung, denn es erhöht die Gefahr von Ammoniakverlusten. Im Projekt AUTOPROT wurde ferner gezeigt, dass Betriebe mit einem hohen Selbstversorgungsgrad an Eiweiß (Eiweißautarkie) einen niedrigeren Anteil an nicht-verwerteten Eiweiß aufweisen. Man kann rechnerisch darstellen, dass das nicht verwertete Eiweiß dem Luxuskonsum an Eiweiß durch das Milchvieh entspricht.

Aus der Literatur ist bekannt, dass hohe Rohproteingehalte in der Ration von Rindern im Allgemeinen zu einer erhöhten Ausscheidung des Stickstoffs unter Form von Harn führen. Dabei ist gerade der Harn dafür verantwortlich, dass Ammoniak entweicht, da der Harnstoff als Hauptbestandteil des Harns sehr schnell in Ammoniak umgewandelt wird. Wenn das Rohprotein in den Rationen gut am Bedarf der Tiere angepasst ist, scheiden die Tiere den Stickstoff vermehrt über Kot aus, der deutlich weniger zu den Ammoniakemissionen beiträgt.

Dank einer Studie von Sajeev et al. (2017) wurde weiter bekannt, dass im Rindviehbereich das Reduzierungspotential der Ammoniakverluste durch Verringerung um 1% des Rohproteinüberschusses in der Ration bei 17% des Gesamtausstoßes liegt.

Ein wesentlicher Punkt ist die Definition einer Zielgröße für die Rationsoptimierung. Nach Ansicht von Experten lassen sich Rohproteingehalte in der Ration von Milchkühen bis auf ein Niveau von 15% in der Trockensubstanz ohne Einbußen in der Milchleistung absenken. Für das Jungvieh ist nach Ansicht der Experten ein Rohproteingehalt in der Ration von 14% ausreichend. Aus diesen Überlegungen konnte für die CONVIS-Betriebe ein Einsparungspotential an NH₃-emissionen über die Rationsoptimierung von rund 10 kg Stickstoff pro ha. Von diesen Einsparungen stammen 90% allein aus der Rationsoptimierung der Milchkühe.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The practice of optimizing crude protein intake in dairy cows (See Figure 3, Measure 16 in CFD AMM library) is a key lever for reducing both ammonia and GHG emissions.

As part of the AUTOPROT project (www.autoprot.eu), it was established that a considerable proportion of the protein produced and fed on the farm is not utilised by the dairy herd. This unutilised protein is of great importance because it increases the risk of ammonia losses. The AUTOPROT project also showed that farms with a high degree of self-sufficiency in protein (protein self-sufficiency) have a lower proportion of unutilised protein. It can be shown mathematically that the unutilised protein corresponds to the luxury consumption of protein by the dairy cattle.

It is known from the literature that high crude protein levels in cattle rations generally lead to increased excretion of nitrogen in the form of urine. It is the urine that is responsible for the escape of ammonia, as urea, the main component of urine, is very quickly converted into ammonia. If the crude protein in the rations is well adapted to the animals' requirements, the animals excrete more nitrogen via faeces, which contributes significantly less to ammonia emissions.

Thanks to a study by Sajeev et al. (2017), it also became known that the potential for reducing ammonia losses in cattle by reducing by 1% the crude protein surplus in the ratio is 17% of the total output.

A key point is the definition of a target value for ration optimisation. According to experts, crude protein levels in the rations of dairy cows can be reduced to a level of 15% in dry matter without any loss in milk yield. In the opinion of the experts, a crude protein content of 14% in the ration is sufficient for young cattle. Based on these considerations, the CONVIS farms in the AUTOPROT project were able to achieve potential savings in NH₃ emissions of around 10 kg of nitrogen per ha through ration optimisation. Of these savings, 90% came from ration optimisation for dairy cows alone.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

Im Rahmen des Projektes AUTOPROT (www.autoprot.eu) wurde festgestellt, dass ein beträchtlicher Teil des Proteins, das im Betrieb erzeugt und verfüttert wird, von der Milchviehherde nicht verwertet wird. Dieses nicht verwertete Eiweiß ist von großer Bedeutung, denn es erhöht die Gefahr von Ammoniakverlusten. Im Projekt AUTOPROT wurde ferner gezeigt, dass Betriebe mit einem hohen Selbstversorgungsgrad an Eiweiß (Eiweißautarkie) einen niedrigeren Anteil an nicht-verwerteten Eiweiß

aufweisen. Die Eiweißautarkie kann in Funktion der Futtervorlage bzw. des Bedarfs an Eiweiß der Milchviehherde ausgedrückt werden (Abb.1).

Das nicht verwertete Eiweiß ist auf engstem mit dem Rohproteinüberschuss in der Ration bzw. mit dem Luxuskonsum vom Milchvieh verbunden. Man kann nämlich rechnerisch zeigen, dass der Unterschied zwischen aufgenommenem Eiweiß, und dem von den Tieren als Milch und Fleisch verwertete Eiweiß umso größer ist, je höher die Menge an Eiweiß ist, das über dem Bedarf hinaus vom Milchvieh aufgenommen wird. Dann steigen auch die ausgeschiedenen Stickstoffmengen und damit das Ammoniak-Ausstoßpotential (Abb.2).

Aus der Literatur ist bekannt, dass hohe Rohproteingehalte in der Ration von Rindern im Allgemeinen zu einer erhöhten Ausscheidung des Stickstoffs unter Form von Harn führen. Dabei ist gerade der Harn dafür verantwortlich, dass Ammoniak entweicht, da der Harnstoff als Hauptbestandteil des Harns sehr schnell in Ammoniak umgewandelt wird. Wenn das Rohprotein in den Rationen gut am Bedarf der Tiere angepasst ist, scheiden die Tiere den Stickstoff vermehrt über Kot aus, der deutlich weniger zu den Ammoniakemissionen beiträgt.

Für die CONVIS-Betriebe wurde im Rahmen des Projektes ein durchschnittlicher Rohproteingehalt bei den Milchkühen von 16,7% in der Trockensubstanz festgestellt. Beim Jungvieh lag der Mittlere Rohproteingehalt bei 14,5% in der Trockensubstanz.

Dank einer Studie von Sajeev et al. (2017) wurde weiter bekannt, dass im Rindviehbereich das Reduzierungspotential der Ammoniakverluste durch Verringerung um 1% des Rohproteingehaltes in der Ration bei 17% des Gesamtausstoßes liegt.

Ein wesentlicher Punkt ist die Definition einer Zielgröße für die Rationsoptimierung. Nach Ansicht von Experten lassen sich Rohproteingehalte in der Ration von Milchkühen bis auf ein Niveau von 15% in der Trockensubstanz ohne Einbußen in der Milchleistung absenken. Für das Jungvieh ist nach Ansicht der Experten ein Rohproteingehalt in der Ration von 14% ausreichend. Aus diesen Überlegungen konnte für die CONVIS-Betriebe im AUTOPROT-Projekt ein Einsparungspotential an NH_3 -emissionen über die Rationsoptimierung von rund 10 kg Stickstoff pro ha. Von diesen Einsparungen stammen 90% allein aus der Rationsoptimierung der Milchkühe.

Wir halten fest

- Im Rahmen des Projektes AUTOPROT wurde der Zusammenhang zwischen Rohprotein-Überschuss in der Ration vom Milchvieh und den Ammoniakverlusten untersucht.
- Die im Rahmen des Projektes AUTOPROT untersuchten CONVIS-Betriebe weisen einen Rohproteingehalt in der Ration der Milchkühe von 16,7% auf.
- Vom Rohprotein-Gehalt kommt man zu den Ammoniak einsparungen durch die Annahme, dass die Reduzierung von 1% des Rohprotein-Gehaltes eine Verringerung der Emissionen um 17% bewirkt.
- Über die Rationsoptimierung von Milchkühen (Absenkung des Rohproteingehaltes auf 15%) und Jungvieh besteht ein Verringerungspotential von bis 25% der NH_3 -Verluste. Im Fall der CONVIS-Betriebe macht dies rund 10 kg $\text{NH}_3\text{-N/ha}$.
- Allgemein gilt: Eine hohe Selbstversorgung mit Eiweiß (hohe Eiweißautarkie) ist eine wesentliche Voraussetzung dafür, niedrige Ammoniakemissionen zu erreichen.

LONGER DESCRIPTION – IN ENGLISH

As part of the AUTOPROT project (www.autoprot.eu), it was established that a considerable proportion of the protein produced and fed on the farm is not valorized by the dairy herd. This not valorized protein is of great importance because it increases the risk of ammonia losses. The AUTOPROT project also showed that farms with a high degree of self-sufficiency in protein (protein self-sufficiency) have a lower proportion of non-valorized protein. Protein self-sufficiency can be expressed as a function of the feed supply or the protein requirement of the dairy herd (Fig. 1).

The not valorized protein is closely linked to the crude protein surplus in the ration or to the luxury consumption of dairy cattle. It can be shown mathematically that the higher the amount of protein consumed by dairy cattle more than their requirements, the greater the difference between the protein consumed and the protein valorized by the animals as milk and meat. This also increases the amount of nitrogen excreted and thus the potential for ammonia emissions (Fig. 2).

It is known from the literature that high crude protein levels in cattle rations generally lead to increased excretion of nitrogen in the form of urine. It is the urine that is responsible for the escape of ammonia, as urea, the main component of urine, is very quickly converted into ammonia. If the crude protein in the rations is well adapted to the animals' requirements, the

animals excrete more nitrogen via faeces, which contributes significantly less to ammonia emissions.

As part of the project, an average crude protein content of 16.7% in the dry matter of dairy cows was determined for the CONVIS farms. For young cattle, the average crude protein content was 14.5% in dry matter.

Thanks to a study by Sajeev et al. (2017), it also became known that the potential for reducing ammonia losses in cattle by reducing the crude protein content in the ration by 1% is 17% of the total output.

A key point is the definition of a target value for ration optimization. According to experts, crude protein levels in the rations of dairy cows can be reduced to a level of 15% in dry matter without any loss in milk yield. In the opinion of the experts, a crude protein content of 14% in the ration is sufficient for young cattle. Based on these considerations, the CONVIS farms in the AUTOPROT project were able to achieve potential savings in NH₃ emissions of around 10 kg of nitrogen per ha through ration optimization. Of these savings, 90% came from ration optimization for dairy cows alone.

Main conclusions

- As part of the AUTOPROT project, the relationship between excess crude protein in the ration of dairy cattle and ammonia losses was analysed.
- The CONVIS farms analysed showed a crude protein content of 16.7% in the ration of the dairy cows.
- From the crude protein content, the ammonia savings are derived by assuming that reducing the crude protein content by 1% results in a 17% reduction in emissions.
- By optimizing the rations of dairy cows (lowering the crude protein content to 15%) and young cattle, there is potential to reduce NH₃ losses by up to 25%. In the case of the CONVIS farms, this amounts to around 10 kg NH₃_N/ha.
- In general, a high protein autonomy (high protein self-sufficiency) is an essential prerequisite for achieving low ammonia emissions.

