INTERCROP VALUES

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Deliverable D7.5 – Set of 24 Practice Abstracts as recommendations for end-users under the EIP-Agri format



Document Summary

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01

Introduction

The IntercropVALUES project has delivered in total 32 practice abstracts to disseminate the key results of the project in an easy and understandable fashion. For this purpose, practice abstracts were created for dissemination in the EIP-AGRI website and network, the project and partners' website, and the Organic Farm Knowledge platform. This report contains the second batch of 24 practice abstracts in M42, complementing the first batch of 8 practice abstracts completed in M18. This deliverable provides a list of the practice abstracts as well as the PAs themselves. All the Practice Abstract are available on the project website as open source resources and will be added to the EU CAP Network and Organic Farm Knowledge as relevant.

The second batch of 24 practice abstracts was developed by the Co-Innovation Case-Studies (CICS) leaders and work packages. IFOAM Organics Europe supported each CICS and WP to identify the topic of their PA. The focus was refined in the second half of 2025 and the PAs developed between September 2025 and April 2026.

Below is a list of the titles, authors, and available languages of all practice abstracts followed by the full practice abstracts themselves collated in this document in the same order.

List of 24 Practice Abstracts

1) Renewed approach of extension services to advance modern intercropping in South Mozambique. PA9 CICS12 Mozambique

Nícia Givá, João Nuvunga, Laurene Pinga, Sebastião Famba, Universidade Eduardo Mondlane; François Affholder, CIRAD

English

2) Intercropping of wheat and pea can suppress weed growth and enhances water use efficiency under Mediterranean conditions. PA10 CICS6 Greece

Christos Dordas, Andreas Michalitsis, Paschalis Papakaloudis, Aristotle University of Thessaloniki

English, Greek

3) Intercropping clover and wheat for regenerative farming. PA11 CICS1 Denmark

Claus Madelung, Business Lolland-Falster

English, Danish

4) Commercial perspectives of intercropping peas and lentils. PA12 CICS1 Denmark

Claus Madelung, Business Lolland-Falster

English, Danish

5) Encouraging public demand for sustainable, healthy plant protein products from intercrops. PA13 CICS2 Sweden

Georg Carlsson and Raj Chongtham, Swedish University of Agricultural Sciences

English, Swedish

6) Collective approach to identify barriers and levers for intercropping at the value chain level. PA14 CICS4 France

Fanny Raoux and Lionel Alletto, INRAE

English, French

7) **Intercropping to improve the nutritional quality of wheat under low-input conditions.** PA15 CICS6 Greece

Christos Dordas, Andreas Michalitsis, Paschalis Papakaloudis, Aristotle University of Thessaloniki

English, Greek

8) **Intercropping broccoli and vetch for Inte-grated Pest Management (IPM).** PA16 CICS8 Spain

Iñigo Arozarena Gonzalez, Noelia Telletxea Senosiain, Sandra Aldaz del Burgo, Elisa Lapuerta Sánchez, INTIA S.A.

English, Spanish

9) **Intercropping broccoli and vetch to increase species biodiversity.** PA17 CICS8 Spain

Iñigo Arozarena Gonzalez, Noelia Telletxea Senosiain, Sandra Aldaz del Burgo, Elisa Lapuerta Sánchez, INTIA S.A.

English, Spanish

10) **Organic pea-wheat intercropping to improve soil nitrogen recycling.** PA18 CICS9 Serbia

Srdjan Šeremešić, Svetlana Vujić, and Bojan Vojnov, University of Novi Sad

English, Serbian

11) How to produce protein-enriched bread with local and natural ingredients? PA19 CICS13 Switzerland

Ludivine Nicod, FiBL; Sébastien Knecht, Richemont

English, French

12) Supporting the design of intercrop-based value chain as researchers: learnings from the adaptative management of a network of case studies across Europe. PA20 WP1

Margot Leclère, Marie-Hélène Jeuffroy, Fanny Raoux, Lionel Alletto, INRAE; Henrik Hauggaard-Nielsen, RUC

English

13) **Soil health changes with the use of inter-cropping supporting good practice.** PA21 WP3

Paul Hargreaves, SRUC; Marie Sauvadet, INRAE

English

14) Approaches to producing organic rapeseed crops in Scotland. PA22 CICS3 Scotland

Dr Robin Walker, SRUC; Jim Booth, SAOS

English

15) **Integration of pea into baking flour and its effects on nutritional value and processing.** PA23 CICS5 Germany

Odette Weedon, University of Kassel

English, German

16) Integration of pea into baking flour and its effects on bread sensory characteristics. PA24 CICS5 Germany

Odette Weedon, University of Kassel

English, German

17) **Optimisation of costs associated with sugarcane intercropping.** PA25 CICS7 La Reunion

Mathias Christina, Cirad; Julien Chetty and Alizé Mansuy, eRcane

English, French

18) **Lentil-based crop mixtures for yield optimisation.** PA26 CICS10 France

Laurent Bedoussac, ENSFEA; Céline Le Gardien, GAB-BAnjou; Justine Lemonnier, Union Cuma; Anna-belle Revel, FNCUMA

English, French

19) **Reduce heat stress in cowpea through intercropping with millet.** PA27 CICS11 Italy

Matteo Petitti, Daniela Ponzini, Michele Salvan, Rete Semi Rurali

English, Italian

20) Modernising intercropping systems. PA28 CICS12 Mozambique

Sebastião Famba, João Nuvunga, Universidade Eduardo Mondlane; François Affholder, CIRAD

English

21) Cereal-legume intercropping: how cultivar, environment, and management shape performance. PA29 WP2

Christos Dordas, Aristotle University of Thessaloniki; Odette Weedon, University of Kassel; Georg Carlsson, Swedish University of Agricultural Sciences; Raphael Paut, INRAE; Luciano Pecetti, CREA

English

22) **Intercropping impacts on microbial diversity and the risk of mycotoxin contamination.** PA30 WP5

Charlie Poss Kevin Bethune, Vincent Chochois, Jean Christophe Meile, Noël Durand, CIRAD

English

23) Lock-in system maps for discussing barriers and levers. PA31 WP6

Céline Chevalier, Philippe Baret, UCLouvain (Sytra)

English

24) Four strategies to deal with impurities in intercropping. PA32 WP6

Céline Chevalier, Philippe Baret, UCLouvain (Sytra)

English

Practice Abstracts

PRACTICE ABSTRACT N°9

Renewed approach of extension services to advance modern intercropping in South Mozambique

Problem

Smallholders' farmers of Inhambane and Gaza region in Mozambique are subsistence-oriented, with most of households suffering from seasonal food insecurity. When engaged in the national strategy of transitioning from subsistence farming to more market-oriented farming, farmers are advised by extension agents to shift from intercropping (Figure 1a and 1b) to input-intensive growing of sole crops. A growing number of farmers in areas where the market is becoming attractive may respond favourably to this advice, which is then economically sound for farmers on the short term but is not sustainable on the long-term. However, to date this is an emerging issue as a majority of farmers are still subsistence oriented with limited access to market or poorly connected to a value chain.

Applicability box

Theme

Biodiversity and nature conservation, Agroecology, Sustainable Communities, Cropping systems, People and skills.

Keywords

Ecosystem services; intercropping; Socioeconomic development; Indigenous knowledge.

Context

Coastal area of Maputo, Inhambane and Gaza provinces in Mozambique, under subhumid tropical climate.

Application time

NA

Required time

NA

Period of impact

A year

Equipment

Not applicable

Best in

NA

Solution

Researchers from the University Eduardo Mondlane, CIRAD, National Extension Services, agricultural private companies and the representative of smallholder farmers, discussed[1] the farmers and the extension services perspectives. The participants agreed that the extension services need to adjust their strategy based on farmers' profile and practices towards reconciling the agricultural economic growth and long-term sustainability. All actors need to acknowledge the soundness of intercropping as a traditional practice of subsistence farming and promote the use of modern and profitable forms of intercropping, instead of transitioning toward sole cropping.

Benefits

- Increased food diversity and security.
- Enhanced biodiversity, nutrient cycling, soil protection against erosion and atmospheric nitrogen capture by legume compared with sole crops like cereal and cassava.

[1] in a workshop held in March 2024 at Bilene, Mozambique (Figure 2).

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- Reduced weeds pressure, integrated diseases and pest control maintained at high level when compared to sole crops.
- Reduced needs for organic or inorganic fertilizer inputs compared to sole crops.
- Reduced labour demand at farm scale.

Practical recommendations

- First, conduct a participatory diagnosis to collectively assess the drivers and farmers' motives of the intercropping practices in Maputo, Gaza and Inhambane provinces of Mozambique.
- Second, identify higher productivity, "modern" intercropping models consistent with farmers' profile and needs, based on literature review and the results of the experiments conducted in the framework of the IntercropVALUES case study.
- Third, co-design extension strategies to advance the advantage of modern intercropping through facilitated discussions among extension agents, farmers' representatives, and researchers to establish efficient knowledge flow (Figure 2, all referred actors engaged in one of these facilitated discussions).
- Fourth, adopt a "coaching" approach as an alternative to top-down approach and provide farm-tailored advice based on active listening and consistent with the context, farmers' profile, and needs, strengthening the peer-to-peer process, whereby facilitating sharing of practical experiences.



Figure 1a: a "modern intercrop" of maize with cowpea planted in row. Soil is poor and not sufficiently fertilized, and very low yield was expected here, making uncertain this specific arrangement of crops was advantageous for farmer compared to the traditional intercropping practice. Photo: Sebastião Famba.



Figure 1b: A typical farmer's field of the coastal area in Inhambane and Gaza provinces in Mozambique, with maize intercropped with groundnut and cowpea. Availability of nutrient is as low as in picture 1a. Crops are not in rows. The practice tends to maximize soil cover by crops and hence soil protection against erosion, radiation use efficiency and labour use efficiency notably for manual sowing and weed control. Photo: François Affholder.

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Figure 2: A presentation of the concepts of ecosystem services and trade-offs among ecosystem services in agriculture at the "Stakeholders engagement workshop", organized as part of the Co-Innovation Case Study of IntercropVALUES project. This session was followed by a lively debate on the messages of extension service regarding current and possible future intercropping in coastal area of Maputo, Inhambane & Gaza provinces in Mozambique. Photo: Nícia Givá

Further information

Further readings

- German, L. A., Tiani, A. M., Daoudi, A., Maravanyika, T. M., Chuma, E., Jum, C., ... & Yitamben, G. (2012). The application of participatory action research to climate change adaptation in Africa. *Ottawa, Canada and Bogor, Indonesia: International Development Research Centre and Center for International Forestry Research*. link

Weblinks

- intercropvalues.eu

About this practice abstract

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François Affholder, Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), AIDA, Univ Montpellier, CIRAD, Montpellier, France, CIRAD, agricultural research for the sustainable development of tropical and Mediterranean regions | Cirad

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IntercropVALUES aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. As a multi-disciplinary and multi-actor project, it brings together scientists and local actors representing the food value chain. It includes 27 participants from 15 countries (3 continents) from a wide diversity of organizations and stakeholders. The project will run for four years and started in November 2022.

Project website: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°10

Intercropping of wheat and pea can suppress weed growth and enhances water use efficiency under Mediterranean conditions

Problem

Weed management in agriculture is an important issue and relies on the use of synthetic herbicides which have detrimental environmental & health impacts.

Solution

Use of intercropping with different crop species and high density, can suppress the development of weeds and so, improve the weed management in a sustainable way (Gu et al., 2021), as well as enhance the water use efficiency (Pankou et al., 2021).

Benefits

Intercropping can reduce the growth of weeds, achieve higher yields (Gu et al., 2021), increase water use efficiency and improve the sustainability of the cropping systems (Figures 1-3, Table 1).

Applicability box

Theme

Cropping systems, Arable crops, Weed management.

Keywords

Low input agriculture, Cereal crops, Legumes, Weed control, Annual weeds.

Context

Temperate areas, Mediterranean climate.

Application time

Autumn crops.

Required time, if relevant

No additional time during cultivation. The harvested crop needs to be separated at a collection point.

Period of impact, if relevant

Duration of the crop.

Equipment

Standard machinery used for wheat cultivation.

Best in

Winter cereals and legumes and especially in rainfed agricultural systems.

Practical recommendations

- Seed bed preparation
  - Seed bed should not be too fine-grained after cultivation.
- Varieties
  - Select cultivars (wheat and grain legume) with the same maturity time taking the local seed costs and availability on the market into account
- Sowing densities, machinery
  - Mix the seeds 75% grain legume and 25% wheat (compared to the standard crop density of both crops) in the seed tank, check that the mixture is homogenous and sow with a conventional seeder.
  - Use same row spacing as for cereals.
  - Matching seed depth and homogeneity of the mixture should be checked.
- Weed control
  - Mixtures with different crop species gave even better weed suppression (Figure 1).
- Harvest
  - Adjust height of harvester to pick up grain legumes close to ground

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- Other recommendations
  - Separate a part of your field before sowing and apply the mixture.
  - Cultivate the rest of the field as usual and compare the intercrop to the sole cereals and /or legumes.
  - We recommend that you test this method under your own farm conditions. You can communicate your experience with us as well as with other farmers, advisors, and scientists.

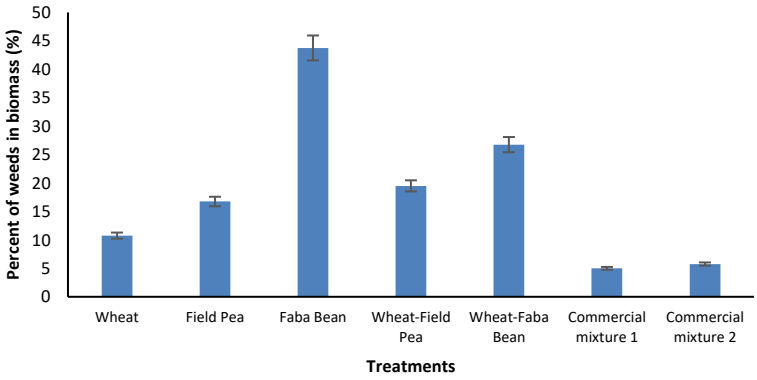


Figure 1. Effect of intercropping and increased in biodiversity on reducing the weed pressure where commercial mixture 1 (20% soft wheat, 10% oat, 35% triticale, 15% field pea and 20% common vetch) and commercial mixture 2 (30% soft wheat, 10% oat, 20% triticale, 15% field pea and 25% common vetch).

Table 1. Water use efficiency of the different mixtures and monocrops under rainfed and irrigated conditions

	Wheat (kg/ha/mm)		Pea (kg/ha/mm)		Intercrop (kg/ha/mm)			
	Yecora E	Elissavet	Isard	Olympos	Yecora E-Isard	Yecora E-Olympos	Elissavet-Isard	Elissavet-Olympos
Irrigated	12.23	11.82	9.16	3.82	13.19	7.64	12.37	5.50
Rainfed	13.47	12.81	7.11	5.00	10.27	8.55	11.84	6.90
Average	12.85	12.32	8.14	4.41	11.73	8.10	12.11	6.20

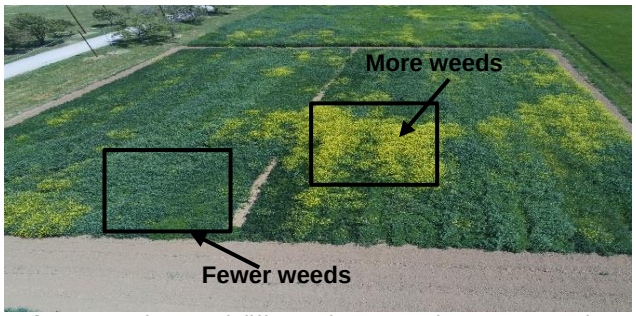


Figure 2. Mixture of different intercropping systems where in some areas there is high weed pressure and in other very low.

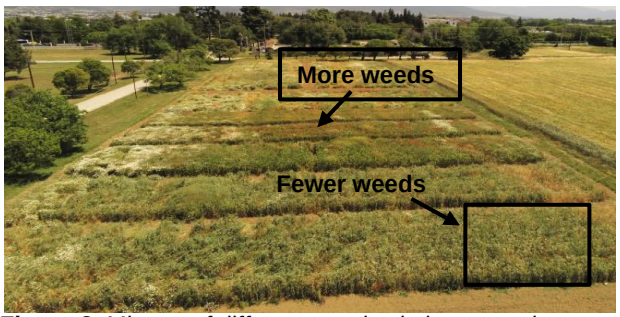


Figure 3. Mixture of different species in intercropping systems where in some areas there is high weed pressure and in other very low.

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Further information

Further readings

- Gu, C., Bastiaans, L., Anten, N. P., Makowski, D., & van der Werf, W. (2021). Annual intercropping suppresses weeds: A meta-analysis. Agriculture, Ecosystems & Environment, 322, 107658.
- Pankou, C., Lithourgidis, A., Dordas, C. (2021) Effect of Irrigation on Intercropping Systems of Wheat (*Triticum aestivum* L.) with Pea (*Pisum sativum* L.). Agronomy 11, 283.

Weblinks

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About this practice abstract

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PRACTICE ABSTRACT N°10

Η συγκαλλιέργεια σιταριού και μπιζελιού μπορεί να μειώσει την ανάπτυξη των ζιζανίων και να αυξήσει την αποτελεσματικότητα χρήσης νερού υπό μεσογειακές συνθήκες

Το πρόβλημα

Η διαχείριση των ζιζανίων στη γεωργία αποτελεί ένα σημαντικό θέμα και βασίζεται στη χρήση χημικώς συντιθέμενων ζιζανιοκτόνων, τα οποία έχουν αρνητικές επιπτώσεις στο περιβάλλον και την υγεία.

Η λύση

Η χρήση της συγκαλλιέργειας με διαφορετικά είδη καλλιεργειών και υψηλή πυκνότητα μπορεί να μειώσει την ανάπτυξη των ζιζανίων και να βελτιώσει τη διαχείρισή τους με βιώσιμο τρόπο (Gu et al., 2021), καθώς και να ενισχύσει την αποτελεσματικότητα χρήσης νερού (Pankou et al., 2021)

Τα οφέλη

Η συγκαλλιέργεια μπορεί να μειώσει την ανάπτυξη των ζιζανίων, να επιτύχει υψηλότερες αποδόσεις (Gu et al., 2021), να αυξήσει την αποτελεσματικότητα χρήσης του νερού και να βελτιώσει τη βιωσιμότητα των συστημάτων καλλιέργειας (Σχήμα 1-3, Πίνακας 1).

Πλαίσιο Εφαρμογής

Θέματα

Συστήματα καλλιέργειας, Αροτραίες καλλιέργειες, Διαχείριση ζιζανίων.

Λέξεις κλειδιά

Γεωργία χαμηλών εισροών, Σιτηρά, Ψυχανθή, Έλεγχος ζιζανίων, Ετήσια ζιζάνια.

Πλαίσιο

Εύκρατες περιοχές, Μεσογειακό κλίμα.

Χρόνος εφαρμογής

Φθινοπωρινές καλλιέργειες.

Απαιτούμενος χρόνος, κατά περίπτωση

Δεν υπάρχει επιπλέον χρόνος κατά τη διάρκεια της καλλιέργειας. Η συγκομιδή πρέπει να γίνει σε σημείο συλλογής και να γίνει η διαχωρισμένη επεξεργασία του συλλεγμένου καλλιεργήματος.

Περίοδος επίδρασης, κατά περίπτωση

Διάρκεια της καλλιέργειας.

Εξοπλισμός

Συνηθισμένα μηχανήματα που χρησιμοποιούνται για την καλλιέργεια σιταριού.

Καλύτερο σε

Χειμερινά σιτηρά και ψυχανθή και ειδικά σε συστήματα ξηρικής γεωργίας.

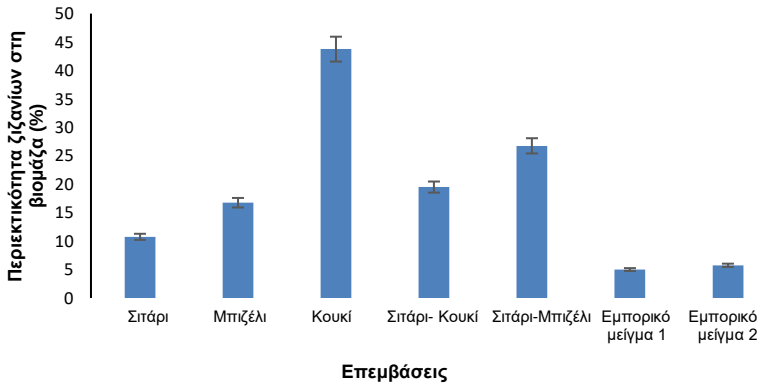
Πρακτικές προτάσεις

- Προετοιμασία σποροκλίνης
  - Η σποροκλίνη δεν θα πρέπει να είναι λεπτόκοκκη μετά την κατεργασία του εδάφους.
- Ποικιλίες
  - Επιλέξτε ποικιλίες (σιταριού και ψυχανθούς) με τον ίδιο χρόνο ωρίμανσης, λαμβάνοντας υπόψη το κόστος και τη διαθεσιμότητα των ποικιλιών στην αγορά.
- Πυκνότητα σποράς, μηχανήματα
  - Αναμείξτε τους σπόρους σε αναλογία 75% σπόροι του ψυχανθούς και 25% του σιταριού (σε σύγκριση με την τυπική πυκνότητα σποράς και των δύο καλλιεργειών) στο δοχείο των σπόρων, ελέγξτε ότι το μίγμα είναι ομοιογενές και σπείρετε με μία συμβατική σπαρτική μηχανή.
  - Χρησιμοποιήστε την ίδια απόσταση μεταξύ των γραμμών σποράς όπως και για τα σιτηρά.
  - Πρέπει να ελεγχθεί το κατάλληλο βάθος σποράς και η ομοιογένεια του μείγματος.

