

# On-farm experiments: farmers and researchers go further together!

A synergy to learn about cultivation and postharvest handling of grain legumes in Sweden

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# Introduction

- Agronomic, environmental and nutritional benefits of **grain legumes for food** (*i.e.* pulses), but very low production and consumption in Sweden (2% of cropland, mostly fava beans and peas for feed)
- Historical factors (focus on cereals) and agronomic constraints  
→ **lack of experience, locally-adapted practical knowledge and support systems** (advice, supply chains)
- scenario analysis: potential for increase and associated benefits (Röös *et al.*, 2018)
- Interest in the society, among researchers and some farmers → project 'New Legume Foods'



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# Introduction

## Aim:

Generating experience and locally adapted knowledge in growing grain legumes in Sweden via on-farm experiments: hybridize the knowledge and ways of learning of scientists and farmers.

Presentation of an [article published in 2022](#):



VetAgro Sup


*Renewable Agriculture and  
Food Systems*

[cambridge.org/raf](https://cambridge.org/raf)

**Research Paper**

On-farm experiments on cultivation of  
grain legumes for food – outcomes from a  
farmer–researcher collaboration

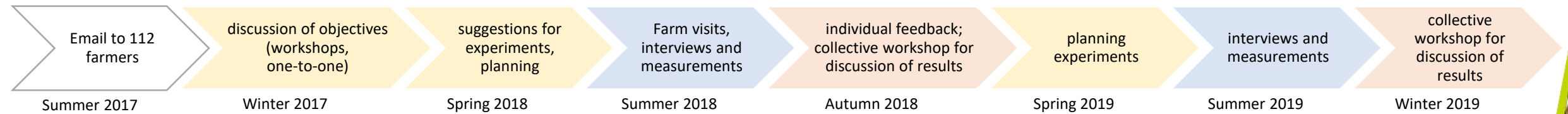
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Today, focus on **postharvest handling** and on the **synergy between researchers and farmers**

# Methods

- **11 farmers** in Southern Sweden and two researchers
- 19 on-farm experiments over 2018 and 2019
- Collective and individual planning and design
- Quantitative measurements (plant density, crop and weed biomass, height, etc.) carried out by the researchers
- Workshops where farmers and researchers jointly discussed and interpreted results and experiences



Data summarised under themes adapted from the framework by Catalogna et al (2018) to describe farmers' experiments:

## Design

- Objective
- Link to previous experimental situations
- Novelty
- Choice of location and size
- Number of treatments

## Management

- Progress, unexpected events
- Information collection
- Feasibility of post-harvest steps

## Evaluation

- Achievement of the goal
- Discussion of the results

# Results: overview of the experiments

Decision to perform **individual experiments** (as opposed to replicates of a common experimental design)  
→ increase the **relevance to specific needs and conditions**

Experiments addressed:

- within-field species diversity (intercropping, cover crops)
- comparative performance of varieties
- practical harvesting techniques
- sorting, cleaning and selling the harvested product (“post-harvest steps”)



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**Objectives:**

- relatively well-known crops like fava bean and yellow pea: establishment methods and weed control or establishing a relationship with a retailer for human consumption.
- new or relatively new crops like **lentil** and grey pea: learning about the crop’s growth cycle and potential difficulties, testing intercropping, comparing varieties, learning about the potential market



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# Example of experiments to try lentil on two contrasting farms

Objective: trying **lentil as a new crop**. Both farms are located in a peri-urban setting and focus on cereal production.

Farm A	Farm E
Organic, landrace cereals, direct sales	Conventional, conservation agriculture
30 ha arable land	250 ha arable land
Lentil intercropped with cereals in 2018 and 2019	Lentil intercropped with fava bean in 2019



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# Design

Example	Farm A		Farm E
Year	2018	2019	2019
Objective	Trying a relatively new crop		Trying a new crop
Link to previous experiments	Solve a technical or agronomic problem due to a previously experimented practice to improve its feasibility		No linkage with previous experimental situations
Novelty	Similar practice to what the farmer already applied		New logic and new practice
Choice of location and size	4 plots on 1 ha	7 plots on 3 fields of 1 ha each	3 plots on 1 ha, within a fava bean field
Treatments	<ul style="list-style-type: none"> <li>• lentil SC</li> <li>• spelt SC</li> <li>• lentil-spelt IC with 2 spelt densities</li> </ul>	Field 1: wheat SC, lentil-wheat IC with 2 wheat densities Field 2: lentil SC, lentil-emmer IC with 2 emmer densities Field 3: emmer SC	<ul style="list-style-type: none"> <li>• lentil SC (two varieties)</li> <li>• lentil-fava bean IC (one lentil variety)</li> </ul>