PHOTOS

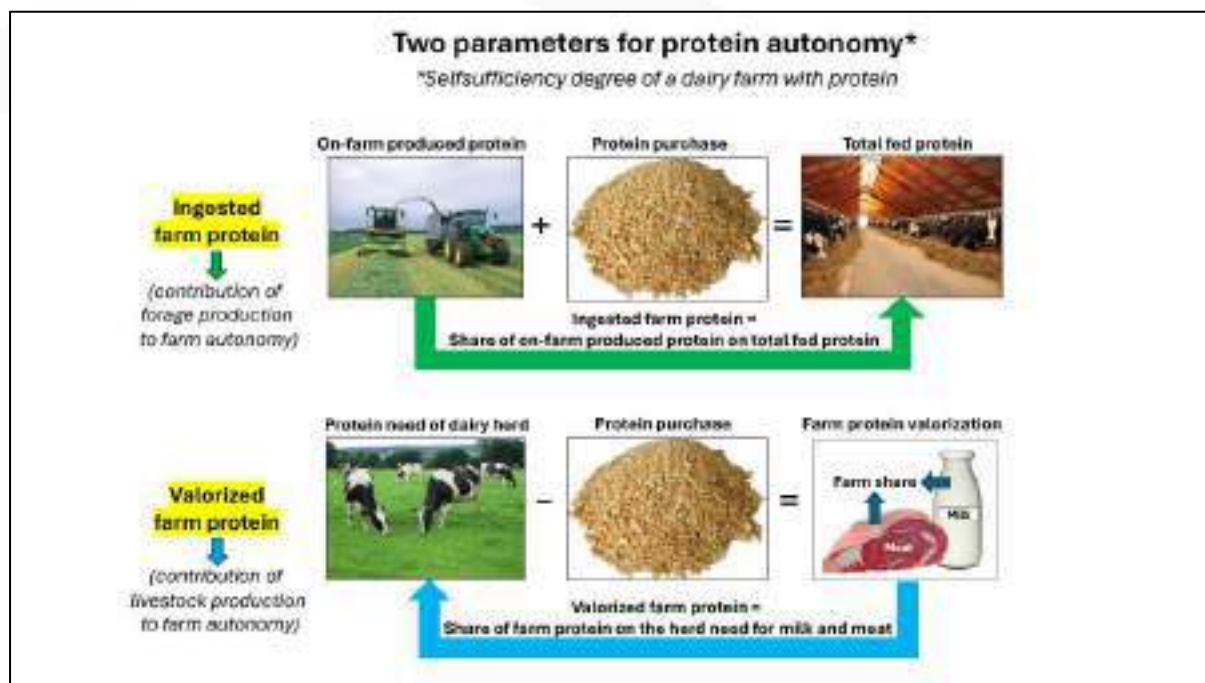


Figure 1: Calculation of protein autonomy for dairy farms

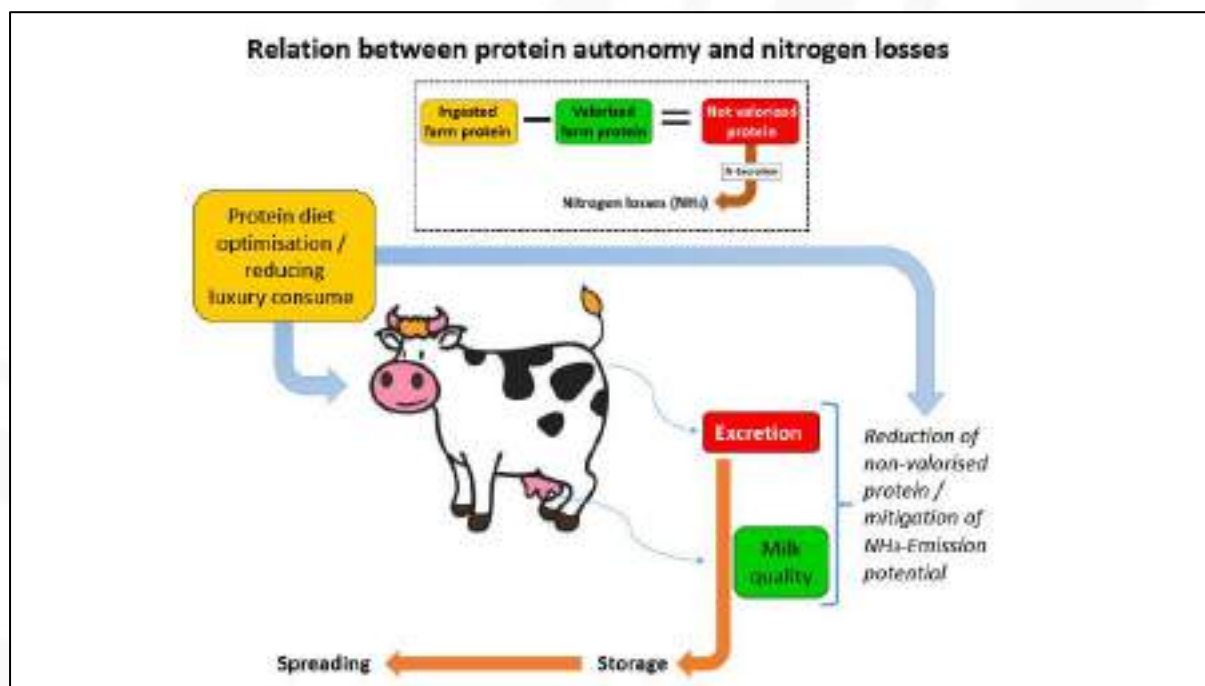


Figure 2: Relation between protein autonomy and nitrogen losses

Measure ID	Measure	Level	Category	Sub-category	Key practices suitable for organic farming	Mitigation and Adaptation	Key adaptation benefits (impact on value chain)	Statistical mitigation potential	Relevance for climate mitigation effects and NBN	Availability of current evidence in
1	Separating feed by its nutrient value	Animal	Animal husbandry and feeding	Feed	Organic	M		3	Increased feed efficiency (kg feed/kg milk)	3
2	Controlling early loss of forage	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	A	Drought		kg of forage stock for storage losses	1
3	Creating an "addition" and pasture access	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	A	Drought		Area available for additional grazing	1
4	Reducing stocking and allowing higher cattle	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	A	Drought		Increased stocking for cattle (kg/ha)	1
5	Optimizing feedstock quality management	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	A			Time of addition between cattle	2
6	Feeding regularly grazing	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	A			Area available for early grazing	2
7	Strengthening woody forage recovery	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	AM		2	Percentage of woody forage in diet	2
8	Strengthening pasture (green)	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	AM		2	Percentage of green in diet	2
9	Continuous full grazing (see animal as part of)	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		4	kg of hay in full grazing	2
10	Feeding of feedstock (see animal as part of)	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	Percentage of feedstock	2
11	Feeding of feedstock (see animal as part of)	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	Percentage of feedstock (see animal as part of)	2
12	Decrease of feed content in feed	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	Percentage of feed content in diet	2
13	High production of feedstock	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	kg of feedstock	2
14	High production of feedstock	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	kg of feedstock (see animal as part of)	2
15	Optimization of feed content in feed	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	Percentage of feed content in diet	2
16	Optimization of feed content in feed	Animal	Animal husbandry and feeding	Feed/ Dairy	Organic	M		1	Percentage of feed content in diet	2

Figure 3: Measure 16 from the Climate Farm Demo Mitigation Adaptation Library

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Technical handbook to calculate protein autonomy in dairy farms, in German (also French version available)

URL:

https://www.autoprot.eu/wp-content/uploads/2021/02/Livable-2.1_Technisches-Handbuch.pdf

Title/Description

Technical report about the mitigation potential of ammonia emissions via optimization of ration of dairy cows, in German (also French version available)

URL:

https://www.autoprot.eu/wp-content/uploads/2022/07/20220719_8.2._DE.pdf

PRACTICE ABSTRACT #48**SHORT TITLE IN ENGLISH**

Reinforcing Your Key Message During Demonstration Events with the use of Props

COUNTRY AND CLIMATIC ZONE

N/A

CONTACT

Laure Triste (laure.triste@ilvo.vlaanderen.be)

3 BENEFITS OF THE PRACTICE

1. Effective demonstration events
2. Use of props
3. Higher retention rates

PRODUCTION SYSTEM

N/A

THEMATIC AREA

N/A

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

When organizing a demonstration event, you want your key message to come across clearly and stick with the participants. A powerful tool to reinforce your key message is the use of props. The word “prop” is borrowed from the theater and movie industry, where it refers to a “movable article or

object used on the set of a movie or play.” Furthermore, it is also defined as “a support to keep something from shaking or falling.” Building on these definitions, in demonstration events, we refer to a “prop” as “an object that supports or emphasizes the key message during a demonstration.”

Props can take many forms, such as information boards, soil samples, feed samples, a harvester, or even a cow. The main idea is that they are simple and enhance understanding of the key message at a glance. For example, when you want to stress the importance of making quality silage to reduce feed costs, a bale of silage can be presented alongside a meal. Or, when explaining different plots on a farm, participants can be provided with a simple map of the plots and their characteristics.

By using a prop, the learning retention rate of participants can be doubled to 20%, compared to a simple lecture, which has a retention rate of 10%. But, if you want to significantly increase the retention rate to 75%, you can introduce a prop that participants can actively engage with. For example, if you want to discuss the difference between multiple varieties of forage, you can present different samples that participants can feel, smell, taste, etc., along with a description of their characteristics. Or, when discussing the quality of a clover field, a clover scorecard can be handed out to the participants to help them judge the clover content in a grass/clover sward.

ADDITIONAL INFORMATION

More tips on organizing effective demo events can be found in the demo design guide (<https://zenodo.org/records/13939148>) and in the FarmDemo Training Kit (<https://trainingkit.farmdemo.eu/>)

PHOTOS



Picture 1: a bale of silage can be presented alongside a meal during a demo event in Ireland

Source: John Greaney, Teagasc



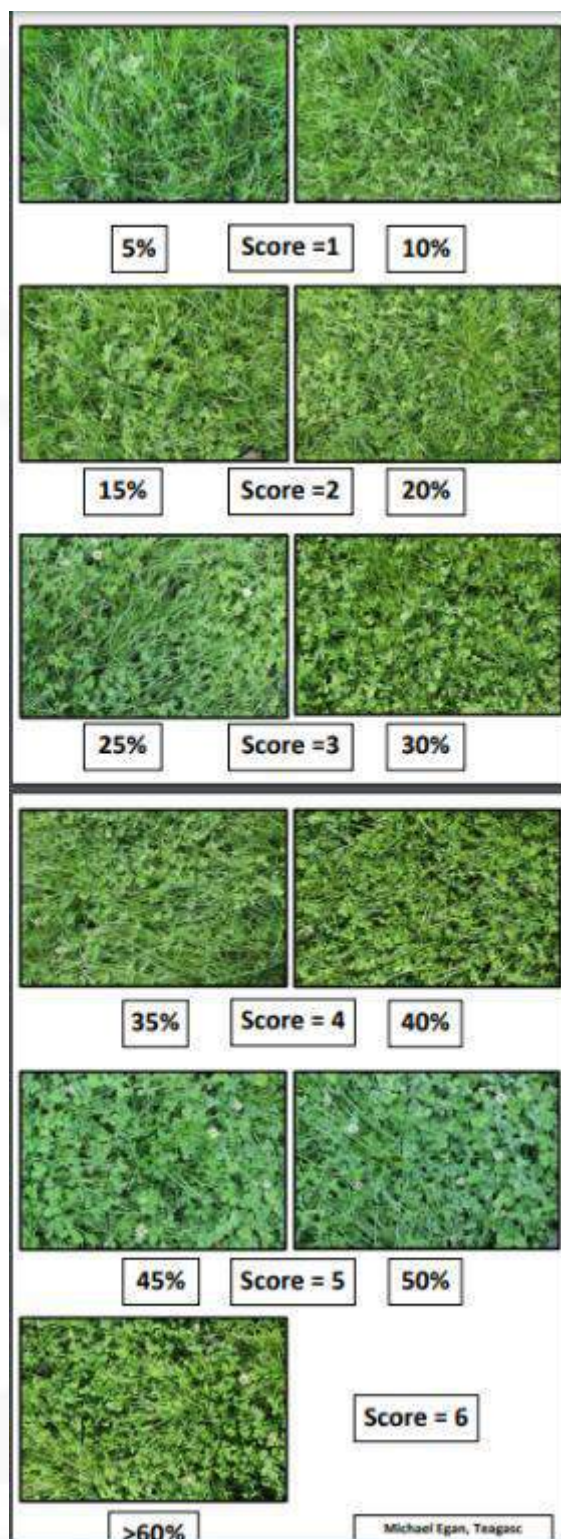
Picture 2: Map of an agroforestry system of a Dutch farm

Source: Willem Hendriks, ZLTO



Picture 3: Different varieties of forages and their characteristics

Source: Elena Bortolazzo, CRPA



Picture 4: Clover scorecard used during demo events in Ireland

Source: Michael Egan, Teagasc

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

ClimateFarmDemo- Demo Design Guide for On-farm Demonstrations

URL:

<https://zenodo.org/records/13939148>

Title/Description

FarmDemo Training Kit

URL:

<https://trainingkit.farmdemo.eu/>

PRACTICE ABSTRACT #52**SHORT TITLE IN ENGLISH**

Effective Communication for Demo Events - Boosting Reach, Engagement, and Impact

COUNTRY AND CLIMATIC ZONE

N/A

CONTACT

Isidora Čolić (isidora.colic@biosense.rs)

3 BENEFITS OF THE PRACTICE

1. Targeted outreach and higher attendance
2. Wider visibility and knowledge transfer
3. Stronger networks and lasting impact

THEMATIC AREA

N/A

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Announcing and promoting your farm demonstration events is key to ensuring strong participation, meaningful exchange, and lasting impact. Whether you are a farmer or advisor, good communication helps bring the right people to your event, builds interest, and ensures your experiences reach others who can benefit from them. Sharing your event before and after also supports the wider goals of the Climate Farm Demo project by spreading knowledge on climate-smart farming practices.

Announcing your demo event

A clear and timely announcement helps participants plan and signals that their presence is valued. Tailor your message and use tools that match your audience:

- **Direct messages** (email, SMS, phone calls) to specific farmers or advisors.
- **Local channels** farmers trust—WhatsApp groups, bulletin boards, newsletters, Facebook groups.
- **Networks and institutions** (advisors, farming groups, local authorities).

Include the **date, time, location, topic, and key benefits** of attending. Explain what will be demonstrated or learned in a practical way.

Promoting your demo

Promotion builds curiosity and widens your audience:

- Share posts via **social media channels** (Facebook, Instagram, LinkedIn).
- Tag partners and Climate Farm Demo to extend reach.
- Use **engaging visuals**—photos of your farm or previous events.
- Highlight the benefit: e.g. “See how cover crops reduce fertiliser needs.”

After the event

Follow up with a **thank-you message** and a **summary post**:

- Share **main outcomes** and **good photos**.
- Mention who attended and what was learned.
- Tag key participants or supporters.

Benefits of good communication:

- Stronger turnout and engagement
- Wider knowledge sharing
- More impact from your effort
- Better visibility for your farm or organisation

By planning your event communication before and after, you help ensure it makes a difference for both your local community and farmers across Europe.

LONGER DESCRIPTION – IN ENGLISH

Promoting and announcing your farm demonstration events is essential for ensuring a successful turnout, meaningful exchange, and long-term impact. Whether you are a farmer or advisor, good communication helps bring the right people to your event, creates interest in the topic, and allows others to benefit from your experience. Sharing your event before and after also supports the wider goals of your project by spreading knowledge on climate-smart farming practices.

Announcing your demo event

The first step is a clear and timely announcement. This helps potential participants plan and signals that their presence is welcome and valued. Depending on your audience, you can use different tools:

- **Direct invitations:** Personal emails, text messages, or calls work well—especially when tailored to the interests of specific farmers or advisors.
- **Farmer-used communication channels:** Post in local WhatsApp or Facebook groups, cooperatives' newsletters, or bulletin boards at local supply stores.
- **Advisor networks and local institutions:** Inform advisory services, local government or extension services so they can help share the news.

Your announcement should include the **date, time, location, topic, and key benefits** of attending. Keep it clear and practically explain what participants can expect to see or learn.

Promoting your event

Promotion adds visibility and builds curiosity beyond your direct contacts. Consider:

- **Posting on your farm or advisory organisation's social media** (Facebook, Twitter/X, Instagram, LinkedIn).
- **Tagging project** (e.g., Climate Farm Demo), local institutions or cooperatives to extend reach.
- **Using engaging visuals:** Share photos from past events or a picture of the host farm to attract attention.
- **Mentioning why the event matters**—for example, “See how cover crops help reduce fertiliser costs.”

After the event

Your work doesn't end when the event does. Sharing a **thank-you message** shows appreciation and builds relationships for future events. A short

follow-up post with key takeaways and a few good photos helps spread the knowledge further and increases impact:

- Post highlights from the demo day on social media. (good photos or videos are highly recommended)
- Mention who attended, what was discussed, and what was learned.
- Use quotes or feedback from participants if available.
- Tag participants, partners, and any supporting organisations.

Key benefits for farmers and advisors:

- Stronger participation and engagement
- Wider sharing of knowledge and practical solutions
- Stronger local networks and visibility for your work
- Greater impact from your demo effort

By announcing, promoting, and following up on your event, you help ensure your demo farm's experience contributes to the wider adoption of climate-smart farming practices—both locally and across Europe.

PRACTICE ABSTRACT #63**SHORT TITLE IN ENGLISH**

Farmers with Power - A 6-Step Approach to Sustainable Energy Management in Climate Farming

COUNTRY AND CLIMATIC ZONE

Belgium, temperate maritime climate

CONTACT

Marleen Gysen (marleen.gysen@boerenbond.be)

3 BENEFITS OF THE PRACTICE

- Reduced energy costs through smart monitoring and optimisation
- Increased use of renewable energy and on-farm production
- Improved energy efficiency and climate resilience in farming operations

PRODUCTION SYSTEM

All

THEMATIC AREA/SECTOR

Energy management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

With rising energy costs and the need for climate-smart farming, farmers require structured guidance to improve energy efficiency. The Belgian farmers' organisation Boerenbond has developed a practical manual to

help advisors and farmers navigate this transition. The *Farmers with Power!* tool offer a six-step approach to optimising energy use, reducing costs, and fostering a greener, climate-smart agricultural sector.

1. Know your farm

Advisors work with farmers to analyse energy consumption: how much is needed, when, and at what power level. This may involve assessing energy use across different seasons and peak operational times. Energy monitoring systems can help track usage and identify areas for improvement.

2. Energy bill optimisation

Farmers should review their energy bills for potential savings, such as negotiating better rates or adjusting contracts to better align with usage patterns.

3. Energy-saving measures

Reducing energy use can involve upgrading lighting, optimising heating, ventilation, and cooling (HVAC) systems, and investing in efficient machinery and equipment.

4. Renewable energy production

Farmers can install solar panels, wind turbines, or biomass systems to cut fossil fuel reliance and emissions. Feasibility depends on space, local climate conditions, labour, and financial resources.

5. Smart use of own produced energy

Aligning energy use with production periods, shifting energy-intensive tasks, and investing in storage solutions maximises renewable energy benefits.

6. Collaboration on energy

Farmers can join energy communities to share costs, access funding, and negotiate better energy deals. Cooperatives can also implement energy-efficient infrastructure and demand-side management strategies, enhancing energy resilience.

This tool supports farmers, advisors, and energy consultants in advancing energy efficiency and sustainability in climate-smart farming.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

This tool is part of the ClimateSmartAdvisors toolbox and is not yet online.