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- Έλεγχος ζιζανίων
  - Τα μίγματα διαφορετικών φυτικών ειδών παρείχαν ακόμα καλύτερη αντιμετώπιση των ζιζανίων (Σχήμα1).
- Συγκομιδή
  - Προσαρμόστε το ύψος του θεριζοαλωνισμού για να συγκομίσετε τον καρπό των ψυχανθών κοντά στο έδαφος.
- Άλλες προτάσεις
  - Διαχωρίστε ένα μέρος του αγρού σας πριν τη σπορά και εφαρμόστε το μείγμα.
  - Καλλιεργήστε τον υπόλοιπο αγρό όπως συνήθως και συγκρίνετε την συγκαλλιέργεια με τη μονοκαλλιέργεια σιτηρού και/ή ψυχανθούς.
  - Σας συνιστούμε να δοκιμάσετε αυτήν τη μέθοδο στις δικές σας συνθήκες καλλιέργειας. Μπορείτε να μοιραστείτε την εμπειρία σας μαζί μας καθώς και με άλλους αγρότες, γεωργικούς συμβούλους και επιστήμονες.



Σχήμα 1. Η επίδραση της συγκαλλιέργειας και της αύξησης της βιοποικιλότητας στη μείωση της ανάπτυξης των ζιζάνιων και κυρίως από δυο εμπορικά μείγματα, όπου το εμπορικό μείγμα 1 (20% μαλακό σιτάρι, 10% βρώμη, 35% τριτικάλε, 15% μπιζέλι και 20% κοινός βίκος) και το εμπορικό μείγμα 2 (30% μαλακό σιτάρι, 10% βρώμη, 20% τριτικάλε, 15% μπιζέλι και 25% κοινός βίκος).

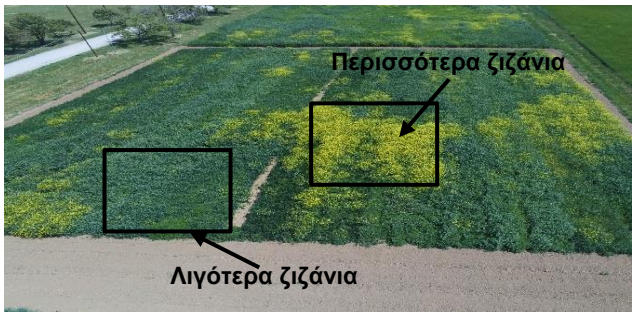
Πίνακας 1. Αποτελεσματικότητα χρήσης του νερού των διαφορετικών συγκαλλιεργειών και των μονοκαλλιεργιών υπό συνθήκες άρδευσης και ξηρασίας.

	Σιτάρι (kg/ha/mm)		Μπιζέλι (kg/ha/mm)		Συγκαλλιέργεια (kg/ha/mm)			
	Yecora E	Elissavet	Isard	Olympos	Yecora E-Isard	Yecora E-Olympos	Elissavet-Isard	Elissavet-Olympos
Αρδευόμενο	12.23	11.82	9.16	3.82	13.19	7.64	12.37	5.50
Ξηρικό	13.47	12.81	7.11	5.00	10.27	8.55	11.84	6.90
Μέσος Όρος	12.85	12.32	8.14	4.41	11.73	8.10	12.11	6.20

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Funded by the European Union

PRACTICE ABSTRACT N°10



Σχήμα 2. Μείγματα διαφορετικών συστημάτων συγκαλλιέργειας όπου σε ορισμένες περιοχές υπάρχει υψηλή πίεση από ζιζάνια και σε άλλες πολύ χαμηλή.



Σχήμα 3. Μείγματα διαφορετικών συστημάτων συγκαλλιέργειας όπου σε ορισμένες περιοχές υπάρχει υψηλή πίεση από ζιζάνια και σε άλλες πολύ χαμηλή.

Περισσότερες πληροφορίες

Περισσότερες βιβλιογραφίες

- Gu, C., Bastiaans, L., Anten, N. P., Makowski, D., & van der Werf, W. (2021). Annual intercropping suppresses weeds: A meta-analysis. Agriculture, Ecosystems & Environment, 322, 107658.
- Pankou, C., Lithourgidis, A., Dordas, C. (2021) Effect of Irrigation on Intercropping Systems of Wheat (*Triticum aestivum* L.) with Pea (*Pisum sativum* L.). Agronomy 11, 283.

Ιστότοπος

- intercropvalues.eu

Σχετικά με αυτή την περίληψη

Συγγραφείς: Χρήστος Δόρδας, Ανδρέας Μιχαλίτσης, Πασχάλης Παπακαλούδης, Ευστράτιος Δεληγιάννης Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Τμήμα Γεωπονίας, Δασολογίας και Φυσικού περιβάλλοντος, Τμήμα Γεωπονίας (ΑΠΘ), Πανεπιστημιούπολη, 54124, Θεσσαλονίκη, Ελλάδα, http://www.agro.auth.gr

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Ημερομηνία: 30/04/2024

Επικοινωνία: chdordas@agro.auth.gr

Αναθεωρητική μελέτη: Claire Morelle, IFOAM Organics Europe

IntercropVALUES Το έργο αυτό έχει ως στόχο την εκμετάλλευση των οφελών της συγκαλλιέργειας για τον σχεδιασμό και τη διαχείριση παραγωγικών, ποικιλόμορφων, ανθεκτικών, κερδοφόρων, περιβαλλοντικά βιώσιμων συστημάτων καλλιέργειας που είναι αποδεκτά για τους αγρότες και τους φορείς στην αλυσίδα τροφίμων. Ως πολυδιάστατο και πολυμερές έργο, συγκεντρώνει επιστήμονες και τοπικούς φορείς που εκπροσωπούν την αλυσίδα τροφίμων. Περιλαμβάνει 27 συμμετέχοντες από 15 χώρες (3 ηπείρους) από μια ευρεία ποικιλία οργανώσεων και ενδιαφερόμενων φορέων. Το έργο θα διαρκέσει τέσσερα χρόνια και ξεκίνησε τον Νοέμβριο του 2022.

Ιστότοπος προγράμματος: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°11

Intercropping clover and wheat for regenerative farming

Problem

Intercropping clover and wheat can result in competition depending on the competitiveness of the crops and their sowing time. Dominant root structure of mature clover may outcompete wheat.

Solution

Intercropping clover and wheat requires careful **timing and balance** in intercropping systems. The method of establishing wheat in standing clover is critical.

Applicability box

Theme

Seeds and breeding - Intercropping wheat and clover

Keywords

Seed testing; Plant breeding; Wheat, clover, timing, nutrition benefits

Context

Denmark

Benefits

High protein wheat in combination with clover can improve yield through complementation. In addition, soil health preservation, nutrient efficiency, and climate resilience are positive benefits of the system.

Practical recommendations

- **Simultaneous establishment:** Sow clover and wheat together to ensure balanced competition and optimal nutrient sharing.
- **Avoid mature clover stands:** Do not attempt to introduce wheat into already established clover fields, if a commercial grain yield is desired.
- **Early sowing strategies:** Early establishment remains advantageous but must be coupled with synchronised crop development.
- **Monitor crop competition:** Regular field assessments should be carried out in early spring to detect early signs of crop competition.
- **Further trials:** Future experiments should test different sowing densities and clover varieties to optimise yield potential and interspecies interaction.

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PRACTICE ABSTRACT N°11



Figure 1: Wheat in clover early sprouting in mature clover
Photo: Susanne Hovmand, Knuthenlund.



Figure 2: Wheat impacted negatively by clover and stopped

Further information

Weblinks

- https://www.remix-intercrops.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

Authors: Claus Madelung, Business Lolland-Falster, Kidnakken 7, 4930 Maribo, Denmark. www.businesslf.dk

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Date: April 2026

Contact: cm@businesslf.dk

Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

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PRACTICE ABSTRACT N°11

Samdyrkning af kløver og hvede til regenerativt landbrug

Problem

Sammensmeltning af kløver og hvede kan føre til konkurrence afhængigt af afgrødernes konkurrenceevne og deres såningstid. Den dominerende rodstruktur hos moden kløver kan udkonkurrere hvede.

Applicability box

Theme

Seeds and breeding - Intercropping wheat and clover

Keywords

Seed testing; Plant breeding; Wheat, clover, timing, nutrition benefits

Context

Denmark

Løsning

Sammendyrkning af kløver og hvede kræver omhyggelig timing og balance i samdyrkningssystemer. Metoden til at etablere hvede i stående kløver er afgørende.

Fordele

Højproteinhvede i kombination med kløver kan forbedre udbyttet gennem komplementering. Derudover er bevarelse af jordens sundhed, næringseffektivitet og klimamodstandsdygtighed positive fordele ved systemet.

Practical recommendations

- **Samtidig etablering:** Så kløver og hvede sammen for at sikre balanceret konkurrence og optimal næringsfordeling.
- **Undgå modne kløverbestande:** Forsøg ikke at introducere hvede i allerede etablerede kløvermarker, hvis der ønskes kommercielt kornudbytte.
- **Tidlige såstrategier:** Tidlig etablering forbliver fordelagtig, men skal kombineres med synkroniseret afgrødeudvikling.
- **Overvåg afgrødekonkurrence:** Regelmæssige markvurderinger bør udføres tidligt på foråret for at opdage tidlige tegn på afgrødekonkurrence.
- **Yderligere forsøg:** Fremtidige eksperimenter bør teste forskellige såtætheder og kløversorter for at optimere udbyttepotentiale og interaktion mellem afgrøderne

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PRACTICE ABSTRACT N°11



Figure 1: Wheat in clover early sprouting in mature clover Photo: Susanne Hovmand, Knuthenlund.



Figure 2: Wheat impacted negatively by clover and stopped growing. Photo: Susanne Hovmand, Knuthenlund.

Further information

Weblinks

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- Se Organic Farm Knowledge Platform for flere praktisk anbefalinger.

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IntercropVALUES sigter mod at udnytte fordelene ved intercropping til at designe og administrere produktive, diversificerede, robuste, profitable og miljøvenlige afgrødesystemer, som er acceptable for landmænd og aktører i agro-fødevarekæden. Som et tværfagligt og multiaktørprojekt samler det forskere og lokale aktører, der repræsenterer fødevareværdikæden. Den omfatter 27 deltagere fra 15 lande (3 kontinenter) fra en bred vifte af organisationer og interessenter. Projektet vil køre i fire år og startede i november 2022...

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PRACTICE ABSTRACT N°12

Commercial perspectives of intercropping peas and lentils

Problem

Intercropping peas and lentils is challenged by the post-harvest costs of cleaning.

Solution

In the post-harvest process, cleaning costs must be minimised and end products with an acceptable level of impurities developed, to keep pea-lentil intercropping economically sustainable.

Applicability box

Theme

Farm economics (agricultural economics); Production economics; Costs

Keywords

Crop testing, commercial benefits

Context

Denmark

Benefits

The practice can result in more efficient resource use, lower costs, improved resilience, soil health and climate benefits, as both crops can fix atmospheric nitrogen. Peas typically grow more vigorously and can support lower-growing lentils.

Practical recommendations

To reap the benefits of pea-lentil intercropping, the final product must be commercially acceptable. Due to the cleaning costs of harvested seeds, cross-contamination or grain impurities need to be accepted. Otherwise, costs can be in excess of what can be covered commercially.

- Minimise cleaning costs: Ensure **physical differences in grain shape or size between crops** to reduce cleaning costs— e.g., through varietal choice—thereby ensuring commercial viability.
- **Cross contamination** must be accepted at an agreed level within the value chain, as 100% clean end product is not commercially sustainable. The level of contamination depends on usage of the cleaned seeds and is specific for end use.
- Farmers need to explore and agree upon **commercial options** with wholesalers and millers to minimize sales risks. This includes options such as high protein flour that can be used for bread and for other use in bakeries.
- Ensure **physical differences in grain shape or size between crops** to reduce cleaning costs – i.e., wheat and peas – thereby ensuring commercial viability. Alternatively, the risk profile needs to be agreed upon among partners involved

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Funded by the European Union

PRACTICE ABSTRACT N°12

Stage Raw			kg
Mixed			**3.500**
Stage Cleaned			
Lentils			192
Peas			2.088
Total			**2.280**
Waste		-	**1.220**
			-35%

Figure 1: Result of cleaning process with calculation of process loss. Source of data: Cleaning data from DLF Beet Seed A/S

					EUR
Seeds cost	Peas				1.724,83
	Lentils				335,57
Growing cost	Leasing of land (5 ha)				5.798,66
	Weeding				322,15
	Swath laying				368,46
	Maschinery				833,29
Post harvest cost	Drying				658,12
	Cleaning				2.297,99
Total					**12.339,06**
Sales value		Peas	2088	1,61	3.363,22
		Lentils	192	2,82	541,21
Total sales value					**3.904,43**
Net profit					**- 8.434,63**

			Per HA
Seed cost			412,08
Land lease			1.159,73
Machineriy etc.			304,78
Total cost per HA			**1.876,59**
Weighted avr. Value per kg		EUR/KG	1,71
Yeild value per HA split as in test		EUR	780,89
Cleaning and Drying per KG on cleaned stage		EUR	1,30
CM per kg cleaned seeds		EUR	0,42
Yeild per ha (KG) in test		**KG**	**456**
Breakeven kg cleaned seeds per ha		**KG/HA**	**4.512**

Further information

Weblinks

- https://www.remix-intercrops.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

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PRACTICE ABSTRACT N°12

Kommercielle perspektiver ved samdyrkning af ærter og linser

Problem

Samdyrkning af ærter og linser udfordres af omkostninger til rensning efter høst

Løsning

I processen efter høst skal rensningsomkostninger minimeres, og der skal udvikles slutprodukter med et acceptabelt niveau af urenheder for at opretholde økonomisk bæredygtighed i samdyrkning af ærter og linser.

Anvendelse

Tema

Landbrugsøkonomi (agroøkonomi); Produktionsøkonomi; Omkostninger

Keywords

Afgrøndeforsøg, kommercielle fordele

Context

Denmark

Fordele

Praksissen kan resultere i mere effektiv ressourceudnyttelse, lavere omkostninger, forbedret robusthed, bedre jordbundssundhed og klimafordele, da begge afgrøder kan fiksere atmosfærisk kvælstof. Ærter vokser typisk mere kraftigt og kan understøtte lavere voksende linser.

Praktiske anbefalinger

- For at opnå fordelene ved samdyrkning af ærter og linser skal slutproduktet være kommercielt acceptabelt. På grund af rensningsomkostningerne for de høstede frø skal krydskontaminering eller urenheder accepteres.
- Minimér rensningsomkostninger: Sikr fysiske forskelle i afgrødens form eller -størrelse mellem afgrøderne for at reducere rensningsomkostninger – f.eks. gennem sortsvalg.
- Krydskontaminering skal accepteres på et aftalt niveau i værdikæden, da et 100 % rent slutprodukt ikke er kommercielt bæredygtigt.
- Landmænd bør undersøge og aftale kommercielle muligheder med grossister og møller for at minimere salgsrisici.
- Sikring af fysiske fysiske forskelle i kornstørrelse og -form kan reducere renseomkostningerne – eks. hvede og ærter – hvorved en kommerciel bæredygtighed kan opåes. Alternativt kan risikoprofilen aftales mellem værdikædens parter

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Yderligere information

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Om dette practice abstract

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PRACTICE ABSTRACT N°13

Encouraging public demand for sustainable, healthy plant protein products from intercrops

Problem

Intercropping cereals and grain legumes for simultaneous harvest faces several barriers in post-harvest handling, including low awareness of benefits among consumers and value chain actors.

Solution

Boosting the demand for legume-based foods will provide more possibilities to sell grain legumes in general, including products from intercropped legumes.

Benefits

Eating legume-based foods enhances public health. Providing profitable outlets will encourage farmers to grow more intercropped legumes.

Applicability box

Themes

Agroecology, Marketing and agricultural trade, Post-harvest management, Sustainable communities

Keywords

Agroecology, Health foods, Marketing, Sustainability

Context

Sweden

Best in

Public kitchens, restaurants, media

Practical recommendations

To increase demand for a category of plant protein, multiple actors need to change their habits—not only consumers, but also retailers, processors, and public kitchens.

One option for tackling this challenge is to organise so called **food jams**: cooking sessions in groups where participants are provided with clear instructions, ingredients, and equipment to prepare one or several meals according to prepared recipes.

Boosting public demand by spreading knowledge and providing hands-on instructions on how to prepare tasty legume meals from local ingredients will help farmers to sell their intercropped legume products.

In Sweden, the communication project Food Jams translated results from research to short movies, articles, and recipes that explain the benefits of growing and eating legumes. The project also organised food jams for legume cooking, especially adapted to school kitchens, and produced instructions and material for others to also organise legume food jams.

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PRACTICE ABSTRACT N°13



Figure 1: Cooking peas and lentils that come from Swedish organic farms. Photo: www.foodjams.se



Figure 2: Intercropped lentils and oats. Photo: Per Modig, Fagraslätt.

Further information

Further readings

- Bedoussac L, Journet EP, Hauggaard-Nielsen H, Naudin C, Corre-Hellou G, Jensen ES, Prieur L and Justes E (2015). Ecological principles underlying the increase of productivity achieved by cereal-grain legume intercrops in organic farming. A review. *Agronomy for Sustainable Development* 35, 911–935. https://doi.org/10.1007/s13593-014-0277-7.
- Röös E, Carlsson G, Ferawati F, Hefni M, Stephan A, Tidåker P, Witthöft C (2020). Less meat, more legumes: prospects and challenges in the transition toward sustainable diets in Sweden. *Renewable Agriculture and Food Systems* 35, 192–205. https://doi.org/10.1017/S1742170518000443.

Weblinks

- Fagraslätt https://www.fagraslatt.se/
- Food Jams www.foodjams.se
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

IntercropVALUES aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. As a multi-disciplinary and multi-actor project, it brings together scientists and local actors representing the food value chain. It includes 27 participants from 15 countries (3 continents) from a wide diversity of organizations and stakeholders. The project will run for four years and started in November 2022.

Project website: https://intercropvalues.eu/

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Funded by the European Union

PRACTICE ABSTRACT N°13

Stimulera efterfrågan på hållbara och hälsosamma växtprotein-baserade livsmedel från samodling

Problem

Samodling av spannmål och baljväxter för samtidig skörd försvåras av hinder i hanteringen efter skörd, bland annat bristande medvetenhet om fördelarna hos konsumenter och aktörer i värdekedjan.

Lösning

Att öka efterfrågan på baljväxt-baserade livsmedel kommer att skapa fler möjligheter att sälja baljväxter, inklusive från samodling.

Tillämpningsområde

Teman

Agroekologi, marknadsföring och jordbrukshandel, hantering efter skörd, hållbara samhällen

Nyckelord

Agroekologi, hälsosam mat, marknadsföring, hållbarhet

Sammanhang

Sverige

Bäst inom

Storkök, restauranger, media

Fördelar

Att äta livsmedel baserade på baljväxter förbättrar folkhälsan. Mer lönsamma avsättningsmöjligheter kommer att uppmuntra jordbrukare att odla fler samodlade baljväxter.

Praktiska rekommendationer

För att öka efterfrågan på växtprotein måste flera aktörer ändra sina vanor – inte bara konsumenter, utan även produktutvecklare, detaljhandel, och storkök.

Ett sätt att ta itu med denna utmaning är att anordna så kallade foodjams: matlagningssessioner i grupp där deltagarna får tydliga instruktioner, ingredienser och utrustning för att tillaga en eller flera måltider enligt förberedda recept.

Att öka efterfrågan hos allmänheten genom att sprida kunskap och ge praktiska instruktioner om hur man tillagar smakrika baljväxtmåltider av lokala råvaror kommer att hjälpa jordbrukare att sälja sina produkter från samodlade baljväxter.

I Sverige använde kommunikationsprojektet Food Jams forskningsresultat för att skapa kortfilmer, artiklar och recept som förklarar fördelarna med att odla och äta baljväxter. Projektet anordnade även foodjams för tillagning av baljväxter, särskilt anpassade för skolkök, och tog fram instruktioner och material så att även andra kan anordna liknande foodjams.

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PRACTICE ABSTRACT N°13



Bild 1: Tillagning av ärtor och linser från svenska ekologiska gårdar. Foto: www.foodjams.se



Bild 2: Samodling av linser och havre. Foto: Per Modig, Fagraslätt

Mer information

Ytterligare läsning

- Bedoussac L, Journet EP, Hauggaard-Nielsen H, Naudin C, Corre-Hellou G, Jensen ES, Prieur L and Justes E (2015). Ecological principles underlying the increase of productivity achieved by cereal-grain legume intercrops in organic farming. A review. *Agronomy for Sustainable Development* 35, 911–935. https://doi.org/10.1007/s13593-014-0277-7.
- Röös E, Carlsson G, Ferawati F, Hefni M, Stephan A, Tidåker P, Witthöft C (2020). Less meat, more legumes: prospects and challenges in the transition toward sustainable diets in Sweden. *Renewable Agriculture and Food Systems* 35, 192–205. https://doi.org/10.1017/S1742170518000443.

Weblinks

- Fagraslätt https://www.fagraslatt.se/
- Food Jams www.foodjams.se
- Check the Organic Farm Knowledge Platform for more practical recommendations.

Om denna sammanfattning av behandlingsmetoden

Authors: Georg Carlsson and Raj Chongtham, Swedish University of Agricultural Sciences SLU Alnarp, Department of Biosystems and Technology, PO Box 190, SE-234 22 Lomma. www.slu.se

Publisher: IFOAM Organics Europe, Rue Marie Thérèse 11, 1000 Brussels -BE, organicseurope.bio

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

IntercropVALUES syftar till att utnyttja fördelarna med samodling för att utforma och sköta produktiva, diversifierade, resilienta, lönsamma och miljövänliga odlingssystem som accepteras av jordbrukare och aktörer i livsmedelskedjan. Som ett tvärvetenskapligt projekt med många aktörer samlar det forskare och lokala aktörer som representerar livsmedelsvärdekedjan. Det omfattar 27 deltagare från 15 länder (3 kontinenter) från en bred mångfald av organisationer och intressenter. Projektet pågår i fyra år och startade i november 2022.