## General findings:

- More than one novel practice at a time, combination of factorial and systemic, no control of heterogeneity (considered not feasible in practice)
- Several multiannual experimental itineraries (Catalogna *et al.*, 2022).
- Some experiments suggested by the researchers were selected, but often modified to fit own interests and conditions  
→ Direct link between the farmer's questions and the design
- Collaboration with research: willingness to take more risks (reimbursement for part of the additional costs)

# Management

<u>Example</u>	Farm A		Farm E
Year	2018	2019	2019
Progress, unexpected events	Interruption due to weeds – small plot preserved!	No change	No change
Information collection	Information on the crops and agroecosystem		Information on the crops and agroecosystem
Feasibility of post-harvest steps	No harvest	All post-harvest steps considered an important part of the experiment	All post-harvest steps considered an important part of the experiment

## General findings:

- Initially, farmers' negative opinion on observations and measurements in situations without in-field comparisons
- Farmers' perception of the suitability of the chosen field for the experiment sometimes changed during the management stage.
- Time constraint: *"I don't have the time to do a perfect experiment."*
- Collaboration with research and group setting: motivation for the farmers to devote extra effort, confirmation that they are "on the right track".





# Evaluation

Example	Farm A		Farm E
Year	2018	2019	2019
[Main conclusions]	Bird damage on spelt. Very high weed pressure. Need to establish lentil in better conditions.	Increasing cereal density led to a reduction in weed biomass. Successful crop; Emmer can be separated from lentils but not wheat. Direct sales of lentils is a success.	Successful lentil crop (both varieties). Harvest losses because of fava bean harvesting time and lodging. Progress in finding a market. Test IC with a cereal.
Achievement of the goal	Results do not achieve the farmer's goals.	Results do not achieve all farmer's goals.	Results do not achieve all farmer's goals.
Discussion of the results	Unexpected technical difficulties and possible alternatives are discussed, Cropping conditions responsible for the results are discussed.		

## General findings:

- Importance of the consistent measurements made by researchers: *"Sometimes you have almost already decided what you want to see. [...] if you assess it yourself you can influence the results"; "If someone else assesses it, there's a greater chance of changing your mind."* Differing perceptions (ex: level of lentil lodging).
- Great value of the collective evaluation workshops allowing in-depth reasoning, combining farmers' know-how and researchers' know-why (Ingram *et al.*, 2010). Explicit comparisons of experiences, sharing hypotheses. Some generalisation possible, but confirmed the value of gaining site-specific knowledge.
- Improvement of the researchers' ability to understand the site-specific conditions

# Focus on post-harvest steps

Design

Management

Evaluation

- Farm scale: systemic approach of the feasibility of all steps (from accessing seeds to selling products).  
*“The experiment is made in the same scale as production, now I know what I can do with my machinery.”*
- group setting to “spare” experiments: unsuitability of certain intercrop mixtures due to difficulty to sort the harvested products. e.g. lentil–emmer intercrop
- farmer E (conventional): harvesting is the main issue in lentil production: sole-cropping or intercropping with fava bean are not satisfactory.  
*“If we had evaluated fava bean+lentil intercropping in small-plot researchers’ experiments, we would not have discovered the unexpected difficulties to sort lentils from broken fava bean seeds.”*  
→ tested successfully with oats in the following year
- Packaging and direct sales vs. finding a buyer for a larger quantity of lentils: both proved possible. A large national corporation started buying and selling national conventional lentils, then stopped the collaboration after two of three years due to high stocks.
- Post-harvest steps and finding a market (price) are a crucial concern for the farmers, underestimated by researchers initially  
→ new focus for ongoing research: low-tech tools and collective organisation for emerging crops



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# Concluding remarks

## On-farm experiments in a collaboration between farmers and researchers

- bring practical knowledge on crop management, strategic for improved profitability and knowledge about collective learning. Focus shifting from “how to produce more” to “how to learn more”.
  - combine advantages of farmers’ and researchers’ experiments:
    - results directly transformed into knowledge for action, motivation and faster learning
    - demonstrate from a more trusted source the efficiency of practices,  
→ increased adoption of agronomic innovations and minor crops seen as risky
    - orientations for new trials  
*”This has increased my interest to try new crops”*
- (see also Hansson, 2019; Toffolini and Jeuffroy, 2022, Leoni *et al.*, 2023)
- question the position of researchers in agronomy: initiators of the collaboration, providers of an analytical view on the biological processes, facilitators in workshops, ... and humble learners when facing practical constraints on the farms.



Thank you!



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