PRACTICE ABSTRACT #64**SHORT TITLE IN ENGLISH**

The Use of LED Lighting in Dairy Housing to Increase Performance and Lower Costs and Carbon Footprint

COUNTRY AND CLIMATIC ZONE

United Kingdom, temperate climate

CONTACT

Richard Lloyd (richardl@i4agri.org)

3 BENEFITS OF THE PRACTICE

1. Improved Milk Production
2. Lower Electricity Costs
3. Improved Animal Welfare

PRODUCTION SYSTEM

Indoor Dairy Housing

THEMATIC AREA

Herd Management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Providing better lighting in dairy setups can increase yields by 10%. Milking cows exposed to light levels over 150 lux for 16 hours a day can increase yields by 8–13%, as increased daylight reduces the cows' melatonin levels. This, in turn, enables more of their naturally occurring milk-producing hormones to be secreted. However, it is also important to provide 8 hours of darkness to

optimise the cows' circadian rhythm, which improves health and reproductive performance.

Farmers must take care when measuring light. It is important to take measurements at cow level, ideally with sensors that automatically activate the lighting systems. A common mistake is placing lights only above the feed passage and not distributing them evenly throughout the cubicle building. A cow typically spends only 3–4 hours per day at the feed barrier but rests in a cubicle for 12–16+ hours per day. If lighting is inadequate in the cubicles, where the cow spends most of her time, she will not be exposed to the required photoperiod.

Red night lights may be used to facilitate cow movement and observation during darkness. The intensity of red light has minimal or no effect on the cows' perception of darkness and thus does not significantly impact melatonin secretion. There should be no brighter lights in any part of the barn, and cows need 2–4 weeks on average to adjust.

LED lights with blue-enriched white light (400–500 nm) are an ideal light source and help reduce energy costs. These can also be incorporated into units that provide red night lights. Optimising the light spectrum and photoperiod helps regulate the cows' circadian rhythm by mimicking summer daylight conditions, which stimulates feed intake and milk production. Red night lights also improve fertility and general well-being, while providing a better environment for farm workers and aiding in heat detection.

Ideal LED lighting: more yield, better welfare, more profit, lower costs, and a reduced carbon footprint.

LONGER DESCRIPTION – IN ENGLISH

At the recent Climate Farm Demo project meeting in Slovenia, the herd management thematic visit highlighted the importance of having suitable lighting in cow sheds, especially when dairy cows are housed for extended periods.

In the UK, and elsewhere, it is common for transparent roofing panels to be used to allow light into cow sheds during the day. However, the transparency of these panels deteriorates as dirt accumulates and the materials degrade, so it is common to encounter sheds with substandard light levels.

Providing better lighting in dairy setups can increase yields by up to 10%. Milking cows exposed to light levels over 150 lux for 16 hours a day can see yields increase by 8–13%, as the extended daylight reduces melatonin levels in cows, which in turn enables more of their naturally occurring milk-producing hormones—IGF-1 and prolactin—to be secreted. However, it is also important to provide 8 hours of darkness to optimise the cows' circadian rhythm. This promotes better sleep patterns and reduces stress, thus improving health and reproductive performance.

Farmers must take care when measuring light. Measurements should ideally be taken with sensors at cow level that automatically activate the lighting system. A common mistake is placing lights only above the feed passage and not evenly throughout the cubicle building. Cows typically spend just 3–4 hours per day at the feed barrier, while resting in cubicles for 12–16+ hours daily. If lighting is inadequate in the cubicles, cows will not receive the required photo period.

Red night lights can be used to facilitate cow movement and observation during darkness. The intensity of red light has minimal or no effect on cows' perception of darkness and thus does not significantly affect melatonin secretion. There should be no brighter lights in any part of the barn. Cows need, on average, 2–4 weeks to adjust to new lighting.

There has been much research in humans on the role that light—and blue light in particular—plays in Seasonal Affective Disorder (SAD). Symptoms of SAD include fatigue, sleep disturbances, and changes in appetite. Cows are no different.

In dairy housing, LED lights are commonly used due to their lower energy consumption and longer lifespan compared to other light sources. The light spectrum of LEDs can vary significantly depending on the type used.

LED lights with blue-enriched white light (400–500 nm) are ideal and help reduce energy costs. These can be integrated into units that also provide red night lights. Optimising the light spectrum and photoperiod helps regulate cows' circadian rhythms by mimicking summer daylight conditions, which increases levels of IGF-1 and prolactin, stimulates feed intake, and boosts milk production. Red night lights also support fertility, general well-being, better working environments for farm staff, and heat detection.

The impact on carbon footprint—measured per litre of milk—can be significant. Increased milk production, improved feed efficiency, and

reduced energy costs per litre are estimated to deliver a 4% reduction in CO₂e per litre.

This impact could be even greater in farms with very poor housing conditions, as the estimate does not account for expected improvements in fertility, cow health, or reduced replacement rates.

Ideal LED lighting: more yield, better welfare, more profit, lower costs, and a reduced carbon footprint.

PHOTOS



Photo 1: LED lights in daylight, cow sheds



Photo 2: Red night lights in cow shed

PRACTICE ABSTRACT #65**SHORT TITLE IN NATIVE LANGUAGE**

Inventário de projetos, iniciativas e decisores políticos

SHORT TITLE IN ENGLISH

Inventory of Projects, Flagship Initiatives, and Policymakers for the Climate Farm Demo (CFD) Network

COUNTRY AND CLIMATIC ZONE

Portugal, Mediterranean zone

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Collaboration
2. Synergies
3. Knowledge exchange

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S)

O desenvolvimento de colaborações com entidades externas ao projeto ClimateFarmDemo tem três objetivos principais:

- 1) Integrar o conhecimento e a investigação de outros projetos, iniciativas e decisores políticos,
- 2) Dar visibilidade ao projeto e divulgar os seus recursos e principais resultados;
- 3) Criar oportunidades de cooperação.

Para facilitar este tipo de colaboração, o projeto estabeleceu uma lista de projetos, iniciativas e decisores políticos relevantes, através da contribuição de vários parceiros do consórcio.

O Inventário de Projetos, Iniciativas e Decisores Políticos (PIP) do Climate Farm Demo (CFD) é uma ferramenta estratégica fundamental para estabelecer a cooperação a nível europeu e nacional entre o Climate Farm Demo e outros PIPs. Esta ferramenta lista vários projetos, iniciativas e decisores políticos que podem ser relevantes para os parceiros do CFD.

Ao utilizar esta base de dados, os parceiros do CFD podem encontrar novas oportunidades de colaboração, tanto a nível nacional como a nível europeu. Tais oportunidades serão, por exemplo, a organização de conferências e workshops conjuntos, a integração de metodologias e ferramentas de outros projetos no trabalho desenvolvido no Climate Farm Demo e até a troca de conhecimento para dar feedback aos decisores políticos.

Foram recolhidos contributos de todos os parceiros do projeto, bem como desenvolvida uma pesquisa orientada para os decisores políticos relevantes da Comissão Europeia, do Parlamento Europeu e do Conselho Europeu. Posteriormente, foi desenvolvida uma pesquisa e análise detalhadas para recolher informações relevantes sobre os projetos, bem como sobre iniciativas e decisores políticos.

A base de dados resultante permite um mapeamento detalhado com descrição dos PIPs e a relevância para os diferentes parceiros do Projeto. Esta ferramenta foi o primeiro passo para o estabelecimento de sinergias que poderão ter valor acrescentado para o Climate Farm Demo.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Establishing links with external networks has three main goals:

1. Integrate knowledge and research from other projects, initiatives and policymakers,
2. Give visibility to the project and disseminate its resources and main outputs.
3. Create opportunities for cooperation.

To facilitate this type of collaboration, the project has established a list of relevant Projects, Initiatives and Policymakers with contributions of several partners in the consortium.

The Inventory of Projects, Flagship Initiatives, and Policymakers (PIP) of the Climate Farm Demo (CFD) is a key strategic tool for establishing cooperation

at European and national levels between Climate Farm Demo and other PIPs. This tool lists various projects, initiatives and policymakers that might prove to be relevant for partners in CFD.

By using this database, CFD partners may find new opportunities for collaboration both at national and at European level. Such opportunities might include the organization of joint conferences and workshops, integrating methodologies and tools from other projects into the work developed in Climate Farm Demo and even knowledge exchange with policymakers to provide feedback on current policy measures.

Input was collected from all project partners, as well as a targeted search for relevant policymakers within the EU Commission, EU Parliament and EU Council. Afterwards, a detailed search and analysis was made to collect relevant information of the identified past, ongoing, and future projects, as well as flagship initiatives and policymakers. The resulting database enables a detailed mapping of PIP names, description and relevance to different partners in the Project. This tool was the first step towards establishing synergies that have an added value for Climate Farm Demo.

PRACTICE ABSTRACT #69**SHORT TITLE IN NATIVE LANGUAGE**

La lisiothermie, une pratique pour réduire les consommations d'énergie et les émissions de GES au bâtiment pour les élevages porcins en système lisier.

SHORT TITLE IN ENGLISH

Manure Cooling, a Practice for Reducing Energy Consumption and GHG Emissions of Pig Buildings with Slurry Systems

COUNTRY AND CLIMATIC ZONE

France, temperate climate

CONTACT

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3 BENEFITS OF THE PRACTICE – ADD KEYWORDS

1. Less GHG emissions
2. Less ammonia emission
3. Reducing energy consumption

PRODUCTION SYSTEM

Pig housing on slatted floors

THEMATIC AREA/SECTOR

Pigs sector

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

La France, comme l'Union Européenne, se fixe d'atteindre la neutralité carbone à l'horizon 2050, avec des réductions des émissions de gaz à effet de serre applicables à tous les secteurs d'activités. L'élevage porcin représente 6% des émissions de GES liées à l'élevage en France. Pour les élevages en système lisier, les émissions de GES liées aux effluents sont dominées par le méthane. L'ammoniac est indirectement impliqué car elle contribue à la formation de protoxyde d'azote, autre GES fortement impactant sur le réchauffement climatique.

La lisiothermie est une technique basée sur la récupération des calories des lisiers stockés en porcherie. Un liquide caloporteur circule dans un réseau de tubulures installé en fond de préfosse permettant l'échange calorique avec le lisier. Il permet d'acheminer les calories vers une pompe à chaleur reliée à un ballon d'eau chaude ou à un système de chauffage pour préchauffer l'air de maternité par exemple. Si l'objectif initial de cette technique est la réduction de la consommation d'énergie, elle peut aussi contribuer à réduire l'impact environnemental des porcheries avec, d'après des essais français conduits par l'Ifip, un abattement de 20% sur l'ammoniac et de 60% sur le méthane. Néanmoins, cette technique est plutôt à réserver aux nouveaux bâtiments ; le réseau de tubulures devant être inséré dans la dalle béton de la préfosse ; son installation en bâtiments existants conduisant à une réduction notable du volume de stockage des lisiers en bâtiment.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

France, like the European Union, aims to achieve carbon neutrality in 2050 by reducing greenhouse gas emission in all sectors. Pig farming accounts for 6% of livestock-related greenhouse gas emissions in France. For pig farms with slurry systems, GHG emissions linked to effluents are dominated by methane. Ammonia is indirectly involved because of its contribution to the formation of nitrous oxide, another greenhouse gas with a major impact on global warming.

Manure cooling is a technique based on recovering heat from slurry stored in pig farms. A heat-transfer fluid circulates through a network of pipes installed at the bottom of the pre-pit, allowing heat exchange with the slurry. This system transfers the recovered heat to a heat pump connected to a hot water tank or a heating system, for example, to preheat the air in farrowing units. While the primary goal of this technique is to reduce energy

consumption, it can also help reduce the environmental impact of pig farms, with French trials conducted by Ifip showing a 20% reduction in ammonia emissions and a 60% reduction in methane emissions. However, this technique is better suited to new buildings, as the pipe network must be embedded in the concrete slab of the pre-pit; installing it in existing buildings would significantly reduce the available storage volume of slurry within the facility.

ADDITIONAL INFORMATION

Depending on the practice used, reducing GHG emissions from buildings also involves thinking about outdoor storage methods as part of an overall approach to avoid shifting emission sources.

PHOTOS



Photo 1: Manure cooling at the bottom of the pre-pit

Photo credit: IFIP

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

Etude de l'influence du refroidissement du lisier sur les émissions gazeuses de NH₃, N₂O et CH₄ de porcs à l'engraissement

Guingand N, Rousselière Y, Lagadec S. and Hassouna Melinda, 2025. 57ème Journées de la Recherche Porcine en France, 57, 107-112.

URL:

<https://www.journees-recherche-porcine.com/>

PRACTICE ABSTRACT #70**SHORT TITLE IN ENGLISH**

How to Structure an Effective European Project with a Wide Range of Agricultural Actors in Several Countries

COUNTRY AND CLIMATIC ZONE

All

CONTACT

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3 BENEFITS OF THE PRACTICE

1. European project running efficiently
2. National ecosystems are connected, locally and with the European level
3. Advisors are trained with the best practices across Europe to support farmers in their climate transition.

PRODUCTION SYSTEM (IF RELEVANT)

All

THEMATIC AREA

All

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

If you're leading a project that involves diverse actors (i.e. farmers, advisors, cooperatives, researchers, and agro-industries) across multiple countries,

like the European "Climate Farm Demo" (CFD), structuring your project effectively is key to success. Here are some insights from over two years of CFD experience:

1. Clear Role Definition

In large-scale projects such as CFD which involves over 80 partners, 1,500 farmers, 250 advisors, and National Coordinators across 26 countries, defining roles is crucial. Clearly identify the levels of responsibility and differentiate between those who carry out tasks (field actors) and decision-makers who provide resources. The goal is to keep the organization simple, flexible, and efficient, with dedicated channels to address each actor type.

2. Linking European and National/Local Levels

To ensure the network functions well across countries, the following steps are key:

- **Leverage Existing Networks:** Build on national or regional demo-farm networks, advisory groups, or cooperatives. If none exist, help partners create one.
- **National Coordinators:** Appoint someone to lead local efforts, connect with national stakeholders and act as an interface with the European level (see dedicated Practice Abstract).
- **Common Operating Framework:** Create a flexible, cohesive framework for national networks to follow.
- **Regular Engagement:** Organize recurring missions like annual national meetings to keep stakeholders engaged.
- **Quarterly Coordination:** Connect all National Coordinators regularly through a dedicated management group and online meetings to share updates, challenges, and solutions.
- **Involving Advisors and Experts:** Advisors are crucial for guiding farmers through climate-smart practices. Ensure that National Coordinators facilitate these networks, connect with advisors' managers for support, and involve experts to train advisors on new practices and facilitation skills.

LONGER DESCRIPTION – IN ENGLISH

Are you a project leader and want to set up a network gathering many different actors, such as farmers, advisors, researchers, cooperatives, suppliers and agro-industries in over 25 countries, as is the case for the European "Climate Farm Demo" (CFD) project?

After more than 2 years up and running, here are some initial observations based on CFD's experience on how to run a project that works. Our first and

most important outcome is to structure the project organisation with defined roles and link the European level with the national and local levels.

Identify roles

In a very large-scale project such as CFD, over 80 partners are involved in the management and activities, while there are 1,500 farmers, over 250 advisors, and 30 work packages and task leaders, 20 thematic and sectors specialists and 26 National Coordinators (i.e. 1 per country involved in demonstration events in the field).