Project website: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°14

Collective approach to identify barriers and levers for intercropping at the value chain level

Problem

Many barriers farmers face related to intercropping, such as agro-industrial standards or consumer acceptance, are beyond their direct control and difficult to identify.

Solution

The causal tree method offers value chain stakeholders a way to identify the obstacles perceived in adopting intercropping and design potential solutions.

Benefits

By exploring the problem, its effects, the bottlenecks and possible levers, this method helps stakeholders understand the causes and consequences underlying the limited use of intercropping and reflect on how to address issues and drive systemic change.

Applicability box

Theme

Agroecology, Sustainable communities

Keywords

Socioeconomic development, Educational resources

Context

Value Chain

Application time

Start of project

Required time

4 hours

Equipment

Posters, pencils, sticky notes

Practical recommendations

1. **Agree on the problem and its effects**

"Intercropping is rarely used" and list its consequences: *Why is this situation problematic?*

2. **Identify the causes**

What are the direct origins and the indirect causes of this problem? For each value chain stage (production, storing/sorting, food processing, commercialisation, transversal), *what are the barriers?*

3. **Prioritise the barriers**

Ask the stakeholders to identify *what are the most important barriers, where are the bottlenecks and where is it crucial to act to unlock the value chain?*

4. **Suggest actions**

Where is each stakeholder able to act? What are the possible solutions to test?

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PRACTICE ABSTRACT N°14

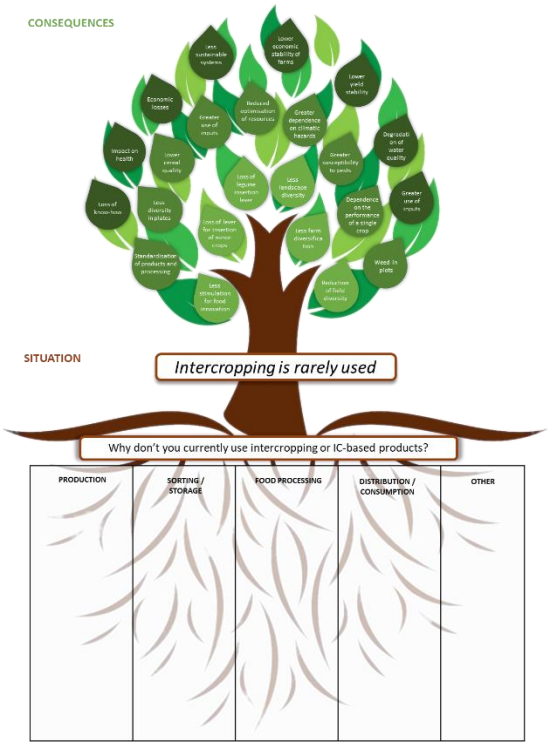


Figure 1: Causal tree template used by 32 stakeholders in CICS 4. Illustration: Fanny RAOUX, INRAE.

Further information

Weblinks

- (French) "Accompagner la conception et la conduite de projets multi-acteurs pour la transition agroécologique dans les territoires : propositions d'outils et de méthodes d'après les résultats du projet H2020 DiverIMPACTS" https://share.google/M6QIQ9kPPMDjOmkIV.
- DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability https://www.diverimpacts.net/
- A workshop on "Barriers and levers to the adoption of crop associations" at the Agricultural High school of Flamarens (South-West of France) - IntercropVALUES
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

Authors: Fanny RAOUX and Lionel ALLETTO (INRAE)

Publisher: IFOAM Organics Europe, Rue Marie Thérèse 11, 1000 Brussels -BE, organicseurope.bio

Date: April 2026

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

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PRACTICE ABSTRACT N°14

Appréhender en collectif les barrières et leviers à l'adoption des associations de cultures pour l'alimentation humaine

Problème

De nombreux obstacles rencontrés tout au long de la filière empêchent les agriculteurs d'adopter pleinement la pratique.

Solution

La méthode de l'arbre causale permet aux parties prenantes de la chaîne de valeur d'identifier les obstacles à l'adoption des cultures associées et de concevoir de potentielles solutions.

Avantages

En explorant le problème, ses effets, les obstacles et les leviers possibles, cette méthode aide les parties prenantes à comprendre les causes et les conséquences de l'utilisation limitée des cultures associées, et à réfléchir aux moyens de résoudre les blocages et favoriser un changement systémique.

Application

Thème

Agroécologie, Collectifs

Mots clés

Développement socio-économique, Ressources éducatives

Contexte

Chaîne de valeur, filière

Période d'utilisation

Au début des projets

Temps requis

Environ 4 heures

Equipement

Affiches, crayons, post-it

Recommandations pratiques

Etape 1 : S'accorder sur le problème et ses effets

« La culture intercalaire est rarement utilisée », énumérer les conséquences de cela : *pourquoi cette situation est problématique ?*

Etape 2 : Identifier les causes

Quelles sont les origines directes et les causes indirectes de ce problème ? Pour chaque étape de la chaîne de valeur (production, stockage/tri, transformation alimentaire, commercialisation, transversale), quels sont les obstacles ?

Etape 3 : Hiérarchiser les obstacles

Demandez aux parties prenantes d'identifier les obstacles les plus importants et là où il est crucial d'agir pour débloquer la situation.

Etape 4 : Suggérer des actions

Sur quels blocages chaque partie prenante peut-elle agir ? Quelles sont les solutions à tester ?

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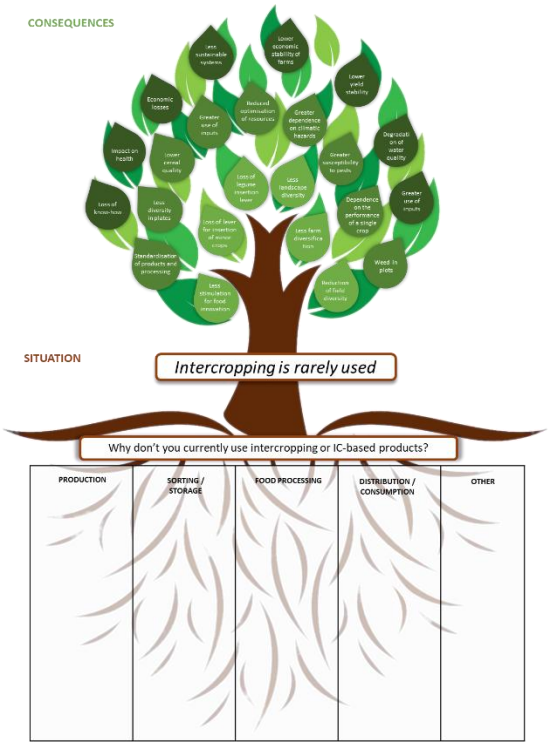


Figure 1: Le modèle d'arbre causale utilisé par 32 parties prenantes dans le cadre du CICS 4.. Illustration: Fanny RAOUX, INRAE.

Informations complémentaires

Liens web

- (Français) "Accompagner la conception et la conduite de projets multi-acteurs pour la transition agroécologique dans les territoires : propositions d'outils et de méthodes d'après les résultats du projet H2020 DiverIMPACTS" https://share.google/M6QIQ9kPPMDjOmkIV.
- Boîte à outils - DiverIMPACTS - Diversification through Rotation, Intercropping, Multiple Cropping, Promoted with Actors and value-Chains towards Sustainability https://www.diverimpacts.net/
- Identifier les barrières et leviers à l'adoption des associations de cultures - IntercropVALUES / Occita'Mix https://www.inrae.fr/actualites/identifier-barrieres-leviers-ladoption-associations-cultures
- Consultez Organic Farm Knowledge Platform pour davantage de recommandations pratiques.

A propos de cette fiche

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Editeur : IFOAM Organics Europe, Rue Marie Thérèse 11, 1000 Brussels -BE, organicseurope.bio

Date : Avril 2026

Contact : fanny.raoux@inrae.fr

Relecture : Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

IntercropVALUES vise à exploiter les avantages des cultures associées pour concevoir et gérer des systèmes de culture productifs, diversifiés, résilients, rentables, respectueux de l'environnement et acceptables pour les agriculteurs et les acteurs de la chaîne agroalimentaire. En tant que projet multidisciplinaire et multi-acteurs, il rassemble des scientifiques et des acteurs locaux représentant la chaîne de valeur alimentaire. Il comprend 27 participants de 15 pays (3 continents) issus d'une grande diversité d'organisations et de parties prenantes. Le projet, d'une durée de quatre ans, a démarré en novembre 2022.

Siteweb du projet : https://intercropvalues.eu/

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PRACTICE ABSTRACT N° 15

Intercropping to improve the nutritional quality of wheat under low-input conditions

Problem

The protein content of bread wheat grown under low-input conditions depends on the soil N content and is in most cases low, requiring alternative ways to increase protein content and nutritional quality.

Solution

Intercropping can improve the nutritional quality of bread wheat grown under low input conditions and increase resource use efficiency and crop productivity.

Benefits

Intercropping pea significantly increased the grain protein concentration of bread wheat compared to their sole crops. Cereal-legume intercropping elevates the nutritional density of wheat grain, reducing dependence on synthetic fertilisers while contributing to food and nutritional security.

Applicability box

Theme

Cropping systems, Arable crops, Nutritive values

Keywords

Low input agriculture, Cereal crops, Legumes, Proteins

Context

Temperate areas, Mediterranean climate.

Application time

Autumn crops.

Required time, if relevant

No additional time during cultivation. The harvested crop needs to be separated at a collection point.

Period of impact, if relevant

Duration of the crop.

Equipment

Standard machinery used for wheat cultivation.

Best in

Winter cereals and legumes and especially in rain-fed agricultural systems under low input conditions.

Practical recommendations

- **Seed bed preparation**: the seed bed should not be too fine after cultivation.
- **Varieties**: select cultivars (cereal and grain legume) with the same maturity time taking the local seed costs and availability on the market into account.
- **Sowing densities and machinery**
  - Mix the seeds 75% grain legume and 25% cereal (compared to the standard crop density of both crops) in the seed tank, check that the mixture is homogenous, and sow with a conventional seeder.
  - Use the same row spacing as for cereals.
  - Check matching seed depth and homogeneity of the mixture.
- **Protein content**: mixtures with different crop species increased protein content.
- **Harvest**: adjust the height of the harvester to pick up grain legumes close to the ground.
- Separate a part of your field before sowing and apply the mixture.
- Cultivate the rest of the field as usual and **compare the intercrop to the sole crop** cereals and/or legumes.
- **Test** this method under your own farm conditions. You can communicate your experience with us as well as with other farmers, advisors, and scientists.

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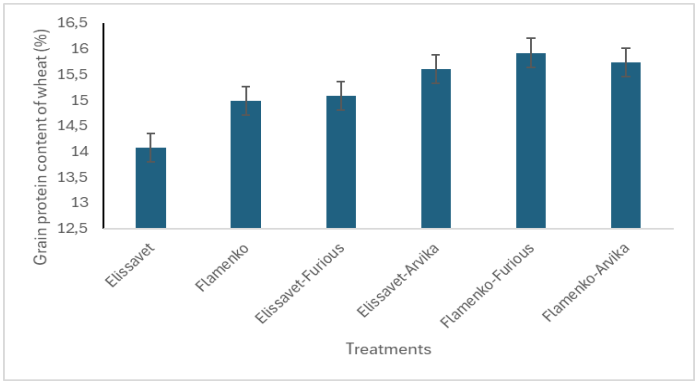


Figure 1. Grain protein content of bread wheat under monocropping and intercropping systems in Commercials farms (1, 2 and 3) and University farms.



Figure 2. Initial growth of wheat with pea in an intercropping system in University farm.



Figure 3. Mixture of different intercropping systems in Commercial farm 1 (Giannitsa).



Figure 4. Intercropping systems of cereal and legume in Commercial farm 2 (Kilkis).



Figure 5. Intercropping systems of cereal and legume in Commercial farm 3 (Galateia).

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PRACTICE ABSTRACT N° 15

Further information

Further readings

- Pankou, C., Lithourgidis, A., Dordas, C. Effect of Irrigation on Intercropping Systems of Wheat (*Triticum aestivum* L.) with Pea (*Pisum sativum* L.). Agronomy 2021, 11, 283.
- Michalitsis, A.; Papakaloudis, P.; Pankou, C.; Lithourgidis, A.; Menexes, G.; Dordas, C. Effect of cultivar on faba bean–wheat intercrop productivity under a Mediterranean environment. Agronomy 2024, 14 (1), 70.
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

Authors: Christos Dordas, Andreas Michalitsis, Paschalis Papakaloudis, Aristotle University of Thessaloniki, Faculty of Agriculture, Forestry and Natural Environment, School of Agriculture (AUTH), University Campus, 54124, Thessaloniki, Greece, http://www.agro.auth.gr.

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Date: April 2026

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

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PRACTICE ABSTRACT N° 15

Η συγκαλλιέργεια μπορεί να βελτιώσει τη διατροφική αξία του σιταριού κάτω από χαμηλές εισροές

Πρόβλημα

Η περιεκτικότητα σε πρωτεΐνη του μαλακού σιταριού που καλλιεργείται υπό συνθήκες χαμηλών εισροών εξαρτάται από την περιεκτικότητα του εδάφους σε άζωτο και, στις περισσότερες περιπτώσεις, είναι χαμηλή. Αυτό καθιστά αναγκαία την αναζήτηση εναλλακτικών τρόπων για την αύξηση της περιεκτικότητας σε πρωτεΐνη και της συνολικής διατροφικής ποιότητας.

Η λύση

Η συγκαλλιέργεια μπορεί να βελτιώσει τη διατροφική ποιότητα του μαλακού σιταριού που καλλιεργείται υπό συνθήκες χαμηλών εισροών και να αυξήσει την αποδοτικότητα χρήσης των πόρων του περιβάλλοντος και την παραγωγικότητα του συστήματος καλλιέργειας.

Τα οφέλη

Η συγκαλλιέργεια με μπιζέλι αύξησε σημαντικά τη συγκέντρωση πρωτεΐνης στους κόκκους του μαλακού σιταριού σε σύγκριση με τις μονοκαλλιέργειές τους (Σχήμα 1). Η συγκαλλιέργεια σιτηρών-ψυχανθών ενισχύει τη θρεπτική αξία του σιταριού, μειώνοντας την εξάρτηση από συνθετικά λιπάσματα και συμβάλλοντας στην επισιτιστική και διατροφική ασφάλεια.

Πλαίσιο Εφαρμογής

Θέματα

Συστήματα καλλιέργειας, Αροτραίες καλλιέργειες, Διατροφική ποιότητα.

Λέξεις κλειδιά

Γεωργία χαμηλών εισροών, Σιτηρά, Ψυχανθή, Διατροφική ποιότητα, Περιεκτικότητα σε πρωτεΐνη.

Περιοχή εφαρμογής

Εύκρατες περιοχές, Μεσογειακό κλίμα.

Χρόνος εφαρμογής

Φθινοπωρινές καλλιέργειες.

Απαιτούμενος χρόνος

Δεν υπάρχει επιπλέον χρόνος κατά τη διάρκεια της καλλιέργειας. Στο συγκομιζόμενο προϊόν θα πρέπει να γίνει διαχωρισμός κατά τη διαδικασία της συλλογής.

Περίοδος εφαρμογής

Διάρκεια της καλλιέργειας.

Εξοπλισμός

Συνηθισμένα μηχανήματα που χρησιμοποιούνται για την καλλιέργεια σιταριού.

Καλύτερο σε

Χειμερινά σιτηρά και ψυχανθή και ειδικά σε συστήματα ξηρικής γεωργίας με χαμηλές εισροές.

Πρακτικές προτάσεις

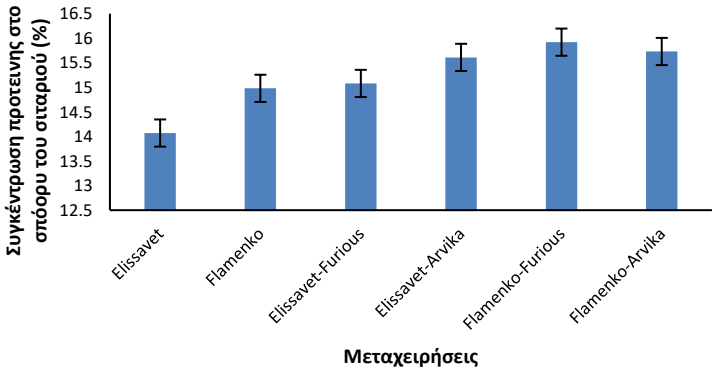
- **Προετοιμασία σποροκλίνης**: Η σποροκλίνη δε θα πρέπει να είναι υπερβολικά λεπτόκοκκη μετά την κατεργασία του εδάφους.
- **Ποικιλίες**: Επιλέξτε ποικιλίες (σιταριού και ψυχανθούς) με τον ίδιο χρόνο ωρίμανσης, λαμβάνοντας υπόψη το κόστος και τη διαθεσιμότητα των ποικιλιών στην αγορά.
- **Πυκνότητα σποράς και μηχανήματα:**
  - Αναμείξτε τους σπόρους σε αναλογία 75% σπόροι του ψυχανθούς και 25% του σιταριού (σε σύγκριση με την τυπική πυκνότητα σποράς και των δύο καλλιεργειών) στο δοχείο των σπόρων, ελέγξτε ότι το μείγμα είναι ομοιογενές και σπείρετε με μία συμβατική σπαρτική μηχανή.
  - Χρησιμοποιήστε την ίδια απόσταση μεταξύ των γραμμών σποράς όπως και για τα σιτηρά.
  - Ελέγξτε το κατάλληλο βάθος σποράς και η ομοιογένεια του μείγματος.
- **Περιεκτικότητα σε πρωτεΐνη:** μείγματα με διαφορετικά είδη καλλιεργειών μπορεί να οδηγήσουν σε αυξημένη περιεκτικότητα σε πρωτεΐνη (Σχήμα 1).
- **Συγκομιδή**: Προσαρμόστε το ύψος της θεριζοαλωνιστκής για να συγκομίσετε τον καρπό των ψυχανθών κοντά στο έδαφος.
- Διαχωρίστε ένα μέρος του αγρού σας πριν τη σπορά και εφαρμόστε το μείγμα.

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PRACTICE ABSTRACT N° 15

- Καλλιεργήστε τον υπόλοιπο αγρό όπως συνήθως και **συγκρίνετε τη συγκαλλιέργεια με τη μονοκαλλιέργεια** σιτηρού και/ή ψυχανθούς.
- Σας συνιστούμε να δοκιμάσετε αυτήν τη μέθοδο στις δικές σας συνθήκες καλλιέργειας. Μπορείτε να μοιραστείτε την εμπειρία σας μαζί μας καθώς και με άλλους αγρότες, γεωργικούς συμβούλους και επιστήμονες.



Σχήμα 1. Περιεκτικότητα σε πρωτεΐνη του μαλακού σιταριού σε συστήματα μονοκαλλιέργειας και συγκαλλιέργειας σε εμπορικά αγροκτήματα (1, 2 και 3) και στο αγρόκτημα του πανεπιστημίου.



Φωτογραφία 1. Αρχική ανάπτυξη σιταριού και μπιζελιού σε σύστημα συγκαλλιέργειας στο αγρόκτημα του πανεπιστημίου.



Φωτογραφία 2. Συστήματα συγκαλλιέργειας σιτηρών και ψυχανθών σε εμπορικό αγρόκτημα στην περιοχή των Γιαννιτσών.



Φωτογραφία 3. Συστήματα συγκαλλιέργειας σιτηρών και ψυχανθών σε Εμπορικό αγρόκτημα στην περιοχή του Κιλκίς.



Φωτογραφία 4. Συστήματα συγκαλλιέργειας σιτηρών και ψυχανθών σε Εμπορικό αγρόκτημα στην περιοχή της Γαλάτειας.

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Funded by the European Union

PRACTICE ABSTRACT N° 15

Περισσότερες πληροφορίες

Περισσότερες βιβλιογραφίες

- Pankou, C., Lithourgidis, A., Dordas, C. Effect of Irrigation on Intercropping Systems of Wheat (*Triticum aestivum* L.) with Pea (*Pisum sativum* L.). Agronomy 2021, 11, 283.
- Michalitsis, A.; Papakaloudis, P.; Pankou, C.; Lithourgidis, A.; Menexes, G.; Dordas, C. Effect of cultivar on faba bean–wheat intercrop productivity under a Mediterranean environment. Agronomy 2024, 14 (1), 70.

Σχετικά με αυτή την περίληψη

Συγγραφείς: Χρήστος Δόρδας, Ανδρέας Μιχαλίτσης, Πασχάλης Παπακαλούδης, Ευστράτιος Δεληγιάννης, Φώτιος Σπυρίδων Αλέξανδρος Αλεξάνδρου Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, Τμήμα Γεωπονίας, Δασολογίας και Φυσικού περιβάλλοντος, Τμήμα Γεωπονίας (ΑΠΘ), Πανεπιστημιούπολη, 54124, Θεσσαλονίκη, Ελλάδα, http://www.agro.auth.gr

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Αναθεώρηση: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

IntercropVALUES Το έργο αυτό έχει ως στόχο να αξιοποιήσει τα οφέλη της συγκαλλιέργειας για τον σχεδιασμό και τη διαχείριση παραγωγικών, ποικιλόμορφων, ανθεκτικών, κερδοφόρων, περιβαλλοντικά βιώσιμων συστημάτων καλλιέργειας που είναι αποδεκτά για τους αγρότες και τους φορείς στην αλυσίδα τροφίμων. Ως πολυδιάστατο και πολυμερές έργο, συγκεντρώνει επιστήμονες και τοπικούς φορείς που εκπροσωπούν την αλυσίδα τροφίμων. Περιλαμβάνει 27 συμμετέχοντες από 15 χώρες (3 ηπείρους) από μια ευρεία ποικιλία οργανώσεων και ενδιαφερόμενων φορέων. Το έργο θα διαρκέσει τέσσερα χρόνια και ξεκίνησε τον Νοέμβριο του 2022.