One of the critical points in the running of such a project is to clearly identify the levels of responsibility and decision-making and to differentiate between those who carry out tasks (field actors) and decision-makers who provide resources. Each actor must understand their role in the global framework, while the organization remains simple and flexible.

The challenge is to develop channels through which these actors can be addressed effectively. In CFD, we organise bi-annual meetings (1 face-to-face and 1 online) and targeted webinars for decision-makers, while structuring a specific operating model for field actors (see below).

Articulate the European level with each national network

It is vital that the network is connected at national and local levels: how to do so?

1. Ideally, establish the national network by building on existing national or local demo-farm networks derived from previous projects, cooperative, agroindustry or advisor groups: this ensures the network is already operational. If no such network exists, the project must support the national partners for its creation. This requires attention and organisational flexibility, as well as the support of operational intermediaries (see next point);
2. Appoint National Coordinators: its role is to create links with the partners involved in its own country, lead local actors towards a common goal and act as an interface with the European level (please see dedicated Practice Abstract "*The key role of the National Coordinator in a project such as CFD: scope and limits of his tasks*");
3. Define a common operating framework for these national networks that is sufficiently solid and coherent, while remaining flexible and 'comfortable';
4. Provide resources in the country language – or translate them if necessary: tools, trainings and documentation will be most useful to advisors and farmers if available in their own language;

5. Define recurring missions and key actions for national networks, such as committing them to organising a national meeting each year;
6. Connect the National Coordinators together through a quarterly online meeting: they will share their highlights, needs and issues, while you can communicate information relevant for all national networks. One of the keys to success is to create an operational intermediate management function through a 'Network Management Unit', which is extremely important and valuable in making the project run smoothly;
7. Connect with the network of advisors in each country, building on current networks whenever possible. Indeed, advisors are crucial to support farmers in the journey towards climate smart transition;
8. Appoint the National Coordinator as Climate Farm Advisors' network facilitator, responsible for creating the dynamics and synergies needed to disseminate climate smart farming practices as widely as possible;
9. Engage with the advisors' direct managers to ensure they will provide the means for the advisors to act in the field;
10. Involve thematic experts to train the advisors on new climate smart practices but also on facilitating skills (see dedicated *Practice Abstract mentioned above*).

ADDITIONAL INFORMATION

Assess the feasibility and conditions for implementing Climate-Smart Farming Practices in the various countries involved in the project

A key element of a project of the scale of CFD is to carry out an inventory of the Agricultural Knowledge and Innovation Systems (AKIS) in the different countries and to anticipate the different situations in which they operate. For a 'Coordination and Support Actions' (CSA) project like CFD, the key point is the link between the advisors and the type of advisory network that exists in the different countries. In fact, in CFD, the widespread dissemination of Climate Smart Practices relies on advisors who are competent both in climate change mitigation and adaptation issues, and in facilitating on-farm demonstration events. The project must be able to provide support solutions (from initial training to ongoing skills upgrading).

In addition, one of the conditions of feasibility is the question of how to support the project partners, first and foremost the volunteer farmers involved in the project. They commit time and energy to organising demonstration events and taking part in cross-fertilisation activities. The question is how to compensate them financially for the time they invest. But

there is also the challenge of financing the mitigation or adaptation measures to be implemented. In CFD, these two points are not covered by the project, which means that 'mirror financing' solutions have to be found where necessary. The key success factor here, as in the CFD project, is to dedicate resources to structuring synergies between projects, initiatives and policymakers.

Do not underestimate the language barrier

The language barrier appears at all levels and for all roles in a European project on the scale of CFD. But it is particularly sensitive and can become a major limiting factor at the key level of advisors, but also of farmers.

At advisor level, the language barrier may prove to be a critical point, mainly in terms of 1/ getting to know and using the tools for assessing the capacity of farms to adapt to and mitigate climate change; 2/ helping them to develop their technical skills on the issues of adapting to climate change and mitigating the effects of agricultural practices on it.

At farmer level, the language barrier is a major obstacle to exchanges and cross-learning between peers from different countries. There is a risk that some of the operational knowledge produced cannot be disseminated widely if it is not translated.

A key success factor is to anticipate the need for translation and to dedicate project resources to the implementation of tools (based in particular on the fast-growing field of Generative Artificial Intelligence) that can overcome the language barrier.

Do not underestimate the effort required to deploy tools for assessing the capacity of farms to adapt to and mitigate climate change.

One of the first lessons to be learnt from the CFD project is to recognise the difficulties and resources that need to be mobilised to deploy tools in the field with advisors and farmers. These difficulties can be seen at a number of overlapping levels: 1/ the choice of tools; 2/ the skills required to use these tools; 3/ the technical skills required to deal with 'climate' issues; 4/ the skills required to organise and facilitate high-quality demonstration events on farms; 5/ the skills required for communication and dissemination activities; 6/ the motivation of agricultural professionals and the political priorities given to climate issues.

The choice of tools is particularly complex and requires a compromise approach for all situations requiring the adaptation of tools designed for different farming systems and soil and climate conditions. Indeed, the long

development times for the tools required for these adaptations cannot always be included in the project.

The level of political priority given to climate issues can have major consequences, particularly in terms of all the measures to support farmers in implementing new, more virtuous practices, sharing the management of climate risks, etc.

PHOTOS

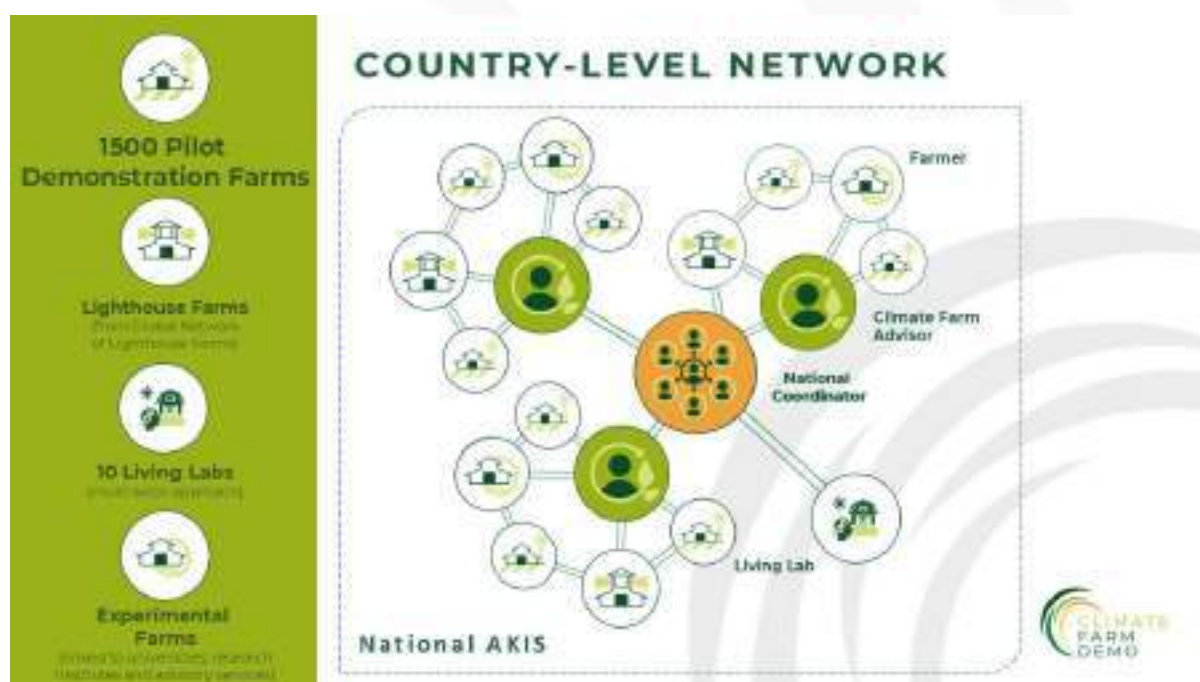


Photo 1: CFD Country-Level Network

CFD EUROPEAN-LEVEL NETWORK



Photo 2: CFD European-Level Network

EUROPEAN-LEVEL NETWORK



Photo 3: European-Level Network

PRACTICE ABSTRACT #71**SHORT TITLE IN ENGLISH**

The Impact of Slurry Separation on Nutrient Content of the Separated Fractions

COUNTRY AND CLIMATIC ZONE

United Kingdom, NW Europe maritime climate

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Creation of organic material with contrasting dry matter and nutrient contents
2. Allows for a more targeted application of organic materials
3. Applicable to all slurry and digestate based systems

PRODUCTION SYSTEM (IF RELEVANT)

Livestock/Biogas

THEMATIC AREA

Manure storage and spreading

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Slurry separation is the mechanical division of livestock slurry or digestate, to create a liquid and solid fraction.

Three common methods of separation used on farm include:

1. Screw press
2. Roller screen press
3. Decanting centrifuge

The efficiency of the separator to remove dry matter (DM) into the solid fraction underpins the association of nutrients into the relevant fractions. Typically, the liquid fraction is characterised by low DM, high readily available nitrogen (N) and low phosphorus (P) and carbon content. The solid fraction has a higher DM, and P content, and has been acknowledged for its potential benefits to improve soil quality indicators such as water holding capacity, aggregate stability and drainage. Typical UK values for separated organic materials are presented in the AHDB Nutrient Management Guide (RB209).

The partitioning of P into the solid fraction can benefit the farmer in supporting the potential use of separated solids to maintain or build up soil P levels without over-applying N, and the potential for P-rich solids to be removed from an area with excess soil P.

Ultimately, farmers are faced with a trade-off between the cost and availability of separation methods. Centrifuge separators are reportedly the most effective at creating a phosphate (PO_4^-) rich solid material. However, this technique is the most expensive per tonne of separated material, has the highest electricity demand, is the most expensive to install, and has a lower throughput of slurry compared to a screw press. It is for farmers to assess which technology is best suited for their slurry management based on their business and regulatory requirements.

ADDITIONAL INFORMATION

The information for this Practice Abstract was generated as part of the UK Government Defra-funded project (Defra RDE372 – Evaluating the agronomic and environmental impacts of slurry and digestate separation).

PHOTOS

Fraction	Material	DM	TN	TP	TK
		%	kg/t fresh weight (FW)		
Solid	Cattle slurry	20	4.0	2.0	3.3
	Pig slurry	20	5.0	3.7	2.0
	Farm digestate	24	5.6	4.7	6.0
Liquid	Cattle slurry	4	3.0	1.2	2.8
	Pig slurry	3	3.6	1.1	2
	Farm digestate	3	1.9	0.6	2.5

Table 1: Typical UK values for separated organic materials

Source: AHDB Nutrient Management Guide (RB209)

PRACTICE ABSTRACT #72**SHORT TITLE IN ENGLISH**

The Key Role of the National Coordinator in a Project such as CFD: Scope and Limits of His/Her Tasks

COUNTRY AND CLIMATIC ZONE

European scale

CONTACT

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BENEFITS OF THE PRACTICE

1. European CSA project
2. Intermediate management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Climate Farm Demo (CFD) project promotes Climate Smart Farming Practices across 26 countries, involving 1,500 farmers and 250+ advisors. To ensure effective implementation, the project relies on National Coordinators (NCs), who serve as the crucial link between the European management team and national agricultural networks.

The NC's main responsibilities include:

- Facilitating smooth communication between the European team and national stakeholders.
- Reporting challenges and progress from their country to the project management team.
- Ensuring all project documents are accessible in the local language.
- Managing the national network by organizing knowledge exchange events and maintaining advisor and farmer engagement.

- Supporting and monitoring national partners in carrying out their expected tasks.
- Expanding the project's reach by engaging policymakers, researchers, and farmers through effective communication.
- Contributing to policy development by working with national and regional authorities.

NCs may have expertise in specific agricultural fields, but they are not required to be specialists in all aspects of climate adaptation and mitigation. However, their role has certain limitations:

- They do not have decision-making authority over national partners.
- They cannot provide specialized training outside their expertise.
- If solely acting as NCs, they are not directly responsible for audits, adaptation plans, or demonstration events.

Overall, NCs play a vital role in ensuring the project's success by bridging communication gaps, supporting local stakeholders, and broadening the impact of climate-smart farming initiatives.

LONGER DESCRIPTION – IN ENGLISH

Climate Farm Demo (CFD) is a project that focuses on the deployment of Climate Smart Farming Practices by those working in the field, in this case farmers engaged in various production systems, accompanied by advisors. The CFD project is deploying its scheme in 26 countries and with 1,500 farmers, accompanied by more than 250 advisors. To bring such a programme to life, it is essential to rely on an intermediary operational management link, the 'National Coordinator' (NC). The NC is essential, because he is familiar with the operating methods (the 'codes') of his country's agricultural ecosystem and, of course, carries out his tasks in the local language!

The NCs are the " pivotal " links between the project's management at global (European) level and the networks deployed in each of the countries (26 countries in the case of CFD). Their main roles are to:

- Ensure a fluid exchange between the team managing the project at European level and the deployment of national actions on the field (and make sure that all the documents made available within the project are accessible in a language that everyone in their country understands),
- Act as a link between the partners in its country (mainly advisory bodies and farmers) while managing the national network by

organizing skill-building and knowledge exchange events and ensuring continued engagement among advisors and farmers,

- Contribute (under the responsibility of the project's general management) to monitoring and supporting the tasks expected of the partners in his/her country throughout the project,
- Broaden the impact of the Climate Farm Demo project within his country by engaging a broader audience, including the farming and scientific communities, through suitable communication channels. Build relationships with national and regional policymakers and contribute to shaping the strategic plan for Policy Initiatives and Policies (PIPs),
- Report on initiatives and difficulties encountered by advisors and farmers in his/her country to the project management.

The NC may of course combine several roles and be an advisor, or a scientific specialist in a particular field or sector, or even be involved in running a Living Lab. However, they are not required to be scientific specialists in all areas of climate change adaptation or mitigation.

The main limitations of his mission are as follows:

- They have no decision-making responsibility in relation to the partners in their country involved in the project.
- They are unable to provide training to their country's advisors or farmers in specialized subjects, except in their own areas of expertise.
- In case they perform only the role of the NC, they are not directly involved in delivering project outputs such as audits, adaptation and mitigation plans, or demonstration events.

From CFD's experience, it is essential to connect the National Coordinators together in order to create a dynamic peer's network. We experienced an efficient pattern through a quarterly online meeting when NCs share highlights, needs and issues of their national networks, while coordination team can communicate information relevant for all national networks.

One of the keys to success is to create an operational intermediate management function through a 'Network Management Unit', which is extremely important and valuable in making the project run smoothly.

In CFD, during the first two years we created small groups of 5 to 7 NCs to create favourable conditions for the NCs to get to know each other. From the third year, once the working links had been developed, we moved to groups of 8 to 10 NCs to widen the circle of exchanges, which has proved to be quite effective and relevant.

In addition, the NCs systematically have a dedicated face-to-face session at the annual meetings organised in one of the partner countries.

PRACTICE ABSTRACT #73**SHORT TITLE IN ENGLISH**

The Role of Soils for Climate Mitigation and Adaptation

COUNTRY AND CLIMATIC ZONE

All EU

CONTACT

Lin Bautze (lin.bautze@fibl.org) and Markus Steffens

3 BENEFITS OF THE PRACTICE

1. Improved soil fertility and long-term productivity
2. Enhanced climate resilience and carbon sequestration
3. Reduced GHG emissions through sustainable soil management

PRODUCTION SYSTEM

Arable crops, horticulture, market gardening, protein and oil seed crops, viticulture

THEMATIC AREA

- Soil health and biodiversity
- Grassland management, forage production, crops management, agroforestry and relation to landscape

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Why Soils Matter

Arable soils are the foundation of farming across the EU, crucial for fertility, productivity, profitability, and long-term sustainability. Soils are now central to climate debates due to their role in reducing greenhouse gas (GHG) emissions and supporting resilient agriculture. Scientists are developing methods to quantify soil organic carbon (SOC) for climate mitigation, while policymakers explore carbon credit schemes. Farmers are increasingly interested in carbon farming as a potential income source.

Effects of Climate Change on Soils

Climate change poses challenges to soil health, including:

- Increased erosion and nutrient leaching from heavy rainfall and extreme weather
- Frequent waterlogging or droughts, impacting plant productivity
- Greater pest pressure and altered microbial activity due to temperature changes
- Faster decomposition of soil organic matter under warmer conditions
- Negative impacts on soil structure and stability

Investing in soil health is essential to preserve ecosystems and maintain productivity.

How to Build Healthy and Fertile Soils

Building healthy soil takes time. Long-term studies, like Switzerland's DOK trial, show that biodynamic and organic practices can sequester more SOC than conventional systems. Farmers can apply two strategies to stabilize or increase carbon in soils: (a) increase carbon inputs (e.g., cover crops, compost) and/or (b) reduce carbon losses (e.g., reduced tillage, rewetting peatlands).

Soil and Climate Goals

While SOC is often seen as a solution to the climate crisis, challenges remain—measuring, verifying, ensuring additionality, permanence, and addressing leakage and sequestration potential. SOC is not a simple fix, but carbon farming can increase farmer engagement and foster sustainable practices.

Balancing climate goals with other sustainability aspects supports the long-term health and fertility of soils.

LONGER DESCRIPTION – IN ENGLISH

Why Soils Matter

The foundation of most farms across the EU is their arable soils, along with their fertility and health. These factors regulate not only soil functions but also productivity, financial returns, and the long-term sustainability of production. In fact, 95% of the world's food is either directly or indirectly produced on soils (1).

In recent years, arable soils have become an increasingly important focus in the climate debate. Their role in reducing greenhouse gas (GHG) emissions and supporting resilient agriculture across the EU is a topic of significant discussion. Scientists are working to develop methods that can accurately quantify soil organic carbon (SOC) to assess its potential as a climate mitigation solution. Policymakers are striving to integrate these findings into carbon credit schemes, while farmers are becoming increasingly interested in carbon farming as a potential source of income.

Effects of Climate Change on Soil Health, Fertility, and Carbon

The unavoidable effects of climate change will present new and additional challenges for farmers related to their soils:

- Erosion and nutrient leaching are likely to increase due to more intense and frequent rainfall, winds, and extreme weather events.
- Waterlogging or changing soil moisture caused by flooding or droughts will become more frequent, posing challenges to plant productivity.
- Increased pest and disease pressures due to changing temperature patterns.
- Higher rates of soil organic matter decomposition driven by warmer temperatures.
- Negative impacts on soil structure and stability (2).

Therefore, investing now in healthy and fertile soils is essential for farmers to preserve the ecosystem functions of arable soils and maintain crop productivity in the long term.

What Can Be Done to Build Healthy and Fertile Soils

Building healthy, fertile, and resilient soils takes time (3). Long-term experiments, such as the DOK trial in Switzerland, show that it takes many years to see the effects of certain management practices on SOC. These studies have demonstrated that biodynamic and organic farming practices

may have greater potential to sequester SOC compared to conventional systems. Organic fertilizers, such as compost, farmyard manure, and cover crop systems, have been proven beneficial in stabilizing or increasing SOC (4). In general, farmers can focus on two approaches:

- Increasing carbon inputs (e.g., through cover crops, compost, organic manure, etc.)
- Reducing carbon losses (e.g., through reduced tillage, rewetting of peatlands, and similar practices) (5).

By adopting these methods, farmers can contribute to building and maintaining healthy, fertile soils over the long term.

Soils and Climate Goals

Currently, there are high expectations that SOC will provide a solution to the climate problem. However, scientific evidence indicates that relying on SOC as a definitive solution for achieving a climate-neutral Europe presents significant challenges. These include issues related to the measurement, verification, and reporting of SOC. Concerns arise from differences in soil carbon sequestration potential, additionality, permanence, and leakage effects (6).

As a result, expectations for soils as an easy fix for climate challenges need to be tempered. Nonetheless, carbon farming can serve as a starting point for advisory efforts and for farmers to engage with the topic of climate change. It can encourage constructive dialogue about potential adaptations to management practices that align with climate mitigation, adaptation, and broader sustainability goals.

It is crucial to emphasize: holistic solutions are needed ones that balance climate goals with other sustainability objectives, ensuring long-term soil fertility and the health of arable soils.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Description/Title

EEA Europe (2015): Soil and climate change. Infographic.

URL

<https://www.eea.europa.eu/en/analysis/maps-and-charts/soil-and-climate-change>

Description/Title

The state of soils in Europe – Fully evidenced, spatially organised assessment of the pressures driving soil degradation

European Commission: European Environment Agency, Joint Research Centre, Arias-Navarro, C., Baritz, R. and Jones, A., Arias-Navarro, C.(editor), Baritz, R.(editor) and Jones, A.(editor), Publications Office of the European Union, 2024

URL

<https://data.europa.eu/doi/10.2760/7007291>

Description/Title

Soil and climate. Research Institute of Organic Agriculture (FiBL), Frick.

Paul Mäder; Markus Steffens; Maïke Krauss; Andreas Fliessbach; Hans-Martin Krause; Colin Skinner; Martina Lori; Giulia Bongiorno; Matthias Klais; Christine Arncken; Hansueli Dierauer; Else Bünemann; Adrian Müller; Urs Niggli; Andreas Gattinger (2022).

URL

<https://www.fibl.org/de/shop/1349-soil-and-climate>

Description/Title

The DOK trial: a 45 years comparative study of organic and conventional cropping systems. Research Institute of Organic Agriculture (FiBL), Frick.

Andreas Fliessbach, Hans-Martin Krause (both FiBL Switzerland), Klaus Jarosch, Jochen Mayer (both Agroscope), Astrid Oberson (ETH Zürich), Paul Mäder (FiBL Switzerland) (2024).

URL

<https://www.fibl.org/en/shop-en/1741-dok-dossier-en>

Description/Title

Agricultural limitations to soil carbon sequestration: Plant growth, microbial activity, and carbon stabilization, Agriculture, Ecosystems & Environment

Tuomas J. Mattila, Noora Vihanto, Volume 367, 2024, 108986, ISSN 0167-8809,

URL

<https://doi.org/10.1016/j.agee.2024.108986>.

Description/Title

Carbon farming: Are soil carbon certificates a suitable tool for climate change mitigation?

Carsten Paul, Bartosz Bartkowski, Cenk Dönmez, Axel Don, Stefanie Mayer, Markus Steffens, Sebastian Weigl, Martin Wiesmeier, André Wolf, Katharina Helming, Journal of Environmental Management, Volume 330, 2023, 117142, ISSN 0301-4797

URL

<https://doi.org/10.1016/j.jenvman.2022.117142>.

PRACTICE ABSTRACT #88**SHORT TITLE IN NATIVE LANGUAGE**

La valutazione dell'impatto ambientale negli allevamenti

SHORT TITLE IN ENGLISH

Environmental Impact Assessment in Livestock Farming

COUNTRY AND CLIMATIC ZONE

Italy and all Europe

CONTACT

Sara Carè (sara.care@crea.gov.it)

3 BENEFITS OF THE PRACTICE

1. Carbon footprint
2. Environmental sustainability
3. Life Cycle Assessment

PRODUCTION SYSTEM

Livestock farming

THEMATIC AREA

Herd management

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

L'allevamento degli animali è un importante componente della filiera agroalimentare e dell'economia rurale; tuttavia è stato messo in evidenza che questo è uno tra i principali emettitori di gas ad effetto serra (GHG),

principalmente metano (CH_4), il protossido di azoto (N_2O) e l'anidride carbonica (CO_2). La valutazione della quantità di questi gas prodotti negli allevamenti può essere fatta attraverso l'applicazione della metodologia del Life Cycle Assessment (LCA) che è un metodo, standardizzato dalle norme ISO 14040 e 14044, che permette di calcolare gli impatti ambientali di un prodotto o di un servizio lungo tutto il suo ciclo di vita. L'LCA si compone di diverse fasi: la definizione dello scopo/obiettivo dell'analisi; la scelta dell'unità funzionale che è associata alla produzione di emissioni GHG (kg FPCM o kg LWG) e del confine del sistema; l'analisi d'inventario attraverso cui si fa la raccolta dei dati necessari per l'analisi; la scelta dei fattori di emissione con cui si andranno a calcolare tutti i gas prodotti in allevamento. Una volta individuati questi fattori di emissione si procede al calcolo del contributo di metano, protossido di azoto e anidride carbonica al riscaldamento globale che viene espresso in base al loro Global Warming Potential (misura del contributo di ogni gas serra al riscaldamento globale) che è riferito ad 1 kg di CO_2 equivalente ed è pari a 28 kg di CO_2 equivalente per il CH_4 e a 265 kg di CO_2 equivalente per il N_2O .

L'LCA applicata al settore agricolo e zootecnico permette di valutare la sostenibilità ambientale degli allevamenti, focalizzandosi sulle cause dei principali impatti, permettendo al contempo di valutare e attuare ipotesi di miglioramento, in modo da migliorare la performance ambientale di ciascuna azienda. Con l'applicazione di questa metodologia, si possono identificare i processi a più alta intensità di emissione e di uso delle risorse all'interno del processo produttivo e, successivamente, individuare le opzioni di miglioramento più adeguate.

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Livestock production is an important component of the agri-food chain and the rural economy; however, it has been identified as one of the main emitters of greenhouse gases (GHG), primarily methane (CH_4), nitrous oxide (N_2O), and carbon dioxide (CO_2). The assessment of these gases in livestock farming can be conducted using the Life Cycle Assessment (LCA) methodology, a standardized method under ISO 14040 and 14044 that calculates the environmental impacts of a product or service throughout its life cycle.

LCA consists of several phases:

- Defining the purpose/objective of the analysis

- Choosing the functional unit associated with GHG emissions (kg Fat and Protein Corrected Milk (FPCM) or kg live weight gain (LWG) and setting system boundaries
- Conducting inventory analysis to collect necessary data
- Selecting emission factors to calculate all gases produced on the farm

Once emission factors are identified, the contributions of methane, nitrous oxide, and carbon dioxide to global warming are calculated using their Global Warming Potential (GWP)—a measure of each gas's impact relative to CO₂ equivalent (CO₂-eq). The values are 28 kg CO₂-eq for CH₄ and 265 kg CO₂-eq for N₂O and 1 kg CO₂ eq for CO₂. (See *IPCC: Fifth Assessment Report*)

Applying LCA to agriculture and livestock enables an assessment of environmental sustainability, identifying the main impact sources while also evaluating and implementing potential improvements. This methodology helps pinpoint high-emission and resource-intensive processes within production systems, allowing for the identification of optimal improvement strategies to enhance environmental performance.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

L'allevamento degli animali è un importante componente della filiera agroalimentare e dell'economia rurale; tuttavia è stato messo in evidenza che questo è uno tra i principali emettitori di gas ad effetto serra (GHG), principalmente metano (CH₄) che deriva dalla fermentazione della sostanza organica nel rumine e nelle deiezioni; il protossido di azoto (N₂O) che si forma per reazioni a carico dei composti azotati escreti dall'animale, nei depositi degli effluenti e in campo e dalle reazioni dei fertilizzanti azotati di sintesi; e l'anidride carbonica (CO₂) che deriva dalla combustione dei carburanti fossili utilizzati nelle lavorazioni colturali e dalla produzione degli alimenti acquistati, dei fertilizzanti e dei pesticidi.

La valutazione della quantità di questi gas prodotti negli allevamenti può essere fatta attraverso il calcolo di indicatori specifici (Carbon Footprint). Il Life Cycle Assessment (LCA) è un metodo, standardizzato dalle norme ISO 14040 e 14044, che permette di calcolare gli impatti ambientali di un prodotto o di un servizio lungo tutto il suo ciclo di vita attraverso il calcolo di specifici indicatori che si compone di diverse fasi: la definizione dello scopo/obiettivo dell'analisi (per esempio la comparazione di diversi sistemi produttivi); la scelta dell'unità funzionale che è associata alla produzione di emissioni GHG (kg FPCM o kg

LWG) e del confine del sistema che generalmente è il *farm gate*; l'analisi d'inventario attraverso cui si fa la raccolta dei dati necessari per l'analisi; la scelta dei fattori di emissione con cui si andranno a calcolare tutti i gas prodotti in allevamento. In accordo con quanto riportato nelle linee guida dell'IPCC, questa scelta può essere fatta applicando tre livelli di precisione il Tier 1: approccio semplificato basato sull'utilizzo di valori di default, il Tier 2: può essere utilizzato se ci sono dati specifici per quella fonte emissiva; il Tier 3: è un approccio fortemente specifico perché considera dei fattori relativi ai sistemi produttivi del paese interessato dall'analisi. Una volta individuati questi fattori di emissione si procede al calcolo del contributo di metano, protossido di azoto e anidride carbonica al riscaldamento globale che viene espresso in base al loro Global Warming Potential (misura del contributo di ogni gas serra al riscaldamento globale) che è riferito ad 1 kg di CO₂ equivalente ed è pari a 28 kg di CO₂ equivalente per il CH₄ e a 265 kg di CO₂ equivalente per il N₂O.

L'LCA applicata al settore agricolo e zootecnico permette di valutare la sostenibilità ambientale degli allevamenti, focalizzandosi sulle cause dei principali impatti, permettendo al contempo di valutare e attuare ipotesi di miglioramento, in modo da migliorare la performance ambientale di ciascuna azienda. Con l'applicazione di questa metodologia, si possono identificare i processi a più alta intensità di emissione e di uso delle risorse all'interno del processo produttivo e, successivamente, individuare le opzioni di miglioramento più adeguate. La metodologia LCA può essere applicata non solo alle aziende agricole, ma anche all'industria alimentare, e più in generale a tutta la filiera agroalimentare, in modo da valutare la sostenibilità ambientale dei prodotti e delle aziende. In tal modo ciascuna azienda potrà conoscere gli aspetti ambientali critici della propria filiera produttiva e valutare opportunità di miglioramento. L'LCA è alla base di sistemi e strumenti a supporto della gestione ambientale quali ad esempio etichette e dichiarazioni ambientali di prodotto.

LONGER DESCRIPTION - IN ENGLISH

Livestock production is an important component of the agri-food chain and the rural economy; however, it has been highlighted as one of the main sectors emitting greenhouse gases (GHG). These include methane (CH₄), which derives from the fermentation of organic matter in the rumen and manure; nitrous oxide (N₂O), which is formed through reactions involving nitrogen compounds excreted by animals during manure storage and in the field, as well as from the reactions of synthetic nitrogen fertilizers; and carbon dioxide (CO₂), which comes from the combustion of fossil fuels used in crop processing and from the production of purchased feed, fertilizers, and pesticides.