Ιστότοπος προγράμματος: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°16

Intercropping broccoli and vetch for Integrated Pest Management (IPM)

Problem

Broccoli is prone to pests. Mixing plant species can build a more resilient ecosystem with collaborative interactions among plants and insects.

Solution

Intercropping broccoli and vetch as an Integrated Pest Management (IPM) technique can be adapted to the farmer's context.

Benefits

The vetch attracts natural enemies, covers the soil, reducing erosion, enhances biological activity through roots diversity and density; extra organic matter retains soil humidity.

Applicability box

Theme

Crop production, Disease and pest control

Keywords

Integrated pest management; Plant protection; Pest control; Integrated pest management; Natural enemies.

Context

Ebro Valley, Navarre, Spain

Required time

Crop cycle (around 90 days)

Period of impact

Spring

Equipment

Centrifugal fertiliser spreader, seed drill

Best in

Spring and autumn crop

Practical recommendations

If pest pressure is high, **sow** vetch before planting broccoli. If it is low, sow once the main crop has already established to reduce potential competition.

Adapt **seeding density** for a soil cover that hosts natural enemies of main crop pests. If too high, it can compete for resources with the main crop. If too low, it can fail to increase soil cover or carry insect interactions. Higher vetch development results in an increase of insect diversity at the intercrop.

With a **mechanical seed drill**, sow before planting the broccoli. If there is sprinkler irrigation, all the lines of the seed drill can be used. In case of drip irrigation, block the lines that match up with the non-irrigated area and sow at max. 20 kg/ha.

With a **centrifugal fertiliser spreader**, sow when the broccoli is already established and before the last cultivation between lines (usually one month after plantation). Seeding density can be 20-30 kg/ha and then buried by a shallow labour.

This technique adds the seed and sowing cost. As broccoli is harvested by hand, the vetch does not affect harvesting.

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PRACTICE ABSTRACT N°16



Figure 1: Sowing with mechanical seed drill before planting. Photo: Miguel Ángel Los Arcos, farmer of Santiago Apóstol Cooperative.



Figure 2: Sowing with centrifugal fertilizer spreader before last cultivation between lines. Photo: Telmo Fernández Ibarburu.

Further information

Video

- Case study of intercropping broccoli and vetch as a pest integrated management technique in Navarre: https://www.youtube.com/watch?v=BOgsQSL1EMQ (March 2025, Spanish with subtitles in English)

Further readings

- Article on previous trials (Remix project) (Telletxea et al., 2021): https://www.navarraagraria.com/component/k2/item/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas

Weblinks

- More information about intercropping in Spain https://www.navarraagraria.com/ (Spanish)
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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RESUMEN PRÁCTICO N°16

Intercultivo de brócoli y veza para la Gestión Integrada de Plagas (GIP)

Problema

El brócoli es propenso a tener plagas. La mezcla de especies vegetales puede ayudar a la construcción de ecosistemas más resilientes con interacciones colaborativas entre plantas e insectos.

Solución

El intercultivo de broccoli y veza puede ser una estrategia de Gestión Integrada de Plagas (GIP) adaptable al contexto de cada explotación.

Beneficios

La veza atrae enemigos naturales, cubre el suelo, reduce la erosión, propicia la actividad biológica a través de la diversidad de raíces y densidad; la materia orgánica extra retiene humedad en el suelo.

Caja de aplicabilidad

Tema

Producción de cultivos, control de plagas y enfermedades

Palabras clave

Gestión integrada de plagas; Protección de cultivos; Control de plagas; Enemigos naturales.

Contexto

Valle del Ebro, Navarra, España

Momento de aplicación

Antes o después de plantación

Tiempo requerido

Ciclo del cultivo (90 días aproximadamente)

Periodo de impacto

Primavera

Equipamiento

Abonadora centrífuga, sembradora a chorrillo

Mejor en

Cultivo de primavera y otoño

Recomendaciones prácticas

Si la presión de plaga es alta, **siembra** la veza antes de plantar el broccoli. Si es baja, siembra una vez el cultivo principal se haya establecido para reducir la potencial competencia.

Adapta la **dosis de siembra** para una cobertura de suelo que atraiga enemigos naturales de las principales plagas del cultivo. Si es muy alta, puede competir por recursos con el cultivo principal. Si es muy baja, puede cubrir poco el suelo o no ser suficiente para que haya interacciones de insectos. Un mayor desarrollo de la veza resulta en un incremento de diversidad de insectos en el intercultivo.

Si se emplea **sembradora a chorrillo**, se siembra antes de la plantación del brócoli. Si es riego por aspersión, se siembran todas las líneas de la sembradora. En caso de utilizar riego por goteo, se cerrarán las líneas de siembran que coincidan con la parte no regada del campo, sembrando a un máximo de 20 kg/ha.

Empleando una **abonadora centrífuga**, la siembra se realizará cuando el brócoli ya se haya establecido y antes del último pase de cultivador (habitualmente un mes tras la plantación). La dosis de siembra puede subir a 30-40 kg/ha y enterrarse con una labor superficial de cultivador.

Esta técnica añade el coste de la semilla y la siembra. Como el brócoli se cosecha a mano, la veza no supone un problema.

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RESUMEN PRÁCTICO N°16



Figura 1: Siembra con sembradora a chorrillo antes de la plantación. Foto: Miguel Ángel Los Arcos, agricultor de la Cooperativa Santiago Apóstol de Funes.



Figura 2: Siembra con abonadora centrífuga antes del último pase de cultivador entre líneas. Foto: Telmo Fernández Ibarburu.

Más información

Vídeo

- Caso de studio de intercultivo de broccoli y veza como estrategia de gestión integrada de plagas en Navarra: https://www.youtube.com/watch?v=BOgsQSL1EMQ (Marzo 2025, castellano con subtítulos en inglés)

Otras lecturas

- Artículo sobre ensayos anteriores (Proyecto Remix) (Telletxea et al., 2021): https://www.navarra-agraria.com/component/k2/item/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas

Enlaces web

- Más información sobre intercultivo en España https://www.navarraagraria.com/ (castellano)
- Accede a la plataforma Organic Farm Knowledge Platform para obtener más recomendaciones prácticas.

Acerca de este recumen práctico

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Web del proyecto: https://intercropvalues.eu/

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Funded by the European Union

PRACTICE ABSTRACT N°17

Intercropping broccoli and vetch to increase species biodiversity

Problem

In the Ebro Valley, cabbage fly (*Delia radicum*), cabbage aphid (*Brevicoryne brassicae*), and cabbage moth (*Plutella xylostella*) in broccoli fields challenge Integrated Pest Management.

Solution

Intercropping broccoli and vetch can increase field biodiversity. Legume crops attract natural enemies to cope with pests.

Benefits

Natural enemies, such as ladybugs (*Coccinella sptempunctata*), hoverflies (*Sphaerophoria rueppellii*), and lacewings (*Chrysoperla carnea*), can establish only at the intercrop. They feed on aphids.

Applicability box

Theme

Crop production, Disease and pest control

Keywords

Integrated pest management; Plant protection; Pest control; Integrated pest management; Natural enemies.

Context

Ebro Valley, Navarre, Spain

Application time

Before planting

Required time

Crop cycle (around 90 days)

Period of impact

Spring.

Equipment

Centrifugal fertiliser spreader, mechanical seed drill

Best in

Spring and autumn crop.

Practical recommendations

Adjust the technique according to the irrigation system, pest pressure[1], and the machinery available (see PA16).

Prevent adventitious herbs by using selective herbicides. Weeds attract pests that can damage the main crop.

Highest insect biodiversity is reached when the vetch is sown before the main crop is planted, and by using a mechanical seed drill at a higher density. To avoid competition, do not exceed a seeding density of 20 kg/ha.

[1] "Specialist pests have different ways of finding their host plants, and non-host plants disrupt some species more easily than others. Crucifer flea beetles (Phyllotreta cruciferae), for example, are attracted to an area by odors of plants in the cabbage family. Since they move somewhat randomly within that area, landing on anything green, intercropping tends to reduce flea beetle numbers on the host plants (although often not enough to control damage). Imported cabbageworm butterflies (Pieris rapae), on the other hand, are good at finding their host plants in a mixture of other plants, and many studies have found that intercropping has no effect on their numbers." (Mohler, 2009)

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PRACTICE ABSTRACT N°17



Figure 1: Intercrop of broccoli and vetch in spring 2025 trial. Photo: Iñigo Arozarena, INTIA.



Figure 2: *Plutella xylostella* damages on broccoli leaves in the intercrop. Photo: Iñigo Arozarena, INTIA.

Further information (150 characters)

Video

- Case study of intercropping broccoli and vetch as a pest integrated management technique in Navarre: https://www.youtube.com/watch?v=BOgsQSL1EMQ (March 2025, Spanish with subtitles in English)

Further readings

- Article on previous trials (Remix project) (Telletxea et al., 2021) https://www.navarraagraria.com/component/k2/item/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas
- CROP ROTATION ON ORGANIC FARMS: a planning manual (Mohler, 2009) https://www.sare.org/wp-content/uploads/Crop-Rotation-on-Organic-Farms.pdf

Weblinks

- More information about intercropping in Spain https://www.navarraagraria.com/ (Spanish)
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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RESUMEN PRÁCTICO N°17

Intercultivo de brócoli y veza para aumentar biodiversidad de especies

Problema

En el Valle del Ebro, la mosca de la col (*Delia radicum*), el pulgón harinoso (*Brevicoryne brassicae*), y oruga de la col (*Plutella xylostella*) en campos de brócoli desafían la Gestión Integrada de Plagas.

Solución

Intercultivo de broccoli y veza puede aumentar la biodiversidad en campo. Los cultivos de leguminosas atraen enemigos naturales para combatir las plagas.

Beneficios

Enemigos naturales, como las mariquitas (*Coccinella sptempunctata*), sírfidos (*Sphaerophoria rueppellii*), y crisopas (*Chrysoperla carnea*), pueden establecerse solo en el intercultivo. Se alimentan de pulgones.

Recomendaciones prácticas

Ajusta la técnica al Sistema de riego, a la presión de plaga[1], y la maquinaria disponible (ver PA16).

Applicability box

Tema

Producción de cultivos, control de plagas y enfermedades

Palabras clave

Gestión integrada de plagas; Protección de cultivos; Control de plagas; Enemigos naturales.

Contexto

Valle del Ebro, Navarra, España

Momento de aplicación

Antes o después de plantación

Tiempo requerido

Ciclo del cultivo (90 días aproximadamente)

Periodo de impacto

Primavera

Equipamiento

Abonadora centrífuga, sembradora a chorrillo

Mejor en

Cultivo de primavera y otoño

Previene la presencia de hierbas adventicias mediante el uso de herbicidas. Las hierbas atraen plagas que pueden dañar el cultivo principal.

La mayor biodiversidad de insectos se consigue cuando la veza se siembra antes de la plantación del cultivo principal, y empleando una sembradora a chorrillo a mayor densidad. Para evitar competencia, no exceda una densidad de siembra de 20 kg/ha.

[1] "Las plagas especialistas tienen diferentes maneras de encontrar sus plantas hospedantes, y las plantas no hospedantes dispersan algunas especies más fácilmente que otras. La pulguilla de las crucíferas (*Phyllotreta cruciferae*), por ejemplo, son atraídas hacia un área por el olor que desprenden las plantas de la familia de las crucíferas. Como se mueven de manera aleatoria por esa área, aterrizando en cualquier cosa verde, el intercultivo tiende a reducir los números de pulguillas en plantas hospedantes (aunque a menudo insuficiente para controlar el daño). Las polillas de las crucíferas importadas (*Pieris rapae*), por otro lado, son buenas encontrando plantas hospedantes en una mezcla de otras plantas, y muchos estudios han encontrado que el intercultivo no tiene efecto en sus números." (Mohler, 2009)

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RESUMEN PRÁCTICO N°17



Figura 1: Intercultivo de broccoli y veza en el ensayo de primavera 2025. Foto: Iñigo Arozarena, INTIA.



Figura 2: Daños de *Plutella xylostella* en hojas de brócoli en intercultivo. Foto: Iñigo Arozarena, INTIA.

Más información

Vídeo

- Caso de studio de intercultivo de broccoli y veza como técnica de gestión integrada de plagas en Navarra: https://www.youtube.com/watch?v=BOgsQSL1EMQ (marzo de 2025, Castellano con subtítulos en inglés)

Otras lecturas

- Artículo sobre ensayos previos (proyecto Remix) (Telletxea et al., 2021) https://www.navarraagraria.com/component/k2/item/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas/1779-brocoli-cultivar-en-mezcla-con-veza-para-reducir-plagas
- CROP ROTATION ON ORGANIC FARMS: a planning manual (Mohler, 2009) https://www.sare.org/wp-content/uploads/Crop-Rotation-on-Organic-Farms.pdf

Enlaces web

- Más información cobre intercultivo en España https://www.navarraagraria.com/ (castellano)
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Sobre este resumen práctico

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PRACTICE ABSTRACT N°18

Organic pea-wheat intercropping to improve soil nitrogen recycling

Problem

In semi-arid conditions, continuous supply of available soil nitrogen (N) is lacking in organic winter wheat production.

Solution

Intercropping winter wheat with field pea in organic systems could increase soil N by biological fixation and residue decomposition to boost growth and nutrition content.

Benefits

Incorporating legumes into cereals can increase biodiversity and activate soil, augment resource use and biomass production, reduce fertilisation costs, and boost ecosystems services. Such advanced agro-ecosystems can increase wheat yield and add value to the final product, such as pasta, noodles, or bread.

Practical recommendations

- **Field pea variety selection**: an early and homogenous ripening filed pea to match with winter wheat varieties. Make sure that the selected legume matches the harvesting period of wheat (e.g., Mraz in Serbia).
- **Seeding density**: wheat at 70% and legume at 30% of their recommended sole-crop densities.
- **Seeding time**: 2-3 weeks after the optimum sowing date to avoid pest and diseases proliferation and lack of rainfall (especially in organic agriculture).
- **Weed control**: usually not needed in the autumn, but weeds can be controlled in spring by harrowing.
- **Harvest**: Adjust the harvesting period to winter wheat ripening and adjust harvester speed to prevent seed shedding.
- Finally, a shallow incorporation of crop residues in the soil speeds up mineralisation and N release for the subsequent crop.

Applicability box

Theme

Crop production, Soil, Nutrient management

Keywords

Intercropping, Crop management, Nutrient cycling, Carbon sequestration, Ecosystem services

Context

South-eastern Europe, temperate climate, rain fed conditions

Application time

Autumn (October) to Summer (June/July)

Required time, if relevant

No additional time during cultivation of pure winter wheat crop. Harvest should adapt to crop conditions

Period of impact, if relevant

Long-term with root and biomass residues

Equipment

Standard machinery for the winter wheat cultivation

Best in

Low input/ organic agricultural systems

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PRACTICE ABSTRACT N°18



Fig 1: Sampling intercrop for N-min in spring. (Photo: Svetlana Vujić)



Fig 2: Intercrops of winter wheat and field peas. Picture taken during the **flowering of field peas (**Photo: Srdjan Šeremešić)



Fig 3: Harvesting intercropping and collecting plant samples (Photo: Srdjan Đuranović)

Further information

Video

- Check the following videos for further instructions https://intercropvalues.eu/news/short-video-release-sowing-winter-wheat-and-field-pea/; https://www.youtube.com/watch?v=gpwpdIBRYAY (English).

Further reading

- Timaeus, J., Weedon, O. D., & Finckh, M. R. (2022). Harnessing the potential of wheat-pea species mixtures: evaluation of multifunctional performance and wheat diversity. Frontiers in Plant Science, 13, 846237. https://doi.org/10.3389/fpls.2022.846237

- More information about practical aspect of the intercropping can be found from Remix project
- Examples of organic intercropping strategies are available also from the Swiss organic farmers

Weblinks

- Legume Hub https://www.legumehub.eu/is_article/intercropping-of-grain-pea-with-cereals/.
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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IntercropVALUES aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. As a multi-disciplinary and multi-actor project, it brings together scientists and local actors representing the food value chain. It includes 27 participants from 15 countries (3 continents) from a wide diversity of organizations and stakeholders. The project will run for four years and started in November 2022.

Project website: https://intercropvalues.eu/

PRACTICE ABSTRACT N°18

Združena setva graška i pšenice u cilju unapređenja kruženja azota u zemljištu u organskoj proizvodnji

Problem

U uslovima umereno kontinentalne klime nedostaje kontinuirano snabdevanje lakopristupačnim azotom (N) u organskoj proizvodnji ozime pšenice.

Rešenje

Združena setva ozime pšenice i stočnog graška u sistemu organske poljoprivrede može povećati sadržaj zemljišnog azota putem biološke fiksacije i razlaganja biljnih ostataka, čime se podstiče porast biljaka i sadržaj hraniva u zemljištu.

Korist

Uključivanje leguminoza u useve žitarica može povećati biodiverzitet i aktivirati zemljište, unaprediti korišćenje resursa i proizvodnju biomase, smanjiti troškove đubrenja i poboljšati usluge ekosistema. Takvi unapređeni agroekosistemi mogu povećati prinos pšenice i dodati vrednost finalnom proizvodu, kao što su testenina, rezanci ili hleb.

Primena tehnologije

Tema

Biljna proizvodnja, zemljište, upravljanje hranivima

Ključne reči

Združena setva, tehnologija gajenja, kruženje hraniva, sekvestracija ugljenika, usluge ekosistema

Kontekst

Jugoistočna Evropa, umerena klima, proizvodnja bez navodnjavanja

Vreme primene

Jesen (Oktobar) do leta (Jun/Jul)

Potrebno vreme za izvođenje (ako je relevatno)

Nije neophodno dodatno vreme u odnosu na setvu čistih useva. Žetva se mora prilagoditi stanju useva

Period uticaja (ako je relevantno)

Duži vremenski period uzimajući u obzir korenske i biljne ostatke

Oprema

Standarna mehanizacija u proizvodnji ozime pšenice

Najbolje primeniti

Sistemi sa niskim ulaganjima, organska poljoprivreda

Praktična preporuka za proizvođače

- **Izbor sorte stočnog graška:** rana sorta stočnog graška sa ujednačenim sazrevanjem koja se uklapa sa sortama ozime pšenice. Voditi računa da odabrana leguminoza odgovara periodu žetve pšenice (npr. Mraz u Srbiji).
- **Gustina setve:** pšenica na 70%, a leguminoza na 30% od preporučenih gustina za pojedinačne useve.
- **Vreme setve:** 2-3 nedelje nakon optimalnog roka setve kako bi se izbeglo širenje štetočina i bolesti, kao i nedostatak padavina (posebno u organskoj poljoprivredi).
- **Suzbijanje korova:** obično nije potrebno u jesen, ali se korovi mogu kontrolisati u proleće drljanjem.
- **Žetva:** prilagoditi vreme žetve sazrevanju ozime pšenice i podesiti brzinu kombajna kako bi se sprečilo osipanje semena.
- **Nakon žetve,** plitko zaoravanje biljnih ostataka u zemljište ubrzava mineralizaciju i oslobađanje azota za naredni usev.

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PRACTICE ABSTRACT N°18



Fig 1: Uzorkovanje združene setve radi analize obezbeđensti azotom u proleće (N-min). (Foto: Svetlana Vujić)



Fig 2: Združena setva ozime pšenice i stočnog graška. Slikano za vreme cvetanja stočnog graška. (Foto: Srdjan Šeremešić)



Fig 3: Žetva i prikupljanje biljnog materijala za analizu združene setve. (Foto: Srdjan Đuranović)

Dodatne informacije

Video

- Pogledajte video kako bi saznali više informacija: https://intercropvalues.eu/news/short-video-release-sowing-winter-wheat-and-field-pea/; https://www.youtube.com/watch?v=gpwpdIBRYAY (English).

Dodatna literatura

- Timaeus, J., Weedon, O. D., & Finckh, M. R. (2022). Harnessing the potential of wheat-pea species mixtures: evaluation of multifunctional performance and wheat diversity. Frontiers in Plant Science, 13, 846237. https://doi.org/10.3389/fpls.2022.846237

- Više informacija u vezi sa praktičnim aspektima združene setve može se naći na stranici Remix project
- Primeri združene setve u organskoj poljoprivredi se mogu naći na stranici Swiss organic farmers

Weblinks

- Legume Hub https://www.legumehub.eu/is_article/intercropping-of-grain-pea-with-cereals/.
- Pogledajte Organic Farm Knowledge Platform za više praktičnih saveta.

Informacije o praktičnom apstraktu

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IntercropVALUES ima za cilj da iskoristi prednosti združenog gajenja useva (interkropinga) kako bi stvorio i unapredio produktivne, diverzifikovane, otporne, profitabilne i ekološki prihvatljive biljne proizvodne sisteme, koji su prihvatljivi za poljoprivrednike i aktere u agro-prehrambenom lancu. Kao multidisciplinarni i projekat sa više učesnika, okuplja naučnike i lokalne aktere koji predstavljaju lanac vrednosti hrane. Projekat uključuje 27 učesnika iz 15 zemalja (sa tri kontinenta), iz veoma raznovrsnih organizacija i zainteresovanih strana. Projekat traje četiri godine i započeo je u novembru 2022. godine.

Internet stranica: https://intercropvalues.eu/

PRACTICE ABSTRACT N°19

How to produce protein-enriched bread with local and natural ingredients?

Problem

Bakers lack practical methods and technical knowledge to produce protein-enriched bread using local, natural ingredients, without compromising on sensory quality.