The assessment of GHG emissions in livestock farming can be conducted through the calculation of specific indicators, such as the Carbon Footprint. The Life Cycle Assessment (LCA) is a standardized method under ISO 14040 and 14044 that calculates the environmental impacts of a product or service throughout its life cycle by analyzing specific indicators. The LCA process consists of several phases:

- Defining the objective of the analysis (e.g., comparing different production systems).
- Selecting the functional unit associated with GHG emissions (kg Fat and Protein Corrected Milk (FPCM) for dairy production or kg live weight gain (LWG) for beef production) and determining the system boundaries, generally the farm gate.
- Conducting an inventory analysis, collecting necessary data.
- Choosing emission factors to calculate all GHG emissions from the farm.

According to IPCC guidelines, emission factors are classified into three levels of precision:

- Tier 1: A simplified approach using default emission factors, not country specific.
- Tier 2: Used when a key source category is highly relevant, incorporating country-specific production characteristics and more detailed influencing factors.
- Tier 3: A highly specific approach that requires extensive experimental data related to the specific production system of the country.

Once emission factors are identified, the contributions of methane, nitrous oxide, and carbon dioxide to global warming are calculated using their Global Warming Potential (GWP). This expresses emissions in CO₂-equivalents, where CH₄ = 28 kg CO₂-eq and N₂O = 265 kg CO₂-eq per 1 kg emitted.

The LCA methodology, when applied to agriculture and livestock, enables an assessment of environmental sustainability, identifying major impact sources while also allowing for the evaluation and implementation of improvement strategies to enhance environmental performance.

By applying LCA, the highest-emission processes and resource-intensive activities within production systems can be identified, leading to the most appropriate improvement measures. This methodology can be used not only for agricultural farms but also in the food industry and, more broadly, across

the entire agri-food chain to assess the environmental sustainability of products and farms.

With this approach, farms can identify critical environmental aspects of their production systems and evaluate opportunities for improvement. LCA also serves as the foundation for environmental management tools, including eco-labels and environmental product declarations.

PHOTOS

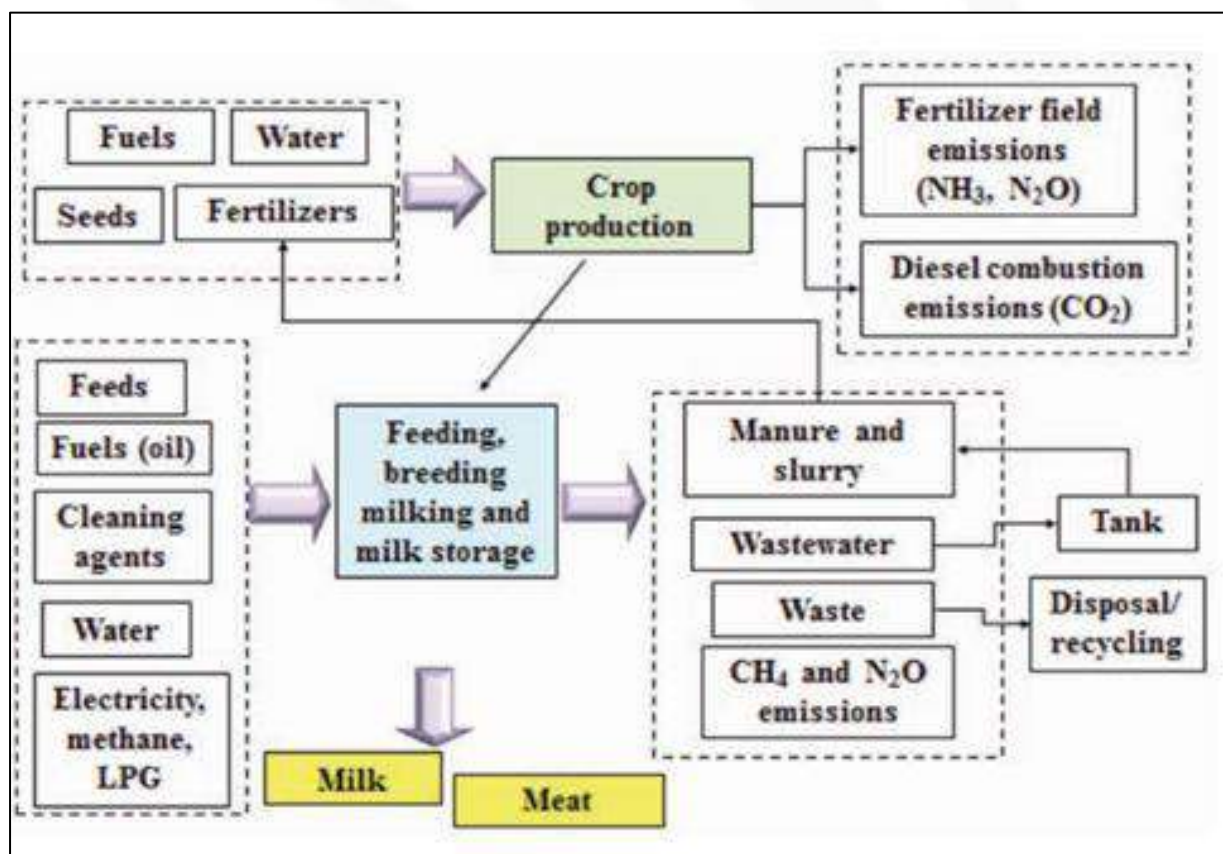


Figure 1: System boundaries in a dairy farm.

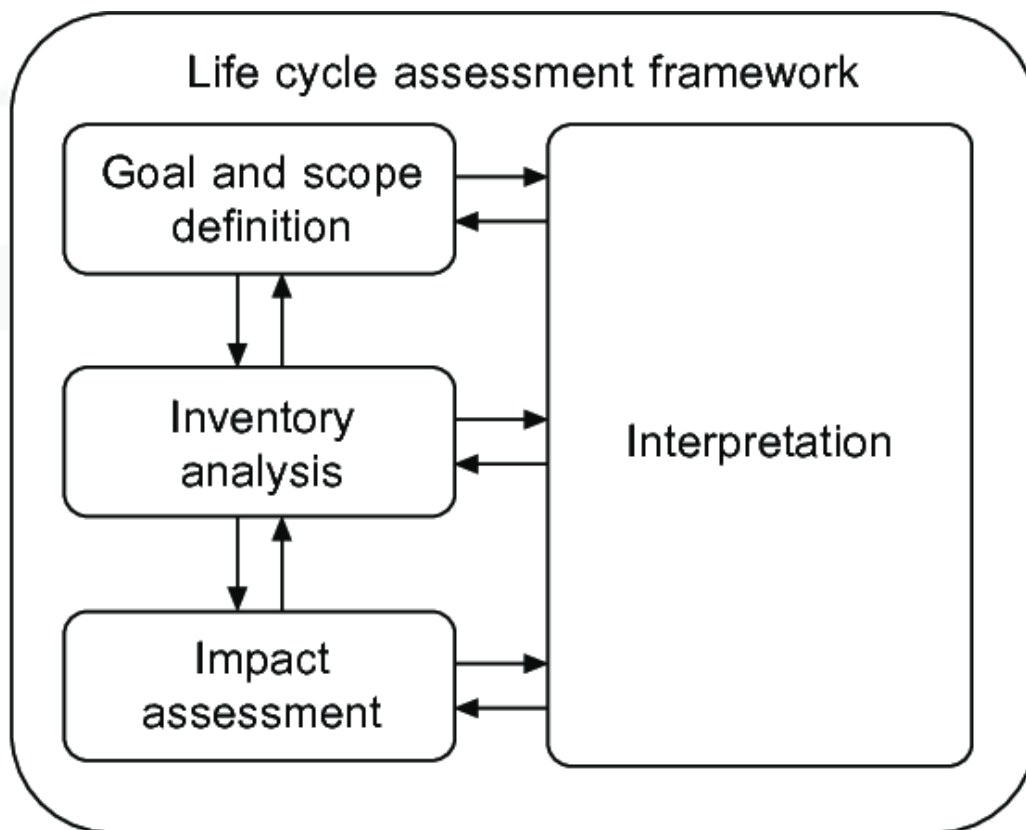


Figure 2: Structure of a Life Cycle Analysis evaluation.

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Title/Description

IPCC: Fifth Assessment Report

URL:

[Fifth Assessment Report — IPCC](#)

PRACTICE ABSTRACT 91**SHORT TITLE IN ENGLISH**

Advisors Supporting Farmers in Climate Action

COUNTRY AND CLIMATIC ZONE

EU

CONTACT

Tom O'Dwyer (tom.odwyer@teagasc.ie)

3 BENEFITS OF THE PRACTICE

1. Farmer Engagement: Higher adoption of mitigation and adaptation practices.
2. Advisor-Farmer Connection: Strengthened relationships and trust.
3. Advisor Benefits: Increased job satisfaction and professional fulfillment.

PRODUCTION SYSTEM

All production systems.

THEMATIC AREA

Not applicable

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

The Climate Farm Demo Top Tips for advisors supporting farmers in the uptake of climate mitigation and adaptation measures are listed below:

1. **Get to know the farmers you are trying to influence.** A range of factors, such as age, access to finance and attitude towards risk,

impact the willingness of farmers to change their farming practices. Don't forget the personal touch – make the connection with the farmer, and their family. And most importantly, listen to the farmer's arguments, fears and wishes.

2. **Highlight the positives** including good practices and the progress made by the farmer, without being afraid of calling out the areas for improvement.
3. **Keep it simple.** Farmers need to know that the recommended solutions are backed up by science, that the new approaches work to reduce GHG emissions...but don't necessarily need to know all the scientific details.
4. **Frame your messages carefully**, highlighting the benefits to the farmer (profitability, productivity, work-life balance) of adopting climate mitigation or adaptation measures. Farmers tend to implement climate-beneficial measures due to other farm-related benefits.
5. **Always prepare before meeting with the farmer.** Use available benchmarking tools/ GHG assessment tools to understand the farm's current GHG emissions profile. Review other available farm performance data also.
6. **Provide ongoing support** through (short) visits, phone consultations, membership of a WhatsApp group, emails, invitations to events etc.
7. **Facilitate farmer-to-farmer learning.** Farmer groups help farmers to identify solutions and solve problems, while allowing farmers to support one another. Consider forming a group of "like minded" farmers to discuss more sustainable farming practices or include the topic in existing group discussions.
8. **Prepare for a long-time horizon:** it may be a number of years before there are measurable environmental and economic outcomes. Also, tackle the adoption of one or two mitigation practices at a time...avoid identifying a list of actions to be taken.
9. Familiarise yourself with currently available **rewards and incentives**, available from the Government/ EU or from the marketplace. Be able to highlight what is required of the farmer to avail themselves of these.
10. Consider what else you can do to **create an enabling environment** that facilitates the farmer taking climate action.

LONGER DESCRIPTION – IN ENGLISH

How can an advisor best support a farmer as they implement climate mitigation and adaptation measures? A useful first step would be to increase the farmer's awareness of the need for climate action, followed by the completion of a GHG audit, to establish the baseline farm GHG emissions. Once the audit is completed, the advisor and farmer can then identify areas for action and agree an action plan. Following this, it will be up to the farmer to implement the chosen actions, and for the advisor to continue to support the farmer in their transition. It is likely that advisors will work with farmers at different stages of the innovation-decision process (Rogers, 2003; Figure 1) and that the advisor's role will change depending on where the farmer is during the process. Advisors will make an impact through a combination of advisory activities, focusing on relevant and user-friendly content, which stimulates farmer learning and motivates their decision to apply new knowledge.

The Climate Farm Demo Top Tips for advisors supporting farmers in the uptake of climate mitigation and adaptation measures are listed below:

1. **Get to know the farmers you are trying to influence.** A range of factors, such as age, access to finance and attitude towards risk, impact the willingness of farmers to change their farming practices. Don't forget the personal touch – make the connection with the farmer, and their family. And most importantly, listen to the farmer's arguments, fears and wishes.
2. **Highlight the positives** including good practices and the progress made by the farmer, without being afraid of calling out the areas for improvement.
3. **Keep it simple.** Farmers need to know that the recommended solutions are backed up by science, that the new approaches work to reduce GHG emissions...but don't necessarily need to know all the scientific details.
4. **Frame your messages carefully**, highlighting the benefits to the farmer (profitability, productivity, work-life balance) of adopting climate mitigation or adaptation measures. Farmers tend to implement climate-beneficial measures due to other farm-related benefits.
5. **Always prepare before meeting with the farmer.** Use available benchmarking tools/ GHG assessment tools to understand the farm's current GHG emissions profile. Review other available farm performance data also.

6. **Provide ongoing support** through (short) visits, phone consultations, membership of a WhatsApp group, emails, invitations to events etc.
7. **Facilitate farmer-to-farmer learning.** Farmer groups help farmers to identify solutions and solve problems, while allowing farmers to support one another. Consider forming a group of “like minded” farmers to discuss more sustainable farming practices or include the topic in existing group discussions.
8. **Prepare for a long-time horizon:** it may be a number of years before there are measurable environmental and economic outcomes. Also, tackle the adoption of one or two mitigation practices at a time and avoid identifying a list of actions to be taken.
9. Familiarise yourself with currently available **rewards and incentives**, available from Government/ EU or from the marketplace. Be able to highlight what is required of the farmer to avail of these.
10. Consider what else you can do to **create an enabling environment** that facilitates the farmer taking climate action.

PHOTOS



Figure 1: Rogers' Innovation Decision Process

PRACTICE ABSTRACT #92**SHORT TITLE IN NATIVE LANGUAGE**

Comment réduire les émissions de méthane des ruminants ? D'après Roques et al., 2024

SHORT TITLE IN ENGLISH

How Can Methane Emissions from Ruminants be Reduced? (Roques et al., 2024)

COUNTRY AND CLIMATIC ZONE

All climatic zones

CONTACT

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3 BENEFITS OF THE PRACTICE

1. Enteric methane
2. Methane emission reduction
3. Feed additives

PRODUCTION SYSTEM

Dairy cattle, Beef cattle, Sheep, Goat

THEMATIC AREA

Additives for reducing enteric methane emissions

SUMMARY FOR PRACTITIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Le méthane des ruminants provient de la digestion des aliments dans le rumen, où des microbes spécialisés (les méthanogènes) transforment certains composants de la ration en méthane, qui est ensuite rejeté dans l'air par éructation. Le méthane éructé constitue une des principales sources de gaz à effet de serre en agriculture. Il est donc essentiel de trouver des solutions pour limiter ces émissions sans compromettre la production et le bien-être des animaux.

Les stratégies existantes pour réduire les émissions de méthane

Plusieurs leviers d'action sont scientifiquement documentés et efficaces pour réduire le méthane émis par les ruminants :

L'alimentation : modifier la ration peut influencer la production de méthane. Par exemple, introduire certains additifs comme les matières grasses ou les tannins, ou privilégier des aliments plus digestibles peut permettre de réduire les émissions.

La sélection génétique : il existe des variations individuelles dans la production de méthane des animaux qui permettent de sélectionner des animaux qui émettent moins. Cela pourrait, à long terme, permettre de réduire les émissions à l'échelle du troupeau.

Les compléments alimentaires anti-méthane : certains compléments bloquent directement la production de méthane dans le rumen. Ces solutions sont très efficaces mais nécessitent une distribution régulière dans l'alimentation, ce qui peut être compliqué dans les élevages au pâturage.

Les nouvelles technologies : des travaux sont en cours sur des vaccins ciblant les microbes producteurs de méthane ou des dispositifs captant le méthane directement à la sortie du nez des animaux. Ces approches sont encore expérimentales mais pourraient offrir des solutions complémentaires dans le futur.

Quels défis pour l'avenir ?

La réduction des émissions de méthane ne doit pas compromettre la rentabilité des élevages ni leur rôle dans la production alimentaire mondiale. La faisabilité des solutions varie selon les systèmes d'élevage, les conditions économiques et les infrastructures disponibles. Pour avoir un impact réel à grande échelle, il faudra combiner plusieurs stratégies et

s'assurer qu'elles restent accessibles aux éleveurs et pratique dans leur utilisation.

En conclusion, la lutte contre les émissions de méthane passe par une meilleure gestion de l'alimentation, la sélection génétique, l'utilisation de compléments alimentaires et l'innovation technologique. Ces efforts doivent s'accompagner de politiques de soutien pour encourager les pratiques durables tout en maintenant la durabilité, y compris économique, des exploitations agricoles.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Methane (CH₄) comes from the digestion of feed in the rumen, where specialized microbes (methanogens) convert certain components of the diet into methane, which is then eructated into the air. Eructated methane is one of the main sources of greenhouse gases in agriculture.

There are several scientifically documented and effective ways to reduce the methane emitted by ruminants:

- **Feed:** Changing the ruminant diet can influence CH₄ production. For example, introducing feed supplements such as fats or tannins or using more digestible feed can reduce methane emissions.
- **Genetic selection:** There are individual variations in methane production among animals, making it possible to select those that emit less methane. In the long term, this could help reduce herd-wide emissions.
- **Feed additives:** These prevent CH₄ production in the rumen. While highly effective, they require regular distribution in the feed, which can be challenging for grazing livestock.
- **New technologies:** Research is underway on vaccines targeting methane-producing microbes and devices that capture methane directly from the animals' noses. These approaches are still experimental but could provide complementary solutions in the future.

Reducing CH₄ emissions must not compromise the profitability of livestock farming or its role in global food production. The feasibility of solutions varies depending on farming systems, economic conditions, and available infrastructure. To have a real large-scale impact, multiple solutions must be combined while ensuring they remain accessible and practical for farmers.

In conclusion, reducing methane emissions requires better feed management, genetic selection, the use of feed additives, and technological innovation. This must be supported by policies that promote sustainable practices while preserving the economic sustainability of farms.

LONGER DESCRIPTION – IN ENGLISH

Roques et al. published a comprehensive paper in 2024 in the *Annual Review of Animal Biosciences* ([link](#)) titled: “Recent Advances in Enteric Methane Mitigation and the Long Road to Sustainable Ruminant Production.”

Main Strategies and Their Mechanisms for Reducing Methane Emissions in Ruminants (see *Figure 1*)

- (a) Herd Level: Methane emissions are reduced by breeding low-emitting animals, either through direct selection or genomic selection based on methane-related genetic traits.
- (b) Dietary Strategies: Methane is reduced by increasing digestibility, accelerating passage rates, or bypassing the rumen to limit nutrient availability for microbes.
- (c) Rumen-Level Strategies: Mitigation occurs by inhibiting hydrogen-producing microbes, shifting the methanogenesis substrate, or directly inhibiting methanogens.
- (d) Targeted Strategies: These approaches reduce methane emissions by inhibiting key enzymes in the methanogenesis pathway or directly affecting methanogens' viability.
[Abbreviations: CNSL – cashew nutshell liquid; 3-NOP – 3-nitrooxypropanol]

The individual variation in enteric methane emissions observed among animals under identical feeding and management conditions suggests the potential for breeding low-emission cattle and sheep. To achieve this, animals with genetic potential for lower methane emissions must be identified and selected (Figure 1a). The heritability of methane production (0 = no impact, 1 = extreme impact) ranges from 0.13 to 0.29 in sheep and 0.11 to 0.45 in dairy cattle.

Dietary Strategies and Methane Mitigation

Dietary strategies modulate methanogenesis in two ways:

1. By influencing the production of substrates used by methanogens

2. By directly affecting methanogens themselves (*Figure 1b,c*)

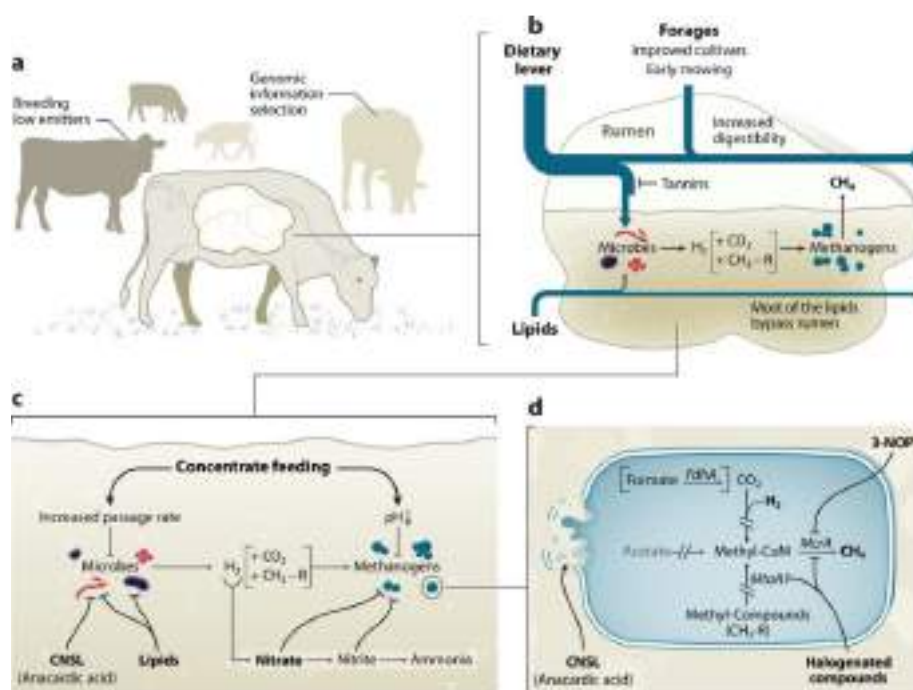
The key dietary factors affecting the rumen ecosystem include:

- Feed digestibility (positively correlated with methane emissions)
- Fermentation products
- Rumen pH

Replacing carbohydrates with lipids in ruminant diets effectively reduces absolute methane emissions. However, dietary and management strategies at the herd level provide an average mitigation effect of 18%, while the global reduction remains much lower (<10%) due to adoption rates and economic challenges.

Most strategies reduce the emission intensity of ruminant-based products, but overall emissions would decrease only if ruminant numbers were reduced. In contrast, strategies that specifically target methanogens and the methanogenic pathway (Figure 1d) have been shown to effectively reduce emissions, often with limited negative effects on the rumen microbial ecosystem. These strategies include feed additives, some of which are now commercially available in certain countries.

PHOTOS



18. Parnell, S. et al. 2019. *Annual Reviews*

Figure 1: A short extract summarising the various levers for action presented by the authors (in the text above)

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)**Title/Description**

“Recent Advances in Enteric Methane Mitigation and the Long Road to Sustainable Ruminant Production” in Annual Review of Animal Biosciences, Volume 12, 2024

URL:

<https://www.annualreviews.org/content/journals/10.1146/annurev-animal-021022-024931>

PRACTICE ABSTRACT #100**SHORT TITLE IN ENGLISH**

GEEP - An Environmental Assessment Tool for Pig Farming in France

COUNTRY AND CLIMATIC ZONE

France, temperate climate

CONTACT

Annie Soulier (annie.soulier@ifip.asso.fr)

3 BENEFITS OF THE PRACTICE

1. Environmental assessment of pig farming
2. Good environmental practices
3. Decision-making tool

PRODUCTION SYSTEM

Pig farming – all production system

THEMATIC AREAS/SECTOR

- Pigs sector
- Manure storage and spreading
- Energy management
- Herd management

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN NATIVE LANGUAGE

Depuis 2014, l'IFIP (institut technique de la filière porcine) met à disposition des éleveurs de porcs français, l'outil de calcul GEEP, pour évaluer les performances environnementales de leur atelier. GEEP c'est aussi un réseau qui regroupe plus de 900 éleveurs porcins et environ 130 conseillers. Le bilan

environnemental s'appuie sur 9 indicateurs quantitatifs portant sur les consommations de ressources naturelles (eau et énergie), les rejets (azote et phosphore), les émissions gazeuses (ammoniac et gaz à effet de serre) et la production de déchets. Ces indicateurs sont calculés avec les flux environnementaux de l'élevage divisés par les kilogrammes de porc générés sur l'élevage (ex : kg de NH₃/ kg de porc produit).

Pour les émissions de gaz à effets de serre, le périmètre prend en compte l'ensemble du cycle de production de porc dans une approche par ACV (analyse de cycle de vie), l'indicateur est alors exprimé par kg de poids vif. Ce type d'indicateur permet aux éleveurs de se comparer à d'autres élevages de même orientation et de se positionner par rapport à des références collectives. GEEP est connecté à la base nationale de données technico-économiques gérée par l'IFIP, ce qui représente un gain de temps pour la saisie des données individuelles et un gage de robustesse de l'information. Cet outil est sensible à de nombreux leviers de réduction d'émissions de GES. L'éleveur peut renseigner la formulation de l'aliment consommé en choisissant les matières premières et leur origine, pour calculer au plus juste l'empreinte carbone de celui-ci. Il intègre de nombreuses bonnes pratiques sur la chaîne de gestion des effluents : fréquence d'évacuation des effluents au bâtiment, différentes modalités de stockage, méthanisation... Les résultats prennent également en compte les performances techniques de chaque stade physiologique. GEEP est un outil complet pour accompagner l'éleveur dans une démarche d'amélioration continue.

SUMMARY FOR PRACTICIONERS ON THE MAIN FINDING(S)/INNOVATIVE SOLUTION(S) – IN ENGLISH

Since 2014, IFIP (the French technical institute for the pig industry) has been providing French pig farmers with the GEEP calculation tool to assess the environmental performance of their workshops. GEEP is also a network of over 900 pig farmers and around 130 advisors. The environmental balance sheet is based on nine quantitative indicators covering the consumption of natural resources (water and energy), emissions (nitrogen and phosphorus), gaseous emissions (ammonia and greenhouse gases), and waste production. These indicators are calculated using the environmental flows from the farm divided by the kilograms of pigs produced on the farm (e.g., kg of NH₃ per kg of pigs produced).

For greenhouse gas emissions, the scope considers the entire pig production cycle using an LCA (life cycle assessment) approach, with the indicator expressed per kg of live weight. This type of indicator enables farmers to compare their performance with other farms in the same sector

and collective benchmarks. GEEP is connected to the national technical-economic database managed by IFIP, which saves time when entering individual data and ensures the robustness of the information.

This tool is sensitive to several levers for reducing greenhouse gas emissions. Farmers can enter the formulation of the feed they use, selecting the raw feedstuffs and their origin to calculate the feed's carbon footprint as accurately as possible. It incorporates several best practices in the effluent management chain, including the frequency of effluent evacuation from buildings, different storage methods, and methanization. The results also consider the technical performance of each physiological stage. GEEP is a comprehensive tool designed to support farmers in their efforts toward continuous improvement.

LONGER DESCRIPTION – IN NATIVE LANGUAGE

En France, la décarbonation prend une place plus importante en production porcine, du fait de la dynamique autour de l'affichage environnemental des produits de consommation, et du fait du Label Bas Carbone initié par le Ministère de la Transition écologique. L'affichage officialise le bilan carbone des produits porcins auprès des consommateurs et génère de fait des questions pour l'étape élevage qui contribue largement à cet impact final ; le Label Bas Carbone donne des perspectives d'une rémunération des efforts réalisés par les éleveurs pour réduire leurs émissions de gaz à effet de serre, sous réserve d'une méthode sectorielle validée pour l'élevage porcin par le MTE.

Accompagner les élevages pour atteindre les objectifs nationaux bas-carbone

La stratégie nationale bas-carbone (SNBC) fixe en France des objectifs de réduction de 46 % des émissions de gaz à effet de serre pour l'agriculture.

Des simulations montrent qu'un élevage naisseur-engraisseur moyen de 250 truies pourrait réduire ses émissions de GES de 2 à 25% à l'échelle du cycle de vie du porc, en fonction des leviers choisis. Cela représenterait quelques dizaines à plusieurs centaines de tonnes de CO2 évitées par an.

Pour permettre une rémunération de ces efforts, une méthode Label Bas Carbone a été construite pour les élevages porcins. Elle s'appuie largement sur la méthode d'évaluation de GEEP en y apportant plus de précisions pour évaluer les émissions de gaz à effet de serre de deux postes.

Elle prend en compte la formulation des aliments qu'ils soient achetés ou fabriqués à la ferme, et permet de prendre en compte l'effet de la

substitution de MP importées liées à la déforestation, de la valorisation des co-produits.

Elle aborde de façon plus détaillée l'étape de méthanisation éventuelles des effluents avec les différents modèles (méthanisation psychrophile, co-génération, injection, unité en autonomie ou collective).

La sensibilité de GEEP aux différents leviers d'atténuation au changement climatique en fait un outil pertinent pour soutenir les projets de décarbonation des ateliers porcins. Ainsi, il est retenu dans deux projets européens (Climate farm demo et Climate smart advisors) qui visent, sur une durée de 6 ans à accompagner des fermes pilotes dans l'élaboration de leur plan d'atténuation et d'adaptation au changement climatique, dans un objectif de démonstration et de massification sur le terrain.

GEEP, un outil en constante évolution pour répondre aux besoins des utilisateurs

GEEP évolue dans ses bases de références et les règles de calculs des émissions gazeuses pour être au plus près des dernières actualisations. Il tient également compte des besoins des utilisateurs et offre depuis 2023 la possibilité de renseigner la formulation détaillée de l'aliment consommé afin d'être au plus près des pratiques réelles de l'élevage, et également l'impact carbone de l'aliment consommé acheté.

Pour diffuser l'information et appréhender les attentes des utilisateurs, plusieurs temps d'échanges sont mis en place chaque année avec le réseau de conseillers.

LONGER DESCRIPTION – IN ENGLISH

In France, decarbonization is becoming increasingly important in pork production due to the environmental labeling of consumer products and the Low Carbon Label launched by the French Ministry for Ecological Transition. The Low Carbon Label offers the prospect of remuneration for pig farmers' efforts to reduce their greenhouse gas emissions, provided they follow a sector-specific method validated for pig farming by the Ministry.

Supporting Pig Farms in Achieving National Low-Carbon Objectives

France's national low-carbon strategy (SNBC) sets a target of reducing greenhouse gas emissions from agriculture by 46%.

Simulations show that an average farrow-to-finish farm with 250 sows could reduce its greenhouse gas emissions by 2% to 25% over the pig's life cycle,

depending on the mitigation measures implemented. This reduction would amount to several dozen to several hundred tonnes of CO₂ avoided per year.

To reward these efforts, a Low Carbon Label method has been developed specifically for pig farms. It is largely based on the GEEP evaluation method, with a more detailed assessment of greenhouse gas emissions in two key areas:

- **Feed formulation:** Whether purchased or produced on the farm, this method allows for the substitution of imported raw materials linked to deforestation and the processing of co-products.
- **Effluent methanization:** A more detailed assessment is conducted, considering different models such as psychrophilic methanization, co-generation, injection, and autonomous or collective units.