Solution

Legume flours are a local source of protein and fibre, with the ability to compliment the nutritional quality of cereal-based foods. The substitution of wheat flour with faba bean flour (10 to 30%) into bread recipes is a natural way to increase protein content and composition.

Benefits

The incorporation of faba bean flour in bread is a sustainable alternative to imported protein ingredients. It offers new market opportunities, meeting consumers' demand for natural, nutritious and locally sourced products.

Applicability box

Theme
Food chain management, Cereal crops, Legumes, Processing

Keywords
Food processing, food quality

Context
Applicable to any breadmaking process

Application time
Any

Required time, if relevant
Equivalent to standard breadmaking process

Period of impact, if relevant
Any

Equipment
Standard breadmaking equipment

Best in
Baking category, innovative food systems

Practical recommendations

- Use the following raw materials:
  - High-quality wheat flour (protein content >12% and strong gluten network) to maintain a proper balance of rheological and processing properties during production
  - Faba bean flour
- Adapt the baking process depending on how much of the wheat flour is substituted by faba bean flour

Substitution level	Impact on functional and sensory properties	Key technical adjustments
10%	Impact on dough handling	Increase of Hydration level +2 % Longer kneading time Decrease final proofing time
15%	Changes in dough strength and elasticity, reduced loaf volume Decrease in elasticity / Increase in extensibility	Increase of the hydration level +2-3 % Longer kneading time Decrease final proofing time
20%	Weakening of gluten network, reduced loaf volume Decrease in elasticity / Increase in extensibility	Increase of the hydration level +3 % Use of sourdough to improve structure and flavour—longer fermentation

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- Sensory properties of the final product vary proportionately with the % of faba bean flour incorporated in the mix:
  - Darker colour of the crust and dough
  - Higher density and powdery texture of the dough
  - Softer crust texture
  - Slight increase in raw, beany flavour



Figure 1: Prototype with 10% faba bean flour substitution. Photo: S. Knecht (Richemont)



Figure 2: Prototype with 15% faba bean flour substitution. Photo: S. Knecht (Richemont)



Figure 3: Prototype with 20% faba bean flour substitution. Photo: S. Knecht (Richemont)

Further information

Further readings

- R. Coda, J.Varis, M. Verni, C. G. Rizzello, K. Katina. Improvement of the protein quality of wheat bread through faba bean sourdough addition, LWT - Food Science and Technology, Volume 82 (2017)
- Maravić N. et al. Faba bean flour and protein isolate as partial substitutes in wheat-triticale bread: technological and sensory properties, Food & Feed Research (2024)

Weblinks

- More information about organic intercropping in Switzerland on Bioactualités.ch (French), bioaktuell.ch (German)
- Knowledge sharing platform about grain legumes in Switzerland: https://swiss.legumehub.eu/
- RICHEMONT école professionnelle - Laboratoire - Source de compétence
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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FICHE PRATIQUE N°19

Comment produire un pain enrichi en protéines à partir d'ingrédients locaux et naturels?

Problématique

Les boulanger.ères manquent de méthodes pratiques et de connaissances techniques pour produire du pain enrichi en protéines à partir d'ingrédients locaux et naturels, sans compromettre la qualité sensorielle.

Solution

Les farines de légumineuses constituent une source locale de protéines et de fibres, et peuvent compléter la qualité nutritionnelle des aliments à base de céréales. Le remplacement de la farine de blé par de la farine de féveroles (10 à 30 %) dans les recettes de pain est un moyen naturel d'améliorer la teneur et la composition en protéines.

Bénéfices

L'incorporation de farine de féveroles dans le pain est une alternative durable aux ingrédients protéiques importés. Elle offre de nouvelles opportunités commerciales, répondant à la demande des consommateur.ices pour des produits naturels, nutritifs et d'origine locale.

Cadre d'application

Thème

Gestion de la chaîne alimentaire, cultures céréalières, légumineuses, transformation alimentaire

Mots-clés

Transformation alimentaire, qualité alimentaire.

Contexte

Applicable à tout processus de panification.

Période

Toute

Durée requise

Équivalente à celle d'un processus standard de fabrication du pain.

Durée d'impact

NA

Équipement

Équipement standard pour la fabrication du pain.

Adapté pour

Catégorie « Boulangerie », systèmes alimentaires innovants.

Recommandations pratiques

- Matières premières:
  - Farine de blé de haute qualité (teneur en protéines > 12 % et réseau de gluten fort) afin de maintenir un bon équilibre entre les propriétés rhéologiques et les aptitudes à la transformation pour la production
  - Farine de féverole
- Adaptations du procédé de panification

Niveau de substitution	Impact sur les propriétés fonctionnelles et sensorielles	Ajustements techniques clés
10%	Impact sur la manipulation de la pâte	Augmenter l'hydratation de +2 % Augmenter le temps de pétrissage Réduire le temps d'apprêt final
15%	Modifications de la force et de l'élasticité de la pâte, réduction du volume du pain Diminution de l'élasticité / Augmentation de l'extensibilité	Augmenter l'hydratation de +2-3 % Augmenter le temps de pétrissage Réduire le temps d'apprêt final
20%	Affaiblissement du réseau glutenique, réduction du volume du pain Diminution de l'élasticité / Augmentation de l'extensibilité	Augmenter l'hydratation de +3 % Utiliser un levain pour améliorer la structure et l'aromatique – Fermentation plus longue.

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- Les propriétés sensorielles du produit final varient proportionnellement au pourcentage de farine de féverole incorporée dans le mélange
  - Couleur plus foncée de la croûte et de la pâte
  - Densité plus élevée et texture poudreuse de la pâte
  - Texture plus molle de la croûte
  - Légère augmentation du goût cru/vert



Figure 1: Prototype avec 10% de farine de féverole. Photo: S. Knecht (Richemont)



Figure 2: Prototype avec 15% de farine de féverole. Photo: S. Knecht (Richemont)



Figure 3: Prototype avec 20% de farine de féverole. Photo: S. Knecht (Richemont)

Informations complémentaires

Documents

- R. Coda, J.Varis, M. Verni, C. G. Rizzello, K. Katina. Improvement of the protein quality of wheat bread through faba bean sourdough addition, LWT - Food Science and Technology, Volume 82 (2017)
- Maravić N. et al. Faba bean flour and protein isolate as partial substitutes in wheat-triticale bread: technological and sensory properties, Food & Feed Research (2024)

Liens

- Plus d'informations sur les cultures associées en Bio sur Bioactualités.ch (Français), bioaktuell.ch (Allemand)
- Plateforme de connaissances sur les légumineuses à graines en Suisse: https://swiss.legumehub.eu/
- RICHEMONT école professionnelle - Laboratoire - Source de compétence

A propos de cette fiche pratique

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IntercropVALUES IntercropVALUES vise à exploiter les avantages de la culture associée pour concevoir et gérer des systèmes de culture productifs, diversifiés, résilients, rentables et respectueux de l'environnement, acceptables pour les agriculteurs et les acteurs de la chaîne agroalimentaire. En tant que projet multidisciplinaire et multi-acteurs, il rassemble des scientifiques et des acteurs locaux représentant les chaînes de valeur alimentaires. Il comprend 27 participants de 15 pays (3 continents) issus d'une grande diversité d'organisations et de parties prenantes. Le projet a démarrée en Novembre 2022 et dure quatre ans.

Site web du projet: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°20

Supporting the design of intercrop-based value chain as researchers: learnings from the adaptative management of a network of case studies across Europe

Problem

Research projects are increasingly based on Living Lab networks to support agroecological transitions. Without dedicated facilitation, the expected outcomes of these initiatives (such as cross-learning, scaling of innovations across Labs) do not occur.

Applicability box

Theme

Farm management, People and skills, Sustainable communities

Keywords

Educational resources, Human resources management

Solution

Develop an adaptative management of networks through facilitation activities (workshops, training sessions, webinars, reflexive interviews) and transversal analysis to understand complex situations, foster cross-learning, and enhance reflexivity (Figure 1).

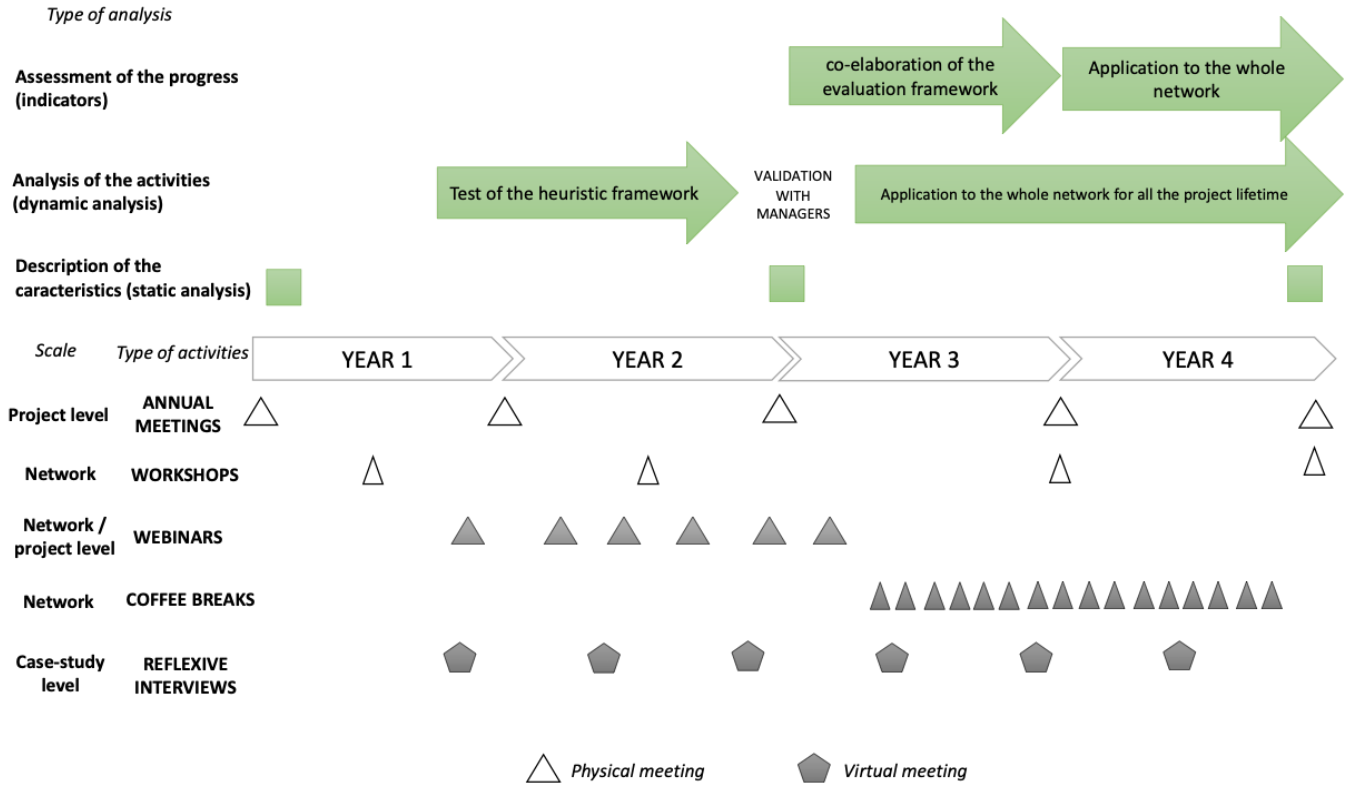


Figure 1: schematic representation of the adaptative management of a network of Living Labs combining facilitation and training activities at different scales (bottom of the figure) and transversal analysis (top of the figure). This representation is largely inspired on what have been done within the WP1 of IntercropVALUES.

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PRACTICE ABSTRACT N°20

Benefits

Living Labs managers report that they felt empowered to initiate organisational, institutional, technical (farm) and/or technological (process) changes.

Practical recommendations

When designing the project:

- Build an interdisciplinary team that combines agronomic knowledge (at different levels) with a social-science background and facilitation skills.
- Dedicate a project task to cover the time and financial resources required to manage and analyse such networks.
- Increase awareness of the whole project consortium about the value of such interdisciplinary and qualitative-facilitative approach.

During the project lifetime:

- Hold regular physical meetings (two minimum) to build trust between researchers and managers, maintain momentum and encourage cross-learning.
- Be transparent about the activity (e.g., workshop), purpose, and managers' roles to ensure fluent co-creation

Further information

Further readings

- Rossing, W.A.H., Albicette, M.M., Aguerre, V., Leoni, C., Ruggia, A., Dogliotti, S., 2021. Crafting actionable knowledge on ecological intensification: Lessons from co-innovation approaches in Uruguay and Europe. Agricultural Systems 190, https://doi.org/10.1016/j.agsy.2021.103103.

Weblinks

- https://www.diverimpacts.net/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

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PRACTICE ABSTRACT N°21

Soil health changes with the use of inter-cropping supporting good practice

Problem

Soil health is crucial for the sustainability of any cropping system. Currently, it is unknown how intercropping contributes to soil health and the improvement of systems sustainability.

Solution

Monitoring soil health through key indicators provides information on soil chemical, physical, and biological properties and how well these components are performing.

Benefits

Knowing the state of soil health allows for management decisions to be made to maintain soil- and agro-system sustainability using a selection of robust soil indicators.

Practical recommendations

Farmers and advisors can use Soil Health Check Cards, a scientifically based scorecard that brings together soil health indicators in one excel file with automated cell colouring.

Applicability box

Theme

Soil; Crop production

Keywords

Soil quality; Soil fertility; Soil pH; Soil structure; Soil fauna

Context

Crop production

Application time

Start and end of cropping cycle

Required time

Three hours for each sampling and field measurement

Period of impact

Yearly

Equipment

Spade, plastic sheet, soil structure and earthworm identification sheets, water, auger, bucket, plastic bags, 20 cm diameter plastic ring, 33 cl water bottles, timer.

The scorecard system was adapted to cover the three areas of soil health—chemistry, physics, and biology—using an outline from the UK AHDB GreatSoils method and the Biofunctool® tool. This prototype scorecard was first tested in 7 experimental sites, comparing cereal monoculture, legume monoculture, and cereal-legume intercropping over two cropping cycles (Figure 1).

The indicators taken together provide a quick-and-easy visual representation of the health of the soil investigated—mainly green: good overall, mainly red: soil in poor health with work needed to improve these indicators to green.

		Field 1		Field 2	
Soil Health Component	Test	Crop 1 (arable)	Mixed Crop 1 (arable/legume)	Crop 1 (legume)	Mixed Crop 1 (arable/legume)
Chemical	pH	6.7	6.6	5.3	5.7
	Inorganic N (kg ha^{-1})	18	19	32	41
	Ext. Phosphorous (P) (mg/l)	3.2	3.8	9.6	10.2
	Ext. Potassium (K) (mg/l)	50	150	71	69
	Ext. Magnesium (Mg) (mg/l)	53	436	203	342
	Soil Organic Matter (%)	7.2	5.3	10.1	8.2
Physical	Soil Structure (VESS score 1 to 5)	2	4	3	1
	Water Infiltration	341	82	69	351
Biological	Earthworm Numbers/Density	10	1	4	12
	Macrofauna Density	25	12	16	32

Figure 1: Soil Health Scorecard for two fields with visual representation of data with a traffic light system

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Funded by the European Union

PRACTICE ABSTRACT N°21

Further information

Video

- How to assess your soil for structure using the Visual Evaluation of Soil Structure (VESS) method A guide to the Visual Evaluation of Soil Structure (VESS) (Scotland 2018, English)
- How to assess water infiltration rates in soil using the Beerkan method. Biofunctool Tutoriel Beerkan (Senegal 2022, French)
- How to assess earthworms' density in your soil. GREATsoils: the worm count test | AHDB

Further reading

- Descriptions of the use of a visual assessment of soil structure The numeric visual evaluation of subsoil structure (SubVESS) under agricultural production (Soil & Tillage Research, 2015)
- Identification of earthworms SOIL-4pp-chart.pdf
- European Union outline of soil health for all EU countries Soil health - Environment - European Commission (webpage 2023, multiple languages)

Weblinks

- Soil health indicators and how to measure them GREATsoils | AHDB
- Assessing agricultural management practices on soil health Biofunctool | CIRAD - IRD
- Nature Based solutions for improving soil health Revitalizing Soil Health: Targeted Recommendations for EU Policies - NBSOIL (2022 to 2026)
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

Authors: Paul Hargreaves, SRUC Barony Campus, Dumfries, Scotland, UK, DG 3NE, www.sruc.ac.uk and Marie Sauvadet, Campus La Gailarde Institut Agro, INRAE,1er étage 2 place Viala, 34060 Montpellier https://www.cirad.fr/

Publisher: IFOAM Organics Europe, Rue Marie Thérèse 11, 1000 Brussels -BE, organicseurope.bio

Date: April 2026

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

IntercropVALUES aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. As a multi-disciplinary and multi-actor project, it brings together scientists and local actors representing the food value chain. It includes 27 participants from 15 countries (3 continents) from a wide diversity of organizations and stakeholders. The project will run for four years and started in November 2022.

Project website: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°22

Approaches to producing organic rapeseed crops in Scotland

Problem

Organic rapeseed is a niche crop in the UK. Agronomic knowledge is limited, and farmers need to develop their own approaches to growing the crop.

Solution

A group of Scottish farmers are collaborating to develop viable approaches to growing reliable organic rapeseed crops, including the use of intercropping.

Applicability box

Theme

Crop Production

Keywords

Cropping systems; Diversification; Arable farming; Low input agriculture; Intercropping

Context

Organic rapeseed in Scotland

Benefits

The collaborative approach enables peer-to-peer learning of positive and negative experiences through facilitated discussion. Collating and sharing this information can help future decision making.

Practical recommendations

Facilitated collaboration can support knowledge exchange to better understand organic rapeseed production and intercropping potential (Picture 1). Trust within the group needs to be built up over time to encourage open and frank discussion of ideas.

Recommendations for organic rapeseed:

- Growing rapeseed after grass-clover and FYM use can help fertility & reduce weed issues.
- Use high vigour, disease & pod shatter resistance varieties.
- Sow early (e.g., early August in Scotland). Autumn sown varieties are generally preferred.
- Organically approved slug pellets may be useful.
- Swathing then combining is preferred, but direct harvesting can work.
- Drying needs care (~ 9% MC).
- Seed sorting likely to be required.
- Early grazing or multiple light cultivations can reduce volunteers.

Crop mixes:

- Intercropping with spring cereals or legumes, e.g., fenugreek may help reduce flea beetle damage.
- Intercropping with clovers or vetch may also confuse pest species and fix N to aid soil and crop fertility.

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PRACTICE ABSTRACT N°22

Picture 1. Farmer members of the intercropping group discussing a crop of organic oilseed rape with vetch, fenugreek, berseem clover and buckwheat sown to help fertility and control flea beetle (Robin Walker, Dec 2025)



Further information

Video

- Marketing organic intercropped rapeseed oil in Scotland (YouTube in English)

Further readings

- https://www.fas.scot/article/organic-oilseed-rape-production-in-scotland/
- https://www.fas.scot/downloads/organic-oilseed-rape-in-scotland-a-technical-guide/

Weblinks

- https://www.or-ganic.co.uk/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

Authors: Dr Robin Walker (SRUC) & Jim Booth (SAOS), SRUC, Craibstone Estate, Ferguson Building, Aberdeen, Scotland AB21 9YA https://www.sruc.ac.uk/, https://saos.coop/.

Publisher: IFOAM Organics Europe, Rue Marie Thérèse 11, 1000 Brussels -BE, organicseurope.bio

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

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PRACTICE ABSTRACT N°23

Integration of pea into baking flour and its effects on nutritional value and processing

Problem

Wheat-pea intercropping results in improved wheat baking quality. After sorting, differing fractions of pea may remain in the wheat as an impurity, necessitating pea integration in the baking process.

Solution

Pea residues of up to 5% in wholemeal and refined flour do not negatively affect baking volume, baking quality or baking processes.

Benefits

Pea integration (impurity) of up to 5% in wheat flour also increases the shelf-life of bread due to the higher water absorption capacity of pea[1]. Wheat flour containing pea has an increased mineral and protein content improving the nutritional value of baked products[2].

Applicability box

Theme

Food chain management

Keywords

Processing, intercropping, cereal crops, legumes, product quality

Context

Germany, but applicable in all contexts/locations

Application time

Post-harvest processing

Equipment

Standard machinery and baking processes

Practical recommendations

Baking processes:

- Due to the greater water absorption capacity of the pea flour, more water may be necessary during dough mixing to achieve desired dough consistency
- The amount of additional water needed depends on the bread recipe, flour type, and pea percentage in the flour
- Higher percentages of pea in the flour can result in a darker crust colour during baking
- Mineral content of both wholemeal and refined wheat flour is increased with higher percentages of pea, thereby improving the nutritional value of baked goods:

Treatment	Mineral content (%)	
	Wholemeal flour	Refined flour
0% pea	1,86	0,57
1% pea	1,86	0,62
3% pea	1,92	0,66
5% pea	1,92	0,71
7% pea	1,95	0,80
10% pea	1,96	0,84

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PRACTICE ABSTRACT N°23

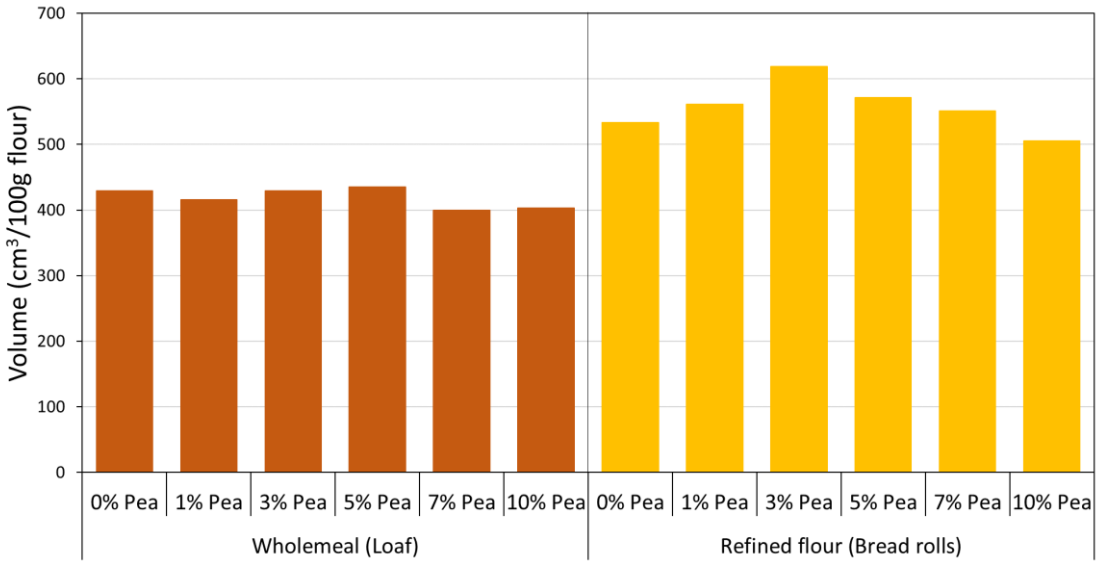


Figure 1: Baking volume (cm^3/100g flour) for both wholemeal flour loaves (brown) and refined flour bread rolls (yellow) containing 1-10% pea. The control treatment consisted of 100% wheat flour (0% pea).