GEEP's sensitivity to various climate change mitigation levers makes it a valuable tool for supporting the decarbonization of pig farms. As a result, GEEP has been selected for two European projects—Climate Farm Demo and Climate Smart Advisors—which, over six years, aim to assist pilot farms in developing climate change mitigation and adaptation plans. These efforts will serve as demonstrations for large-scale implementation in the field.

GEEP: A Constantly Evolving Tool to Meet User Needs

GEEP's reference databases and calculation rules for gaseous emissions are continuously updated to incorporate the latest developments. It also adapts to user needs. Since 2023, it has allowed farmers to enter the detailed formulation of the feed used, ensuring alignment with actual on-farm practices and enabling precise calculations of the carbon impact of purchased feed.

To disseminate information and understand user expectations, several meetings are organized annually with the network of advisors.

ADDITIONAL INFORMATION

Support for Specifications and Eco-Design Initiatives in Supply Chains

The list of specifications recognizing GEEP for monitoring environmental and collective performance is growing steadily, and the tool is also being used in several eco-design initiatives.

Outlook

The **Label Bas Carbone** method for pig farming is currently under review by the French Ministry for Ecological Transition. In 2025, the new version of

GEEP for the methanization component will be finalized, ensuring full compatibility with the calculation rules associated with the draft LBC pork method.

To meet user needs, **IFIP and IDELE** are working on integrating GEEP with **CAP'2ER**, the environmental assessment tool designed for cattle and poultry, to support a whole-farm approach.

Collective data from GEEP will soon be more widely disseminated through a summary brochure, following validation by a newly formed strategic committee.

PHOTOS



Photo 1: GEEP

ADDITIONAL DISSEMINATION AND COMMUNICATION MATERIAL(S)

Description/Title

Learn more about GEEP

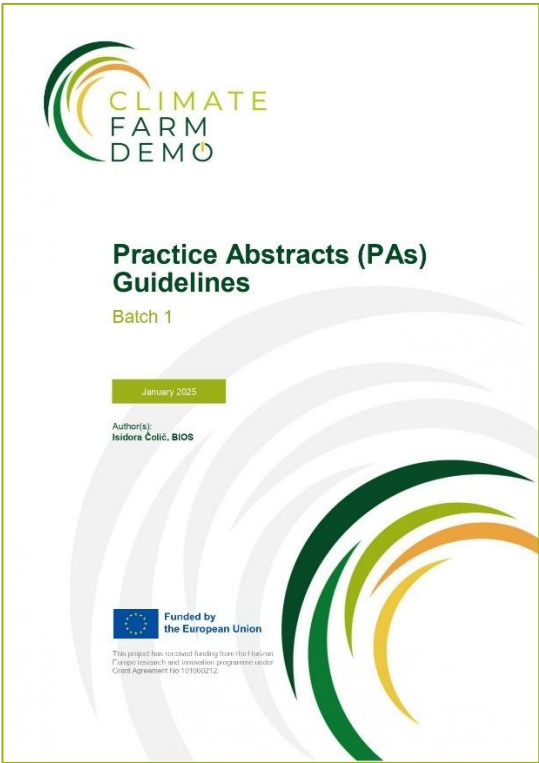
URL:

<https://geep.ifip.asso.fr/>

Chapter 5

Annexes

5.1 Guidelines



PROJECT NAME – Climate Farm Demo
Project Number 101060212

CLIMATE FARM DEMO

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2

PROJECT NAME – Climate Farm Demo
Project Number 101060212



What are Practice Abstracts (PAs)

Practice Abstracts are innovative, practice-oriented solutions for farmers, foresters, advisors and rural communities.

The 'practice abstracts' must be clear and concise as well as be attractive and relevant for practice. They should be drafted from the view to make them well understandable to the end-user and focus on those elements that most interest him/her. Typical scientific language is to be avoided. The focus should be on the needs/objectives of the Climate Farm Demo and its practical outcomes/recommendations. Details on the precise activities/measurements are less important than the final practical results and recommendations.

Climate Farm Demo Practice Abstracts (PAs) – batch 1

The first batch of 100 Practice Abstracts must be finalized and submitted by the end of March 2025. To enhance visibility and accessibility, in addition to being uploaded to the EU CAP Network, Climate Farm Demo will feature a dedicated section on its website, www.climatefarmdemo.eu. Unlike static PDF documents, each Practice Abstract will be presented as an individual landing page, allowing for automatic translation into all project languages and English to reach broader audiences.

To streamline navigation and organization, the Practice Abstracts will be categorized into the following clusters: **Adaptation and Mitigation Measures, Pilot Demo Farms, Living Labs, Rewarding Mechanisms, MRV Tools, and Cross-Cutting Topics**. Dedicated templates have been developed for each cluster, enabling better filtering and ensuring end-users can easily access relevant content.

Steps for writing and submitting PAs

- 1. Assigning Tasks:**
 - Work Package Leaders (WPLs): Responsible for drafting PAs related to their work package.
 - National Coordinators (NCs): Draft PAs and assign Climate Farm Advisors (CFAs) to write specific PAs.
 - Thematic Leaders (TLs): Draft PAs related to their thematic areas.
- 2. Download the Template:**
 - Select the appropriate PA template based on your topic and cluster.
 - Please **DO NOT** fill in the template directly on SharePoint, but rather download it first and then fill it in. You can find the templates [here](#).
- 3. Update the Monitoring Table:**
 - Insert relevant information into the provided monitoring table [here](#).
- 4. Draft the PA:**
 - Fill in the chosen template with accurate and concise information.
 - Ensure the draft is completed by **February 15th**.
- 5. Submit the PA:**
 - Upload the finalized template to the dedicated folder [here](#).
- 6. Please save and upload the document in .docx format (Word)**



PROJECT NAME – Climate Farm Demo
Project Number 101060212



- Please rename the document accordingly – **CFD – PA – #X – Title of the PA in English**
 - Mark the corresponding checkbox in the monitoring table [here](#) to confirm submission.
- Upload the photos [here](#), (create a folder for your dedicated PA)
 - Please upload photos in **.jpg, .jpeg or .png** formats
- 9. Review and Dissemination:**
 - WP8 will review and revise all submitted PAs.
- Final versions will be uploaded to the EU CAP Network and featured on the Climate Farm Demo website.

Sections in the template - mandatory

All sections marked with * are mandatory to complete.

Title

Provide a self-explanatory title that shortly summarises the challenge/opportunity and the project result(s) that address(es)/seize(s) it/them and are relevant for the practitioners. The title should be written in both native language and English, and the maximum character limits specified in the templates (255 characters, including spaces) are strictly adhered to.

3 Benefits of the Practice

Please insert 3 key benefits of the practice (keywords) to improve filtering and enhance the visibility of your practice. Including relevant keywords helps categorize the content effectively, making it easier for users to find and access, and amplifies its reach to a broader audience.

Summary for Practitioners on the Main Finding(s)/Innovative Solution(s)

The most important part of your PA is Summary for Practitioners on the Main Finding(s)/Innovative Solution(s). This summary should be as interesting as possible for farmers/foresters/other end-users, using a direct and easy understandable language and pointing out entrepreneurial elements which are particularly relevant for practitioners (e.g. related to cost, benefits, productivity, etc.). Presenting research results in scientific language, which does not respond to real needs of the practitioners, should be avoided.

Summary should consist of:

- Objective(s):** what challenge(s)/opportunity(ies) does the project address/seize that are relevant for the practitioners/end-users?
- Result(s)** of the project related to what new knowledge/innovative solution(s) have been developed that solve the challenge(s)/seize the opportunity(ies).
- Practical implications/recommendations:** how can the practitioners make use of the results/outcomes in practice? What would be the main costs/benefits to the end-users if the generated new knowledge / innovative solution(s) is/are implemented? etc.
- Target Audience:** Specify who can benefit from the practice (e.g., farmers, advisors).

To ensure the text is presented accurately, it is mandatory to write the summary in both the native language and English. We recommend using [DeepL Translate](#), The world's most accurate translator, for translating into English. However, we strongly advise reviewing the translated version to ensure its accuracy.



PROJECT NAME – Climate Farm Demo
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Please ensure that the **maximum character limits** specified in the templates (2,000 characters, including spaces) are strictly adhered to.

Photos/Images

To make your PA more engaging and avoid plain text, please upload photos and images that best represent the topic you are writing about. You can upload them by creating a subfolder in the dedicated folder [here](#) (rename the subfolder as # and the number of your PA as presented in the example for #1 and #2) and upload the high-resolution images there for better quality.

Sections in the template – optional

Longer summary for the Climate Farm Demo website

The Climate Farm Demo website provides an opportunity for a more in-depth exploration of your findings. While the 2,000-character summary is required, we believe this length may be too limiting to fully capture the details of your work. Therefore, although not mandatory, we suggest you provide a longer version of your summary, with a maximum of 4,000 characters (including spaces). This additional text will allow end-users to dive deeper into the topic, and it will give you the space to elaborate on your results, recommendations, and any other relevant information that can further enhance their understanding.

Longer summary should be submitted in both native language and English, allowing your PA to be automatically translated to all project languages.

Additional Dissemination and Exploitation Material(s)

Provide title/description and URL link to additional materials which are useful and attractive for practitioners (e.g., link to relevant websites, social media, videos, pictures, pdf files, other dissemination materials).

Although it is not mandatory, we highly recommend sharing additional materials with end-users. Many partners have already produced video content and webinars, which is available on our FarmDemo YouTube channel. These videos can further enrich the understanding of your topic and provide a more engaging experience for the audience.

Whom should I contact if I have some questions?

For any questions or concerns, please contact the person who assigned you to write the PA. For all the other partners – please contact saidora.colic@biosense.rs in case you have any questions and/or concerns.



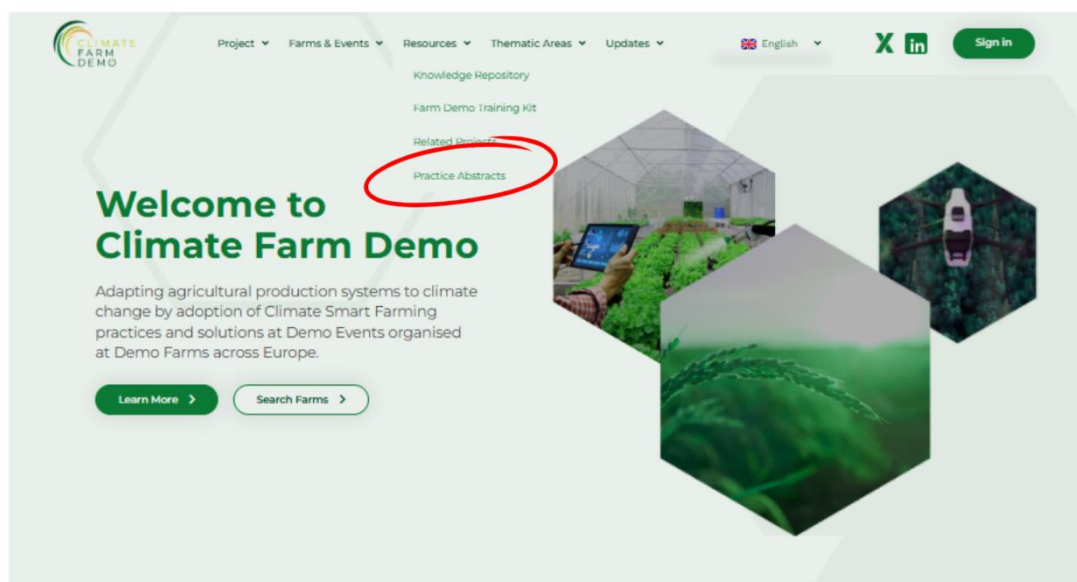
PROJECT NAME – Climate Farm Demo
Project Number 101060212



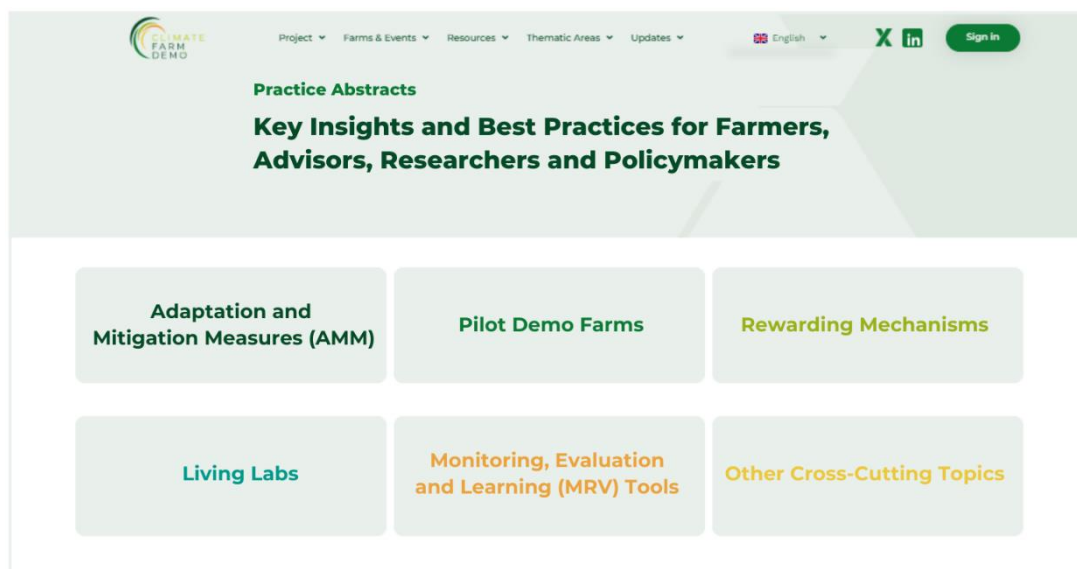
**Funded by
the European Union**

This project has received funding from the Horizon Europe research and innovation programme under Grant Agreement No 101060212.

5.2 Website Feature



Visit www.climatefarmdemo.eu and navigate to the 'Resources' section, then select 'Practice Abstracts'.



The Practice Abstracts are organized into **six thematic clusters**, each representing a key topic area. Selecting a topic reveals related content. *This page is currently under construction.*



Enter a key word to search

Country

Thematic area

Search Reset

To help navigate the extensive collection, Practice Abstracts can be searched and filtered by **keyword, country, and thematic area.**



Increasing organic matter by intercroops

Italy Cool Temperate Dry

Benefits of the practice

1. Prevention of soil erosion, increasing organic matter
2. Carbon sequestration
3. Weed control

Production system

Conventional/organic

Thematic Area

Intercropping

Summary for practitioners on the main finding(s)/Innovative solution(s)

The use of intercroops has changed over the years; their earlier function on Polish farms was to produce fodder for animals. Today, their primary function is to provide protection against wind and water erosion, as well as to enrich the soil with organic matter.

Contact

Paweł Górecki

Each Practice Abstract will follow this format: it includes the **country, climatic zone, benefits of the practice, production system, thematic area, a short summary (up to 2000 characters), an extended description accessible via a dropdown menu, and the author's contact information.** Where applicable, both summaries and extended descriptions will be available in original languages.



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the European Union**

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Grant Agreement No 101060212.