Further information

Video

- Videos on practitioners' experiences with wheat-pea intercrops including sowing, harvesting, seed sorting, milling and baking: @vorwerts-projekt (January 2026, German with subtitles in English).

Further reading

- [1]Burger, TG & Zhang, Y (2019): Recent progress in the utilization of pea protein as an emulsifier for food applications. Trends in Food Science and Technology (86). https://doi.org/10.1016/j.tifs.2019.02.007.
- [2]Zucco, F, Borsuk, Y, Arntfield, S (2011): Physical and nutritional evaluation of wheat cookies supplemented with pulse flours of different particle sizes. LWT – Food Science and Technology (44). https://doi.org/10.1016/j.lwt.2011.06.007.

Weblinks

- More information about organic intercropping in Germany on vorwerts-projekt.de (German)
- https://www.remix-intercrops.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

Authors: Odette Weedon, University of Kassel, Section of Ecological Plant Protection, Nordbahnhofstr. 1a, Witzenhausen, 37213, Germany. UniKassel, Section of Ecological Plant Protection.

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Review: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

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PRAXISZUSAMMENFASSUNG Nr. 23

Einarbeitung von Erbsen in Mehl und deren Auswirkungen auf Mineralstoffgehalt und Verarbeitung

Problem

Der Mischanbau von Weizen und Erbsen führt zu einer verbesserten Backqualität des Weizens. Nach dem Sortieren können unterschiedliche Anteile an Erbsen als Verunreinigungen im Weizen verbleiben, was eine Einarbeitung der Erbsen in den Backprozess erforderlich macht.

Lösung

Erbsenrückstände von bis zu 5% in Vollkorn- und Typenmehl haben keinen negativen Einfluss auf Backvolumen, Backqualität oder Backprozesse.

Anwendungsbereich

Thema

Lebensmittelkettenmanagement

Schlüsselwörter

Verarbeitung, Mischkultur, Getreide, Hülsenfrüchte, Produktqualität

Kontext

Deutschland, aber in allen Kontexten/Standorten anwendbar

Anwendungszeit

Verarbeitung nach der Ernte

Ausstattung

Standardmaschinen und Backverfahren

Vorteile

Die Einbeziehung von Erbsen (als Verunreinigung) von bis zu 5% in Weizenmehl erhöht zudem die Haltbarkeit von Brot aufgrund der höheren Wasseraufnahmefähigkeit von Erbsen[1]. Weizenmehl, das Erbsen enthält, weist einen erhöhten Mineralstoff- und Proteingehalt auf, was den Nährwert von Backwaren verbessert[2].

Praktische Empfehlungen

Backprozesse:

- Aufgrund der höheren Wasseraufnahmefähigkeit des Erbsenmehls kann beim Kneten des Teigs mehr Wasser erforderlich sein, um die gewünschte Teigkonsistenz zu erreichen
- Die Menge des zusätzlich benötigten Wassers hängt von der Brotrezeptur, der Mehltyp und dem Erbsenanteil im Mehl ab
- Ein höherer Erbsenanteil im Mehl kann beim Backen zu einer dunkleren Krustenfarbe führen
- Der Mineralstoffgehalt sowohl von Vollkorn- als auch von Typenmehl steigt mit höheren Erbsenanteilen, wodurch sich der Nährwert der Backwaren verbessert:

Behandlung	Mineralstoffgehalt (g/100g TM)	Type
Kontrolle	0,57	T550
99:1	0,62	T550
97:3	0,66	T812
95:5	0,71	T812
93:7	0,80	T812

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PRAXISZUSAMMENFASSUNG Nr. 23

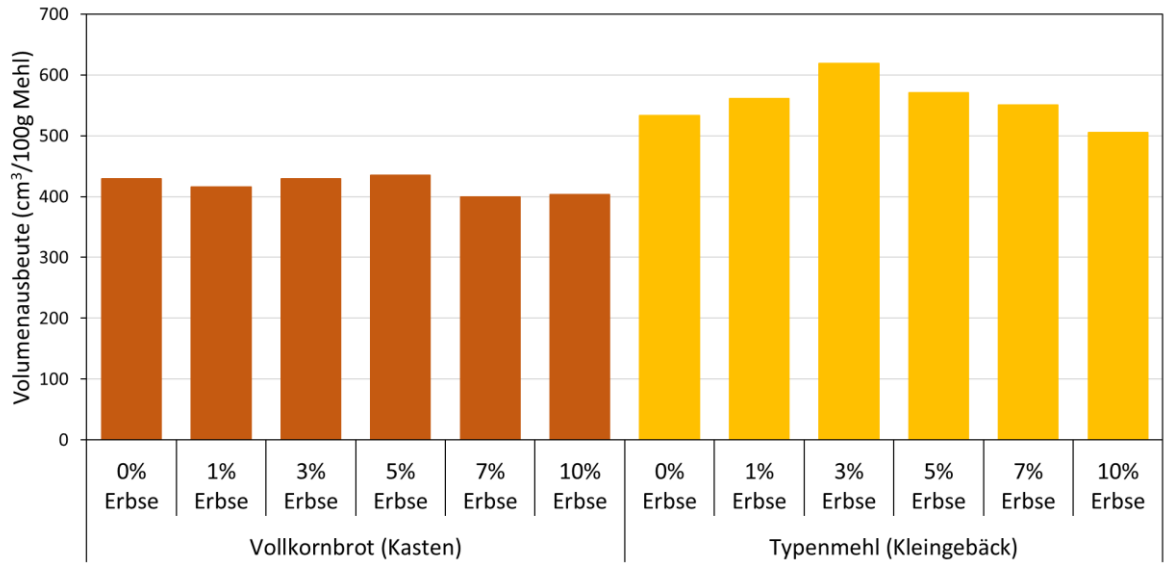


Abbildung 1: Backvolumen (cm³/ 100g Mehl) für Vollkornbrotlaibe (braun) und Weißbrotbrötchen (gelb) mit einem Erbsenanteil von 1–10%. Die Kontrollgruppe bestand aus 100% Weizenmehl (0% Erbse).

Weitere Informationen

Video

- Videos zu den Erfahrungen von Praktikern mit Weizen-Erbsen-Mischkulturen, einschließlich Aussaat, Ernte, Saatgutsortierung, Mahlen und Backen: @vorwerts-projekt (Januar 2026, Deutsch mit englischen Untertiteln).

Weiterführende Literatur

- [1] Burger, TG & Zhang, Y (2019): Aktuelle Fortschritte bei der Verwendung von Erbsenprotein als Emulgator für Lebensmittelanwendungen. Trends in Food Science and Technology (86). https://doi.org/10.1016/j.tifs.2019.02.007
- [2] Zucco, F, Borsuk, Y, Arntfield, S (2011): Physikalische und ernährungsphysiologische Bewertung von Weizenkeksen, die mit Hülsenfrüchte-Mehlen unterschiedlicher Partikelgröße angereichert wurden. LWT – Food Science and Technology (44). https://doi.org/10.1016/j.lwt.2011.06.007

Weblinks

- Weitere Informationen zum ökologischen Mischanbau in Deutschland auf vorwerts-projekt.de (Deutsch)
- https://www.remix-intercrops.eu/
- Weitere praktische Empfehlungen finden Sie auf der Wissensplattform für den ökologischen Landbau.

Über diese Praxiszusammenfassung

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Datum: April 2026

Kontakt: Odette Weedon (odetteweedon@uni-kassel.de)

Rezension: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, Universität Kassel

IntercropVALUES zielt darauf ab, die Vorteile der Mischkultur zu nutzen, um produktive, diversifizierte, widerstandsfähige, rentable und umweltfreundliche Anbausysteme zu entwerfen und zu bewirtschaften, die für Landwirte und Akteure in der Agrar- und Lebensmittelkette akzeptabel sind. Als multidisziplinäres und akteursübergreifendes Projekt bringt es Wissenschaftler und lokale Akteure zusammen, die die Lebensmittelwertschöpfungskette repräsentieren. Es umfasst 27 Teilnehmer aus 15 Ländern (3 Kontinenten) aus einer Vielzahl von Organisationen und Interessengruppen. Das Projekt hat eine Laufzeit von vier Jahren und startete im November 2022.

Projekt-Website: https://intercropvalues.eu/

Dieses Projekt wurde im Rahmen des Forschungs- und Innovationsprogramms „Horizont 2020“ der Europäischen Union unter der Fördervereinbarung Nr. 101081973 finanziell unterstützt. Diese Mitteilung gibt ausschließlich die Meinung des Autors wieder. Die Exekutivagentur für Forschung übernimmt keine Verantwortung für die Verwendung der bereitgestellten Informationen. Die Autoren und Herausgeber übernehmen keine Verantwortung oder Haftung für etwaige sachliche Ungenauigkeiten oder Schäden, die sich aus der Anwendung der Empfehlungen in dieser Praxiszusammenfassung ergeben.

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PRACTICE ABSTRACT N°24

Integration of pea into baking flour and its effects on bread sensory characteristics

Problem

Wheat-pea intercropping results in improved wheat baking quality. After sorting, differing fractions of pea may remain in the wheat as an impurity, necessitating pea integration in the baking process.

Solution

The sensory profiles of bread with differing pea fractions of up to 7% indicate that the sensory profile of bread remains unaffected by pea additions of up to 5%, reducing the need for costly additional grain sorting.

Applicability box

Theme

Food chain management

Keywords

Processing, intercropping, cereal crops, legumes, product quality

Context

Germany, but applicable in all contexts/locations

Application time

Post-harvest processing

Equipment

Standard machinery and baking processes

Benefits

An increased perception of saltiness in bread with the addition of 7% pea may allow for the reduction of salt within baked goods. Due to the higher water absorption capacity of pea[1], salt can taste more prominent if the addition of water is not adjusted accordingly.

Practical recommendations

Napping sensory profiling:

- Napping is a sensory testing methodology and is an efficient and easy way to identify sensory differences in products without the need for a trained tasting panel

Adjusting water additions to the dough:

- Due to the greater water absorption capacity of the pea flour, more water may be necessary during dough mixing to achieve desired dough consistency.
- The addition of water depends on the bread recipe, flour type, and pea percentage in the flour.
- If the water quantity is not adjusted or increased in dough containing pea flour, the salt profile in bread can be increased. This is particularly prevalent in pea additions over 5%.
- Bread dough may be drier than usual with increasing pea additions when water volume is not adjusted, although no differences in loaf consistency and texture were identified during the bread sensory profiling and assessment.
- Additionally, loaf and bread roll baking volume were not negatively affected by additions of pea of up to 7% (see Practice Abstract N°X), indicating that baking processes, quality and sensory characteristics are in no way negatively affected by pea additions of up to 5%, reducing the need for additional grain sorting in this intercropping combination.

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PRACTICE ABSTRACT N°24

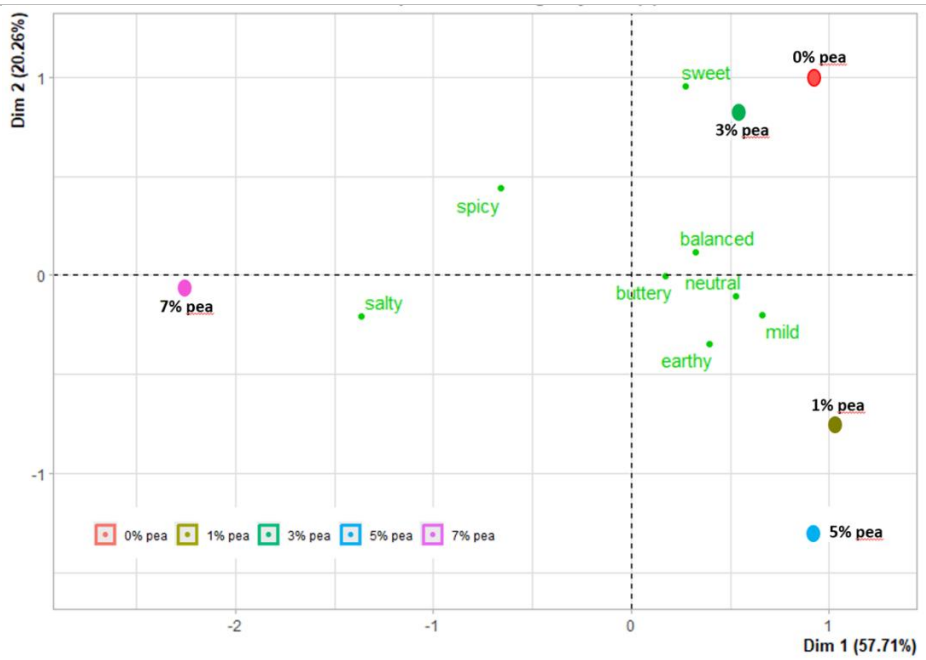


Figure 1: Results of the Principal Component Analysis (PCA) for the bread samples containing pea from 0-7% and their associated sensory profiles. Bread with pea additions up to 5% were found clustered together and indicate similarity in their taste profiles. The sample with 7% pea was an outlier identified as having a salty and spicy (savoury) profile.

Further information

Video

- Various videos on practitioners' experiences with wheat-pea intercrops including sowing, harvesting, seed sorting, milling and baking: @vorwerts-projekt (January 2026, German with subtitles in English).

Further readings

- [1]Burger, TG & Zhang, Y (2019): Recent progress in the utilization of pea protein as an emulsifier for food applications. Trends in Food Science and Technology (86). https://doi.org/10.1016/j.tifs.2019.02.007

Weblinks

- More information about organic intercropping in Germany on vorwerts-projekt.de (German)
- https://www.remix-intercrops.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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PRAXISZUSAMMENFASSUNG Nr. 24

Einarbeitung von Erbsen in Mehl und deren Auswirkungen auf die sensorischen Eigenschaften von Brot

Problem

Der Mischanbau von Weizen und Erbsen führt zu einer verbesserten Backqualität des Weizens. Nach dem Sortieren können unterschiedliche Anteile an Erbsen als Verunreinigungen im Weizen verbleiben, was eine Einarbeitung der Erbsen in den Backprozess erforderlich macht.

Lösung

Die sensorischen Profile von Brot mit unterschiedlichen Erbsenanteilen von bis zu 7% zeigen, dass das sensorische Profil des Brotes durch Erbsenzugaben von bis zu 5% unbeeinträchtigt bleibt, wodurch der Bedarf an kostspieliger zusätzlicher Getreidesortierung reduziert wird.

Anwendungsbereich

Thema

Lebensmittelkettenmanagement

Schlüsselwörter

Verarbeitung, Mischkultur, Getreide, Hülsenfrüchte, Produktqualität

Kontext

Deutschland, aber in allen Kontexten/Standorten anwendbar

Anwendungszeit

Verarbeitung nach der Ernte

Ausstattung

Standardmaschinen und Backverfahren

Vorteile

Eine erhöhte Wahrnehmung der Salzigkeit in Brot mit einem Erbsenanteil von 7% könnte eine Reduzierung des Salzgehalts in Backwaren ermöglichen. Aufgrund der höheren Wasseraufnahmefähigkeit von Erbsen[1] kann Salz stärker hervortreten, wenn die Wasserzugabe nicht entsprechend angepasst wird.

Praktische Empfehlungen

Sensorische Profilierung mittels Napping:

- Napping ist eine sensorische Testmethode und eine effiziente und einfache Möglichkeit, sensorische Unterschiede bei Produkten zu identifizieren, ohne dass ein geschultes Verkostungspanel erforderlich ist

Anpassung der Wasserzugabe zum Teig:

- Aufgrund der höheren Wasseraufnahmefähigkeit des Erbsenmehls ist beim Kneten des Teigs möglicherweise mehr Wasser erforderlich, um die gewünschte Teigkonsistenz zu erreichen.
- Die Zugabe von Wasser hängt von der Brotrezeptur, der Mehlsorte und dem Erbsenanteil im Mehl ab.
- Wird die Wassermenge in einem Teig mit Erbsenmehl nicht angepasst oder erhöht, kann sich das sensorische Salzprofil im Brot verstärken. Dies tritt insbesondere bei Erbsenzusätzen von über 5% auf.

Dieses Projekt wurde im Rahmen des Forschungs- und Innovationsprogramms „Horizont 2020“ der Europäischen Union unter der Fördervereinbarung Nr. 101081973 finanziell unterstützt. Diese Mitteilung gibt ausschließlich die Meinung des Autors wieder. Die Exekutivagentur für Forschung übernimmt keine Verantwortung für die Verwendung der bereitgestellten Informationen. Die Autoren und Herausgeber übernehmen keine Verantwortung oder Haftung für etwaige sachliche Ungenauigkeiten oder Schäden, die sich aus der Anwendung der Empfehlungen in dieser Praxiszusammenfassung ergeben.

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- Der Brotteig kann bei steigendem Erbsenanteil trockener als gewöhnlich sein, wenn die Wassermenge nicht angepasst wird, obwohl bei der sensorischen Profilierung und Bewertung des Brotes (ohne zusätzliches Wasser) keine Unterschiede in der Konsistenz und Textur der Brote festgestellt wurden.
- Zudem wurde das Backvolumen von Broten und Brötchen durch Erbsenzusätze von bis zu 7% nicht negativ beeinflusst (siehe Praxis-Zusammenfassung Nr. 23), was darauf hindeutet, dass Backprozesse, Qualität und sensorische Eigenschaften durch Erbsenzusätze von bis zu 5% in keiner Weise beeinträchtigt werden, wodurch der Bedarf an zusätzlicher Getreidesortierung bei dieser Mischkulturkombination verringert wird.

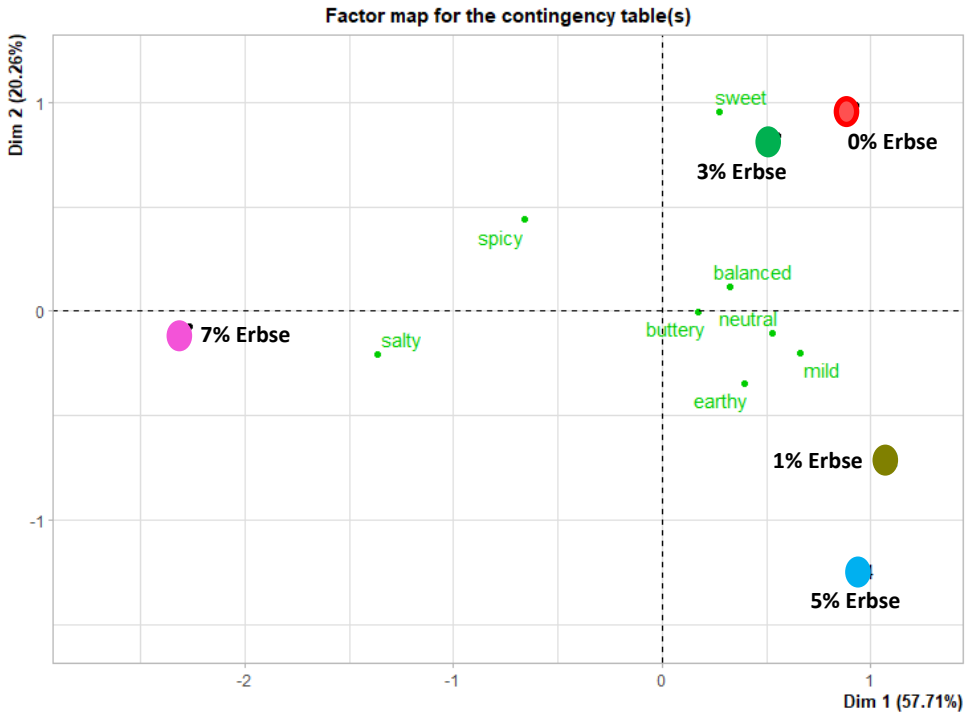


Abbildung 1: Ergebnisse der Hauptkomponentenanalyse (PCA) für die Brotproben mit einem Erbsenanteil von 0–7% und die dazugehörigen sensorischen Profile. Brote mit einem Erbsenanteil von bis zu 5% gruppierten sich zusammen (rechts) und wiesen ähnliche Geschmacksprofile auf. Die Probe mit 7% Erbsen war ein Ausreißer, der als salzig und würzig (herzhaft) identifiziert wurde.

Weitere Informationen

Video

- Verschiedene Videos zu den Erfahrungen von Praktikern mit Weizen-Erbsen-Mischkulturen, einschließlich Aussaat, Ernte, Saatgutsortierung, Mahlen und Backen: @vorwerts-projekt (Januar 2026, Deutsch mit englischen Untertiteln).

Weiterführende Literatur

- [1] Burger, TG & Zhang, Y (2019): Aktuelle Fortschritte bei der Verwendung von Erbsenprotein als Emulgator für Lebensmittelanwendungen. Trends in Food Science and Technology (86). https://doi.org/10.1016/j.tifs.2019.02.007

Weblinks

- Weitere Informationen zum ökologischen Mischanbau in Deutschland auf vorwerts-projekt.de (Deutsch)
- https://www.remix-intercrops.eu/

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- Weitere praktische Empfehlungen finden Sie auf der Wissensplattform für den ökologischen Landbau.

Über diese Praxiszusammenfassung

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Rezension: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, Universität Kassel

IntercropVALUES zielt darauf ab, die Vorteile der Mischkultur zu nutzen, um produktive, diversifizierte, widerstandsfähige, rentable und umweltfreundliche Anbausysteme zu entwerfen und zu bewirtschaften, die für Landwirte und Akteure in der Agrar- und Lebensmittelkette akzeptabel sind. Als multidisziplinäres und akteursübergreifendes Projekt bringt es Wissenschaftler und lokale Akteure zusammen, die die Lebensmittelwertschöpfungskette repräsentieren. Es umfasst 27 Teilnehmer aus 15 Ländern (3 Kontinenten) aus einer Vielzahl von Organisationen und Interessengruppen. Das Projekt hat eine Laufzeit von vier Jahren und startete im November 2022.

Projekt-Website: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°25

Optimisation of costs associated with sugarcane intercropping

Problem

Intercropping is associated with greater costs and time than sole cropping. Reduced herbicide use only partially offsets the increase in manual labour.

Solution

Use sowing methods suited for the operating conditions:

- Manual sowing (~1,800€/ha)
- Sowing with a micro-tractor (~1,000€/ha, Figure 1)
- Straw cutter seeder with a tractor (~100€/ha, Figure 2), which also avoids having to handle the cane straw.

Applicability box

Theme

Cropping system, Weed management, Biodiversity, and nature conservation

Keywords

Companion plants, Sowing methods, Ecosystem services

Context

Spring in tropical climatic conditions (Reunion Island)

Application time

Sowing 1 to 6 weeks after harvest

Required time

Depends on the sowing method

Period of impact

During the sugarcane growth, before canopy closure

Equipment

Seeds, workforce, adaptative seeders, tractor

Benefits

Harvesting companion crops can generate additional income, thereby mitigating costs and losses associated with intercropping. However, it can be challenging to mechanise and can negatively impact sugarcane production.

Practical recommendations

- When sowing with a micro-tractor, concentrate the cane straw manually on the row before sowing, unlike with other mechanised practices.
- Depending on the purpose of harvesting (personal consumption, sale at markets, etc.), different species can be considered for human or animal consumption, with a preference for grain legumes (chickpeas, mung beans, pigeon peas).
- To harvest the companion plant, sow early after the cane harvest.
- Favor short-cycle companion plant varieties to allow harvesting before sugarcane canopy closure (~4 months after cane harvest).
- When using climbing species (e.g., beans), plan to mix them with support plants (e.g., corn).

To support the uptake of intercropping and enable its widespread adoption, policymakers should encourage sharing of agricultural machinery to promote mechanisation and limit costly manual labour, provide support for individual investment in mechanisation, and subsidise ecosystem services provided by intercropping.

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PRACTICE ABSTRACT N°25



Figure 1: Micro-tractor seed drill (with mulch concentrated on the row). Photo: eRcane.



Figure 2: Disc seeder with straw cutter (for use with mulch). Photo: eRcane.

Further information

Video

- IntercropVALUES sugarcane case study : Le Projet Intercrop-Values (November 2024, French).

Further readings

- Reference guide on companion plants: Guide pratique de mise en place des plantes de services – Coatis (coatis.rita-dom.fr) ; Référentiel des plantes de service de saison chaude – Agritrop (cirad.fr) (French)
- Scientific article with economic assessment: A long-term multi-criteria analysis of sugarcane inter-cropping – HAL (hal.science) (English)
- Growers' testimonials: Saint-Louis ; Saint-Benoît – Coatis (coatis.rita-dom.fr) (French)
- Seed supplier in Réunion: Guide des fournisseurs en matériel végétal en AB à La Réunion – Armeflhor (armeflhor.fr) (French)

Weblinks

- Practice knowledge sharing tool: Plantasso (French)
- Tropical species knowledge sharing platform: Wiktrop (French & English)
- https://intercropvalues.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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PRACTICE ABSTRACT N°25

Optimisation des coûts liés à la culture intercalaire de la canne à sucre

Problèmatique

La culture intercalaire entraîne des coûts et un investissement en temps plus importants que la monoculture. La réduction de l'utilisation d'herbicides ne compense que partiellement l'augmentation de la main-d'œuvre nécessaire.

Solution

Utilisez des méthodes de semis adaptées aux conditions d'exploitation :

- Semis manuel (~1,800€/ha)
- Semis avec un micro-tracteur (~1,000€/ha, Figure 1)
- Semoir avec disques trancheur de paille avec un tracteur (~100€/ha, Figure 2), qui évite également d'avoir à manipuler la paille de canne.

Bénéfice

La récolte de cultures associées peut générer des revenus supplémentaires, atténuant ainsi les coûts et les pertes liés à la culture intercalaire. Cependant, elle peut être difficile à mécaniser et avoir un impact négatif sur la production de canne à sucre.

Application de la méthode

Thème

Systèmes de culture, Gestion des adventices, Biodiversité, et conservation de la nature

Mots clés

Plantes compagnes, méthodes de semis, services écosystémtiques

Contexte

Eté en condition climatique tropicale (île de La Réunion) Island)

Période d'application

Semis 1 à 6 semaines après coupe

Temps requis

Dépendant de la méthode de semis

Période d'impact sur la culture

Au cours de la période de croissance de la canne, avant fermeture du couvert

Equipements

Semences, main d'oeuvre, semoir adapté, tracteur

Recommandations pratiques

- Lors du semis avec un micro-tracteur, concentrez manuellement la paille de canne sur le rang avant de semer, contrairement aux autres pratiques mécanisées.
- En fonction de l'objectif de la récolte (consommation personnelle, vente sur les marchés, etc.), différentes espèces peuvent être envisagées pour la consommation humaine ou animale, avec une préférence pour les légumineuses à grains (niébé, haricots mungo, pois cajan).
- Pour récolter la plante compagne, semez tôt après la récolte de la canne à sucre.
- Privilégiez les variétés de plantes compagnes à cycle court afin de permettre la récolte avant la fermeture du couvert végétal de la canne à sucre (environ 4 mois après la récolte de la canne).
- Lorsque vous utilisez des espèces grimpantes (par exemple, des haricots), prévoyez de les mélanger avec des plantes de soutien (par exemple, du maïs).

Afin de soutenir l'adoption de la culture intercalaire et de permettre sa généralisation, les décideurs politiques devraient encourager le partage des machines agricoles afin de promouvoir la mécanisation et de limiter le coût élevé de la main-d'œuvre manuelle, soutenir les investissements individuels dans la mécanisation et subventionner les services écosystémiques fournis par la culture intercalaire.

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Figure 1 : Semoir pour micro-tracteur (avec paillis concentré sur le rang). Photo : eRcane.



Figure 2 : Semoir à disque trancheur de paille (à utiliser avec du paillis). Photo : eRcane.

Pour aller plus loin

Vidéo

- Étude de cas IntercropVALUES sur la canne à sucre : Le Projet Intercrop-Values : Le Projet Intercrop-Values (Novembre 2024, Français).

Lectures complémentaires

- Guide de référence sur les plantes compagnes : Guide pratique de mise en place des plantes de services – Coatis (coatis.rita-dom.fr) ; Référentiel des plantes de service de saison chaude – Agritrop (cirad.fr) (Français)
- Article scientifique avec évaluation économique: A long-term multi-criteria analysis of sugarcane intercropping – HAL (hal.science) (Anglais)
- Témoignage de producteurs: Saint-Louis ; Saint-Benoît – Coatis (coatis.rita-dom.fr) (French)
- Fournisseur de semences à La Réunion: Guide des fournisseurs en matériel végétal en AB à La Réunion – Armeflhor (armeflhor.fr) (Français)

Liens web

- Outil de partage des connaissances pratiques : Plantasso (Français)
- Plateforme de partage des connaissances sur les espèces tropicales : Wiktrop (Français & Anglais)
- https://intercropvalues.eu/
- Consultez la plateforme de connaissances sur l'agriculture biologique pour obtenir davantage de recommandations pratiques.

A propos de ce résumé

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INTERCROP VALUES

PRACTICE ABSTRACT N26

Lentil-based crop mixtures for yield optimisation

Problem

In organic and conventional lentils, yields are often limited by weeds, lodging, and bruchids, which vary from year to year and from region to region.

Solution

The proposed solution is to grow lentils in mixture with another crop (here camelina or barley).

Benefits

Such mixtures should help limit weeds, lodging, and bruchids, thereby improving gross margins by limiting yield losses.

Applicability box

Theme

Crop production; Cropping systems; Legumes; Weed management; Disease and pest control.

Keywords

Crop management; Diversification; Intercropping; Legumes; Seedbed preparation.

Context

All areas where lentil is cultivated.

Equipment

Sowing machine, combine harvester, and grain separator.

Best in

All cropping systems aimed at produce lentils.

Practical recommendations

- Lentils must be sown at the recommended density (300 to 400 seeds/m²), and the soil must be well prepared to ensure good contact between the soil and the seeds to guarantee a satisfactory germination rate (68% in our trials, with an average ranging from 45 to 98%).
- The density of the associated cereal (in this case barley) must not exceed 25% of that in a pure crop to limit competition with the lentils (Viguier, 2018).
- The target density for camelina should be around 50 plants/m², but due to the low germination rate (13% on average in our trials, ranging from 4% to 35%), it is recommended to sow camelina between 2-4 kg/ha.
- The mixture should be harvested as soon as possible and immediately sorted to remove any impurities, then treated by freezing or asphyxiation to kill weevils (see PA N°4).



Figure 1: Lentil-Camelina mixture (left) and Lentil-Barley mixture (right). Photo: Laurent Bedoussac, ENSFEA.

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PRACTICE ABSTRACT N26



Figure 2: Main results obtained from experiments conducted on farms in north-western France as part of CICS10 (from left to right and top to bottom: (i) crop emergence (%), (ii) crop height at maturity, (iii) dry matter of weeds at harvest, (iv) percentage of bruchid-damaged grains, (v) dry grain yield, and (vi) dry grain yield after removal of bruchid-damaged grains).

Further information

Further readings

- Bedoussac L, Albouy L, Deschamps E, Salembier C, Jeuffroy M;-H.. (2021). From theory to practice of species mixtures: Redesigning European cropping systems based on species MIXtures, 108p., https://hal.inrae.fr/hal-04064291v1
- Viguier L (2018). Analyse de la performance agronomique et économique des associations de culture lentille-blé de printemps en agriculture biologique, https://theses.fr/2018INPT0070.
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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INTERCROP VALUES

PRACTICE ABSTRACT N26

Mélanges d'espèces à base de lentille pour optimiser le rendement

Problématique

En agriculture biologique et conventionnelle le rendement des lentilles est souvent limité par les adventices, la verse et les bruches, qui varient d'une année à l'autre et d'une région à l'autre.

Solution

La solution proposée consiste à cultiver la lentille en mélange avec une autre espèce (ici, la caméline ou l'orge).

Bénéfices

Ces mélanges devraient contribuer à limiter les adventices, la verse et les bruches, améliorant ainsi la marge brute en réduisant les pertes de rendement.

Cadre d'application

Thème

Production végétale ; Systèmes de culture ; Légumineuses ; Gestion des adventices ; Lutte contre les maladies et les ravageurs.

Mots-clés

Gestion des cultures ; Diversification ; Culture associée ; Légumineuses ; Préparation du lit de semence.

Contexte

Toutes les zones où la lentille est cultivée.

Equipement

Semoir ; moissonneuse-batteuse ; trieur

Idéal pour

Tous les systèmes de culture destinés à la production de lentille

Recommandations pratiques

- Les lentilles doivent être semées à la densité recommandée (300 à 400 graines/m²), et le sol doit être bien préparé afin d'assurer un bon contact entre le sol et les graines et garantir un taux de germination satisfaisant (68 % dans nos essais, avec une moyenne comprise entre 45 et 98 %).
- La densité de la céréale associée (dans ce cas, l'orge) ne doit pas dépasser 25 % de celle en culture pure afin de limiter la concurrence avec la lentille (Viguier, 2018).
- La densité ciblée pour la caméline devrait être d'environ 50 plants/m², mais en raison du faible taux de germination (13 % en moyenne dans nos essais, variant de 4 % à 35 %), il est recommandé de semer la caméline entre 2 et 4 kg/ha.
- Le mélange doit être récolté dès que possible et immédiatement trié pour éliminer les impuretés, puis traité par congélation ou asphyxie pour tuer les bruches (voir PA N°4).



Figure 1: Mélanges de lentille-caméline (à gauche) et de lentille-orge (à droite). Photo : Laurent Bedoussac, ENSFEA.

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PRACTICE ABSTRACT N26



Figure 2 : Principaux résultats obtenus à partir des expérimentations menées dans des exploitations agricoles du nord-ouest de la France dans le cadre du CICS10 avec de gauche à droite et de haut en bas : (i) levée des cultures (%), (ii) hauteur des cultures à maturité, (iii) matière sèche des adventices à la récolte, (iv) pourcentage de grains endommagés par les bruches, (v) rendement sec en grains, et (vi) rendement sec en grains après élimination des grains endommagés par les bruches.

Informations complémentaires

Rapport technique

- Bedoussac L, Albouy L, Deschamps E, Salembier C, Jeuffroy M;-H.. (2021). De la théorie à la mise en pratique des mélanges d'espèces: Re-concevoir les systèmes de culture européens avec des mélanges d'espèces, 108p., https://hal.inrae.fr/hal-04064291v1

Lecture complémentaire

- Viguier L (2018). Analyse de la performance agronomique et économique des associations de culture lentille-blé de printemps en agriculture biologique, https://theses.fr/2018INPT0070.

A propos de ce practice abstract

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PRACTICE ABSTRACT N°27

Reduce heat stress in cowpea through intercropping with millet

Problem

Cowpea is a short-cycle summer crop. The high summer temperatures in the Po Valley can cause floral abortion in cowpea plants, compromising the yield.

Solution

The intercropping of millet and cowpea results in the millet shading the cowpea, reducing heat stress. This technique was developed by a Lombardy farmer.

Benefits

Millet is taller than cowpea and creates a shading effect. Their growth cycle length is similar, so they can be harvested together and easily separated.

Applicability box

Theme

Cropping system, Arable Crop, Climate, Agroecology

Keywords

Intercropping, Legumes, Cereal crop, Diversification, Climate change adaptation, Heat tolerance

Context

Po Valley, Mediterranean Region

Application time

June-October

Required time

Crops need to be separated after harvest

Period of impact

From sowing to harvest

Equipment

Grain drill, Combine harvester, Rotary cleaner, Vibratory or gravity separator

Best in

Farms in dry and hot climate, with heavy/compacted soils

Practical recommendations

Crop variety used:

- Millet *Panicum miliaceum* var. VIR9181
- Cowpea *Vigna Unguiculata* var. Dolico Arcoiris

Sowing density:

- 30 kg/ha of millet (50%) with 80 kg/ha of cowpea (100%). Valid as legume in crop rotation plan.

Soil preparation:

- Two passes with a light disc harrow

Cultivation:

- Crops are sown in late June using a grain drill (12.5 cm row spacing). In two passes, millet is sown first, followed by cowpea at a slightly greater depth in alternate rows.
- The system involves no mechanical tillage, fertilisation, or phytosanitary treatments during the growing season.

Harvest:

- The crops are harvested together with a combine harvester.
- Millet and cowpea can easily be sorted using a seed cleaner (rotary cleaner, vibratory, or gravity separator) and sold for human consumption.

This intercropping also improves water management in heavy or compacted soils and allows for greater crop diversification at the farm level.

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PRACTICE ABSTRACT N°27



Figure 1: Floral abortion in cowpea plants under sole crop condition, 80% of production was lost. Photo: Ilena Maran, Cascina Bosco Fornasara.



Figure 2: Intercropping cowpea-millet. The millet's shade shielded the cowpea from the heat promoting pod set. Photo: Ilena Maran, Cascina Bosco Fornasara.

Further information

Video

- Heat stress: a comparison between sole Cowpea and intercropped Cowpea with Millet (Instagram)

Further readings

- OLIVEIRA, L. B. D. et Al. (2017). Cowpea growth and yield in sole crop and intercropped with millet. Revista Caatinga, 30, 53-58.

Weblinks

- https://www.remix-intercrops.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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PRACTICE ABSTRACT N°27

Ridurre lo stress da calore nel fagiolo dall'occhio tramite la consociazione con il miglio

Problema

Il fagiolo dall'occhio è una coltura estiva a ciclo breve. Le alte temperature della Pianura Padana possono causare aborto fiorale, compromettendo il raccolto.

Soluzione

La consociazione miglio/fagiolo dall'occhio, sviluppata da un agricoltore lombardo, fa sì che il miglio ombreggi il fagiolo, riducendo lo stress da calore.

Benefici

Il miglio è più alto del fagiolo dall'occhio e lo ombreggia. Il loro ciclo di crescita è simile. Possono essere raccolti insieme e separati facilmente.

Applicabilità

Tema

Sistemi Colturali, Seminativi, Clima, Agroecologia

Keywords

Consociazioni, Legumi, Cereali, Diversificazione, Adattamento ai cambiamenti climatici, Resistenza al calore

Contesto

Pianura Padana, Regione mediterranea

Tempo di applicazione

Giugno-Ottobre

Tempistiche aggiuntive

Le colture devono essere separate dopo la raccolta.

Periodo interessato

Dalla semina al raccolto

Attrezzatura

Seminatrice da frumento, Mietitrebbia, Pulitore rotante, Separatore vibrante o densimetrico

Condizioni ottimali di applicazione

Aziende agricole in aree con clima caldo e siccitoso, con terreno pesante/compatto.

Consigli pratici

Varietà utilizzate:

- Miglio *Panicum miliaceum* var.VIR9181
- Fagiolo dall'occhio *Vigna Unguiculata* var. Dolico Arcoiris

Densità di semina:

- 30 kg/ha di miglio (50%) con 80 kg/ha di fagiolo dall'occhio (100%). Valido come leguminosa nella rotazione.

Preparazione del terreno:

- Due passaggi superficiali con erpice a dischi.

Coltivazione:

- Le colture sono seminate a fine giugno con una seminatrice da frumento: prima il miglio, poi il fagiolo dall'occhio ad una profondità leggermente maggiore. Le file sono alternate (12,5 cm).
- Non vengono effettuate lavorazioni, concimazioni o trattamenti fitosanitari.

Raccolta:

- Le colture vengono raccolte insieme con una mietitrebbia.
- Il miglio e il fagiolo dall'occhio possono essere facilmente separati con un pulitore e venduti per alimentazione umana.

Questa consociazione migliora la gestione irrigua in terreni compatti e pesanti e permette di diversificare il sistema colturale.

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Figure 1: **Aborto fiorale nella coltivazione di fagiolo dall'occhio in purezza con perdita dell'80% del raccolto.** Foto: Ilena Maran, Cascina Bosco Fornasara.



Figure 2 **Consociazione miglio-fagiolo dall'occhio. L'ombra del miglio ha protetto il fagiolo dal caldo, favorendo la formazione dei baccelli. F**oto: Ilena Maran, Cascina Bosco Fornasara.

Further information

Video

- Danni da calore: un confronto fra coltivazione di fagiolo dall'occhio in purezza e in consociazione col miglio (Instagram)

Ulteriori approfondimenti

- OLIVEIRA, L. B. D. et Al. (2017). Cowpea growth and yield in sole crop and intercropped with millet. Revista Caatinga, 30, 53-58.

Collegamenti web

- https://www.remix-intercrops.eu/
- Visita Organic Farm Knowledge Platform per altri consigli pratici.

A proposito di questo practise abstract

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Revisione: Boglarka Bozsogi, IFOAM Organics Europe; Christine Watson, SRUC; Odette Weedon, University of Kassel

IntercropVALUES mira a sfruttare i vantaggi delle consociazioni per progettare e gestire sistemi di coltivazione produttivi, diversificati, resilienti, redditizi e rispettosi dell'ambiente, accettabili per gli agricoltori e gli attori della filiera agroalimentare. Come progetto multidisciplinare e multi attoriale, riunisce ricercatori e attori locali che rappresentano la filiera. Riunisce 27 partecipanti provenienti da 15 Paesi (3 continenti) provenienti da un'ampia varietà di organizzazioni e parti interessate. Il progetto è iniziato nel Novembre 2022.

Sito web del progetto: https://intercropvalues.eu/

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PRACTICE ABSTRACT N°28

Modernising intercropping systems

Problem

Growing demand for agricultural products in urban centres, together with market policies, are pushing cereal and legume producers from subsistence- to market-oriented enterprises.

Many farms in Mozambique are expected to abandon long-established practices of intercropping maize with legumes and cassava, preferring sole crops and more intensive maize production. This would come at the expense of valuable ecosystem services of traditional intercropping in exchange for higher economic returns on investing in cereal intensification compared to legume production.

Applicability box

Theme

Biodiversity and nature conservation, Agroecology, Sustainable Communities, Cropping systems, People and skills

Keywords

Ecosystem services, Intercropping, Socioeconomic development, Indigenous knowledge

Context

Coastal area of Maputo, Inhambane, and Gaza provinces in Mozambique, under subhumid tropical climate

Solution

Preserving intercropping requires compensation for farmers for the trade-off between the short-term benefits of intensifying cereal production and the long-term benefits of ecosystem service delivery. Both technical and policy adjustments are required to handle this trade-off.

Modern intercropping solutions, designed using participatory design methods, should increase the economic return of intensified intercropped systems compared to intensified sole cropping in rotation or maize monocropping. Cereal-legume combinations appropriate for the more intensive agriculture that would emerge in this transition need to be identified for Sub-Saharan Africa, including spatial arrangement of species, sowing dates, and cultivars.

Policy must develop markets for agricultural products and inputs to ensure access for farmers to adapted seeds, especially legumes. The relative price of maize and legume products paid to farmers must support the maintenance of legume production to the economic advantage at farm level of intercropping over sole cropping.

Benefits

- Increased food diversity and security.
- Enhanced biodiversity, nutrient cycling, soil protection against erosion, and atmospheric nitrogen capture by legume compared with sole crops of cereals and cassava.
- Reduced weeds pressure, integrated diseases and pest control maintained at high level when compared to sole crops.
- Reduced needs for (in)organic fertiliser inputs compared to sole crops.
- Reduced labour demand at farm scale.

Practical recommendations

It is helpful to develop a multi-local network of participatory design experiments to compare the agronomic performances of legume-cereal intercropping and sole cropping. The experiments should take place under current conditions on smallholder farms (low nutrient availability in soil) and conditions of reasonably in-

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tensified agriculture (involving N fertilisation of 50-80kg/ha), and a variety of spatial arrangements of legume and cereal species with key candidate cultivars. Methods for this type of participatory design are available (e.g., mother-baby trials).

Organise an advisory panel of agricultural science institutions, experts of extension services, farmer representatives, and legume, cereal, and cassava value chain actors. They can assess the economic feasibility of reconciling intensification with intercropping systems at farm level, under the observable price at the farm gate, and given potential technical options resulting from the experiments above. The panel will identify and advise the Ministry of Agriculture on market correcting measures to favour intercropping over sole cropping for market-oriented farms.

Identify and convince sponsors to contribute to the operational expenses of the network of experiments to develop a price monitoring system and support meetings with the advisory panel. Additionally, sponsors should help to increase the limited public funding available in Mozambique.



Figure 1: Typical traditional, low input and low yielding intercropping system with cassava, maize and groundnut. Photo: F. Affholder, CIRAD, UEM.



Figure 2: prototype of intensified intercroping system with maize and cowpea. Photo: F. Affholder, CIRAD, UEM.

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Figure 3: Different patterns of intercropping maize with cowpea, in a CICS trial to identify the most appropriate pattern for intensified, modern intercropping. Photo: Joao Nuvunga.



100 Maize + 50%cowpea



50 % maize +50 % cowpea



100% cowpea



75 % maize +25% cowpea



75% maize +25% cowpea

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Further information

Further readings

- Nuvunga, J., Couedel, A., Famba, S., Hauggaard-Nielsen, H., Falconnier, G., Giva, N., Affholder, F., Submitted. “Is cereal-legume intercropping a relevant option for ecological intensification in sub-Saharan Africa? A review.” *European Journal of Agronomy*. Forthcoming.

Weblinks

- https://www.remix-intercrops.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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PRACTICE ABSTRACT N° 29

Cereal-legume intercropping: how cultivar, environment, and management shape performance

Problem

Intercropping systems rely on interactions between component species; however, the performance of intercrops is governed by complex genotype × genotype × environment × management (G*G*E*M) interactions, which remain insufficiently understood and rarely integrated into species and genotype selection.

Solution

Understanding how G*G*E*M interactions affect intercrop performance can help inform crop cultivar choice, growing environments, and management practices to optimise intercropping productivity.

Applicability box

Theme
Cropping systems, Arable crops
Keywords
Cereal crops, Legumes
Context
Temperate, subtropical and tropical areas
Application time
Autumn and summer crops
Equipment
Standard machinery used for cereal cultivation
Best in
Cereals and legumes under low input conditions

Benefits

G*G*E*M interactions indicate that genotype suitability is highly environment- and management-specific, demanding integrated breeding and agronomic approaches. Disentangling these interactions provides a framework for designing resilient and productive intercrops tailored to local agroecological conditions, contributing to more sustainable cropping systems.

Practical recommendations

Considerations for cultivar choice:

- Cereal and legume cultivars for intercropping systems should be carefully selected to maximise complementarity and cooperation, while reducing competition to optimise intercrop performance
- Cultivar selection criteria may include many traits, such as species growth synchronisation, especially at maturity, abiotic and biotic stress tolerance, growth habit, cultivar vigour, lodging resistance, and other morphological aspects such as leaf size and plant and root architecture
- Crop cultivars can be highly plastic in their response and can adapt to their growing environments
- Differential sowing densities of the two crop species will affect crop interactions and individual crop species performance

Recommendations:

- Farmers should test several cultivar mixtures and sowing densities under their own conditions, while considering experiences and recommendations from other farmers and external advisors
- Integrated breeding approaches for cultivars better suited for intercropping should be encouraged and supported through research and policy

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PRACTICE ABSTRACT N° 29



Figure 1: Different spacial arrangements in field trials of white lupin-cereal intercropping at a 50:50 sowing ratio (alternate rows). Photo: Luciano Pecetti, CREA, Lodi, Italy.



Figure 2: Cultivar testing within an intercropped system in an organic farmer's field. Photo: Christos Dordas, AUTH, Giannitsa, Greece.



Figure 3: Testing of different spring wheat and faba bean varieties as both sole and intercrops at 50:50 sowing ratio. Photo: Pascal Winten, UBonn, Klein-Altendorf, Germany.

Further information

Further readings

- Justes, E, Bedoussac, L, Dordas, C et al. (2021): The 4C approach as a way to understand species interactions determining intercropping productivity. Frontiers in Agricultural Science and Engineering, Vol. 8 (3). https://doi.org/10.15302/J-FASE-2021414.
- Kiær, L, Weedon, O, Bedoussac, L et al. (2022): Supply chain perspectives on breeding for legume-cereal intercrops. Frontiers in Plant Science 13:844635. https://doi.org/10.3389/fpls.2022.844635.

Weblinks

- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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PRACTICE ABSTRACT N°30

Intercropping impacts on microbial diversity and the risk of mycotoxin contamination

Problem

Mycotoxins are secondary fungal metabolites present in foods that cause adverse effects in humans and animals. They can be present in both cereals and grain legumes. It is important to ensure that intercropping does not increase mycotoxins in either crop type due to growing systems effects (e.g., microclimate).

Applicability box

Theme

Cropping systems, Arable crops, Food chain management, Seed quality and health

Keywords

Food quality; Product quality; Food hygiene

Context

Greece, France and Germany

Solution

Test whether mycotoxin infection and diversity differ in intercropped and monocropped wheat and peas, in organic and conventional agriculture, with or without fertilisation in 2024 and 2025, in 3 geographical areas: Greece, France, Germany.

Benefits

Information on mycotoxin contamination and associated fungal diversity will enable management decisions to limit the mycotoxin problem.

Practical recommendations

In two consecutive years, all wheat samples exhibited low levels of mycotoxins (*aflatoxins, DON, fumonisins, zearalenone, and ochratoxin A*) below the detection limit.

Cropping system (intercrop vs. monocrop) did not affect the fungal diversity of the wheat mycotoxins. However, wheat fungal diversity differed significantly between countries over the period monitored (Figure 1).

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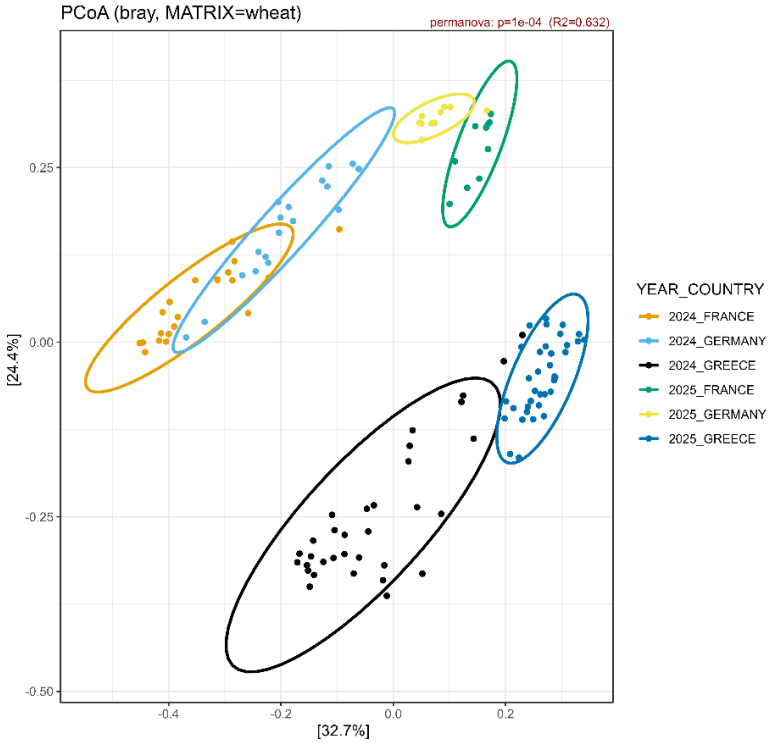


Figure 1: Comparison of fungal diversity of wheat as a function of countries and seasons monitored.

Regardless of season, crop types, or treatment type, no major contamination by mycotoxins was observed. Consequently, intercropping did not increase mycotoxin contamination for either crop type on all samples studied during the two seasons (2024 and 2025), indicating no negative effect of an intercropping system in terms of increased mycotoxin contamination and changes in fungal diversity.

Further information

Further readings

Drakopoulos D, Kägi A, Six J, Zorn A, Wettstein FE, Bucheli TD, Forrer HR, Vogelgsang S (2021). The agronomic and economic viability of innovative cropping systems to reduce Fusarium head blight and related mycotoxins in wheat. Agricultural Systems 192:103198. https://doi.org/10.1016/j.agsy.2021.103198.

Chabert A, Marchand D, Sarthou JP (2020). Data from extensive comparative measurements of conventional, conservation and organic agricultures in southwestern France. Data in Brief 31:105827. https://doi.org/10.1016/j.dib.2020.105827.

About this practice abstract

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Lock-in system maps for discussing barriers and levers

Problem

A lock-in—emerging from the interactions between barriers—hampers the use of intercropping (IC) in Europe. Understanding lock-ins will help design solutions to foster IC.

Applicability box

Theme

Agroecology, Cropping systems, Food chain management, People and skills

Keywords

Diversification, Farm management, Sustainability

Context

Europe

Solution

Identify constituent barriers of the lock-in and the interactions between these barriers through interviews and workshops with system actors. Visualise them as cognitive maps (Figure 1), with barriers as nodes and interactions as arrows linking nodes.

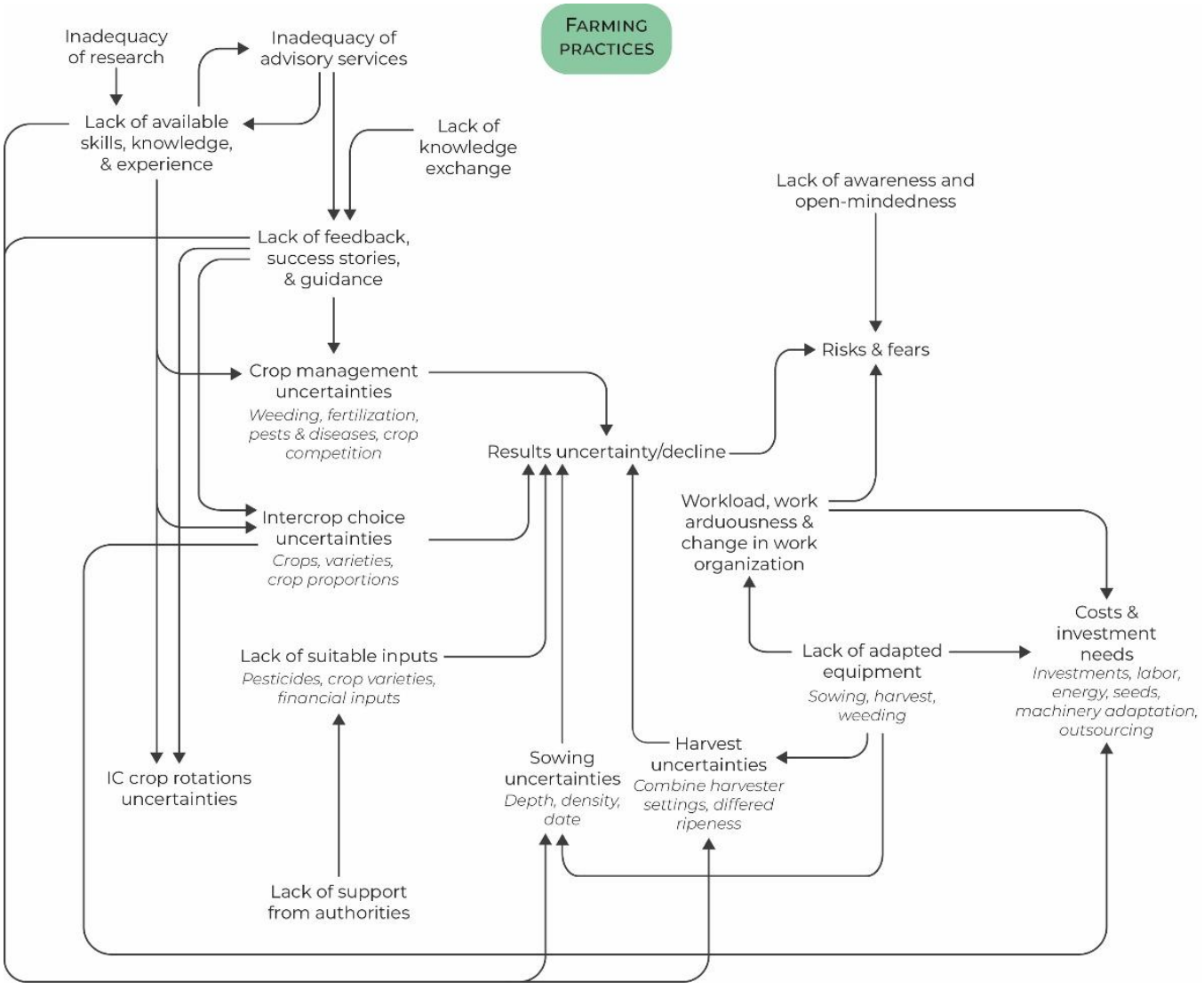


Figure 1 – Lock-in system map focused on barriers to farming practices in intercropping.

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PRACTICE ABSTRACT N°31

Benefits

Highlighting interactions between barriers helps understanding how targeted interventions on specific barriers may affect others.

Practical recommendations

For barrier and barrier interaction identification:

- Rely on interactions with a diversity of system actors to identify barriers comprehensively
- Unravel the causal roots of barriers, e.g., through iterative questioning such as “Why?”

For barrier and barrier interaction analysis:

- Ensure the readability of lock-in system map by:
  - Grouping barriers to decrease the number of nodes
  - Dividing the lock-in system map into thematic, sub-lock-in system maps
  - Avoiding arrows overlapping
  - Using short, explicit terms for nodes
- Once barrier analysis is complete, validate the identification of barriers and their interactions with actors.

Further information

Further readings

- Chevalier, C., Justes, E., Morelle, C., & Baret, P. (2023). Compilation of lock-ins, encompassing the whole value-chain and its actors [IntercropVALUES Horizon Project Deliverable].
- Simoens, M. C., Leipold, S., & Fuenfschilling, L. (2022). Locked in unsustainability: Understanding lock-ins and their interactions using the case of food packaging. Environmental Innovation and Societal Transitions, 45, 14-29.

Weblinks

- https://intercropvalues.eu/
- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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PRACTICE ABSTRACT N°32

Four strategies to deal with impurities in intercropping

Problem

Harvested crops grown in intercropping contain impurities from the crop(s) they were grown with, rendering them incompatible with food processors' quality standards.

Solution

Design a cognitive map depicting impurity-related barriers and their interrelations.

Applicability box

Theme

Post-harvest management, Cropping systems, Processing.

Keywords

Postharvest equipment, Intercropping, Food processing

Context

Europe

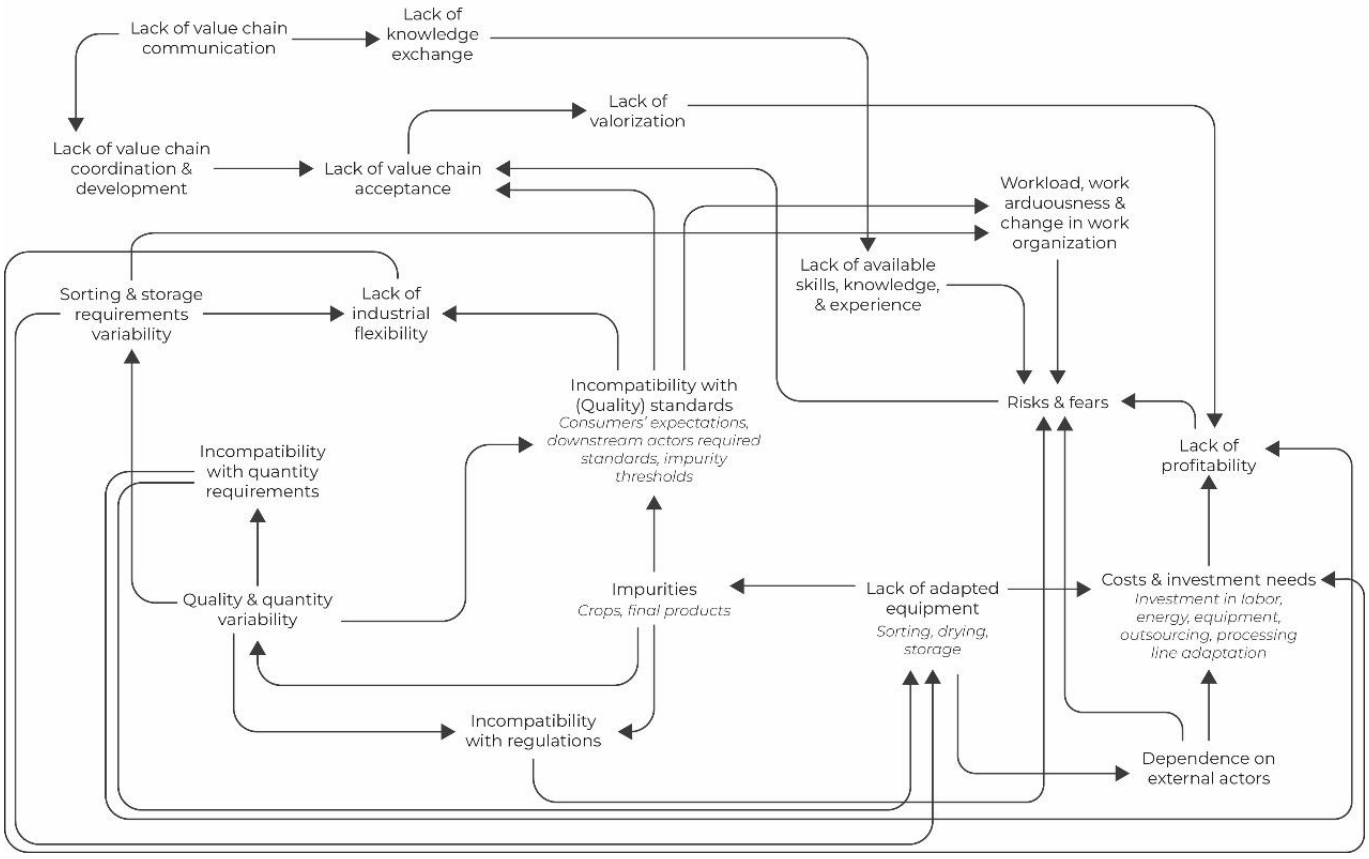


Figure 1 – System map of impurity-related barriers.

Benefits

Simultaneously viewing the multiple dimensions of the impurity issue facilitates the identification of possible leverage points for effective interventions.

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PRACTICE ABSTRACT N°32

Practical recommendations

Strategies to deal with impurities:

- **Minimisation**: improve sorting equipment efficiency to reach maximum impurity threshold accepted by processors,
- **Acceptance**: increase the maximum impurity threshold accepted by processors as long as impurities have no impact on processing processes and products' quality,
- **Adaptation**: adapt processing processes to impurity presence without changing the final product,
- **Valorisation**: develop new products based on the integration of impurities.

Each strategy targets different leverage points (e.g., sorting equipment, knowledge development) and rely on the involvement of specific actor types.

Strategies must be discussed with field actors for relevance and feasibility assessment and for translation into concrete interventions.

Maps of barriers can be designed for other intercropping-related issues and discussed with field actors to identify leverage points and related resolution strategies.

Further information

Further readings

- Stone, T. F., Alford, J., Bečvářová, P. H., Eisa, M. A. M., El-Naggar, A. H., Carpio Espinosa, M. J., Frąc, M., Álvaro-Fuentes, J., García-Gil, J. C., Krabbe, K., Martins, J. T., Pathan, S. I., Plaza, C., Rasmussen, J., Righini, C., & Thorsøe, M. H. (2025). Food system strategies to increase grain legume-cereal intercropping in Europe. Agroecology and Sustainable Food Systems, 49(4), 518-542.
- Bedoussac, L., Salembier, C., Jeuffroy, M.-H., albouy, lisa, & Elina, D. (2022). *FROM THEORY TO PRACTICE OF SPECIES MIXTURES : Redesigning European cropping systems based on species MIXtures*. https://doi.org/10.17180/B5F1-W556.

Weblinks

- Check the Organic Farm Knowledge Platform for more practical recommendations.

About this practice abstract

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IntercropVALUES aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. As a multi-disciplinary and multi-actor project, it brings together scientists and local actors representing the food value chain. It includes 27 participants from 15 countries (3 continents) from a wide diversity of organizations and stakeholders. The project will run for four years and started in November 2022.

Project website: https://intercropvalues.eu/

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INTERCROP VALUES

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