FORK-TO-FARM AGENT-BASED SIMULATION TOOL AUGMENTING BIODIVERSITY IN THE AGRI-FOOD VALUE CHAIN



NEWSLETTER

Magazine

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1. Our Farmer Recommendations



At BioValue, we've gathered insights from across our partner regions to bring you key recommendations for sustainable and efficient farming. Here's what we suggest:

LENTIL CULTIVATION

Soil Preparation

Go for minimum or no tillage, ideally combined with mulching and cover crops to improve soil health and suppress weeds. The false seedbed technique can also be an effective way to reduce weed pressure before planting.

Sowing

Aim for 300-400 live seeds/m², sown at a depth of 40-60 mm, depending on seed size. Rows should be spaced 15-25 cm apart.

Seed treatments with fungicides can help protect against seedling rot. Seeding rates vary:

- ·60-80 kg/ha for small-seeded varieties
- ·120-160 kg/ha for large-seeded ones
- ·Mixed cropping is also advised to reduce lodging and improve crop resilience.

Fertilization

Lentils are nitrogen-fixing crops, meaning they generally don't need added fertilizer. They work especially well in crop rotations to naturally enrich the soil—an excellent strategy for organic systems.

Disease & Pest Management

Prevention is key:

- ·Use certified seed and rotate crops widely
- ·Watch out for diseases like Fusarium, Botrytis, and viruses (e.g., bean yellow mosaic virus)
- ·Pests such as wireworms, aphids, and nematodes can also reduce yields.



1. Our Farmer Recommendations



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LENTIL CULTIVATION

Weed Control

Lentils grow slowly at first and don't compete well with weeds. Consider:

- ·Wider row spacing (45-50 cm) for mechanical weeding
- Integrated non-chemical strategies like false seeding, cover crops, higher sowing densities, and timely hoeing/weeding.

<u>Harvesting</u>

Harvesting is usually mechanized using tall, upright varieties. Depending on the method, it can be done in one pass (with a combine harvester) or in two steps (mowing and threshing).

Bonus: leftover residues are valuable forage!

Crop Rotations

In semi-arid areas (250-350 mm rainfall/year), rotating lentils with other crops plays a vital role in maintaining soil fertility and breaking disease cycles.







1. Our Farmer Recommendations



At BioValue, we've gathered insights from across our partner regions to bring you key recommendations for sustainable and efficient farming. Here's what we suggest:

LATHYRUS CULTIVATION

Soil Preparation

In regions like Spain, minimum tillage is commonly practiced:

- Shallow seedbed prep using surface tools (e.g., cultivator or vibrocultivator)
- Avoid tilling deeper than 20 cm, and aim to retain 30% of previous crop residues

In Andalusia, do not bury dry stems of Orobanche crenata (broomrape), a problematic parasitic plant, as this can spread its seeds.

Tip: Level your field before sowing and roll it after sowing to ease harvesting and reduce losses. As a legume, Lathyrus supports soil fertility and is well-suited for organic rotations.

Weed & Disease Management

Lathyrus is highly susceptible to broomrape (Orobanche crenata). Farmers can manage it by:

- Delaying sowing until spring
- Choosing early-maturing varieties to avoid broomrape development

Effective mechanical weed control includes:

- Blind harrowing and row hoeing, especially in dry conditions
- Performing these before emergence (consider seed depth)
- Using precision hoeing tools with optical or digital guidance for increased efficiency Other helpful weed control strategies:
- Higher sowing density
- Rotating with crops that suppress weeds or green manure crops
- Using polycultures (e.g., cereals with legumes) or mixed cropping systems

Crop Rotation

As a nitrogen-fixing legume, Lathyrus is a valuable rotational crop, improving soil health for future plantings.

Recommendation: Avoid planting Lathyrus on the same field more than once every 3-4 years.



1. Our Farmer Recommendations



At BioValue, we've gathered insights from across our partner regions to bring you key recommendations for sustainable and efficient farming. Here's what we suggest:

BUCKWHEAT CULTIVATION

Buckwheat is a fast-growing, resilient crop with multiple benefits for agroecological systems. Here's how farmers across our regions are successfully cultivating it:

Soil Preparation

Buckwheat thrives under reduced or minimum tillage combined with mulching—a method that improves soil fertility and controls weeds while supporting conservation agriculture.

<u>Sowing</u>

Timing depends on soil temperature and moisture. While optimal germination occurs at 27°C, buckwheat can germinate in a wide range (8°C to 40°C).

-Seeding rate: 35-80 kg/ha / Row spacing: 15-20 cm / Planting depth: 2-3 cm

Fertilisation & Irrigation

Avoid excessive nitrogen, especially when combined with heavy rain or wind, as this increases the risk of lodging and delays ripening.

 ${\bf Buckwheat\ typically\ doesn't\ require\ irrigation-excess\ water\ can\ reduce\ yields.}$

Weed Control

Buckwheat's short growth cycle limits weed problems.

Mechanical weeding can be done post-germination. Chemical herbicides are not registered in most countries studied

Pro tip: Use false sowing 2-4 weeks before planting. Let weeds germinate and then uproot them (to 3-5 cm depth) to reduce early competition.

Pollination

Pollination is key to yield. Encourage insect activity by:

Placing bee colonies near the fields / Planting flower strips to attract pollinators

Harvesting

Buckwheat doesn't mature uniformly—it flowers continuously until harvest. Begin harvesting when at least 75% of grains are brown. Harvest timing is crucial to avoid grain loss.

Crop Rotation

Best preceding crops include winter wheat, rye, peas, and clover.

Avoid planting buckwheat after canola, sunflower, or mustard, which may lead to volunteer plants.

Note: Buckwheat is a heavy feeder, especially of phosphates, so plan fertilizer use accordingly for the next crop.



2. Interview with JLU

·What is JLU's role in the BioValue project?



Justus Liebig University Giessen (JLU) plays a central and multifaceted role in the BioValue project, contributing its interdisciplinary expertise in climate science, organic farming, and agri-food systems. JLU leads Work Package 8, titled "Enhancing the agri-food value chain biodiversity links via the BIOVALUE tool," which focuses on developing and testing strategies to increase plant diversity along the agri-food value chain. JLU's team, particularly from the climatology and agricultural sectors, analysed diversification strategies tailored to each actor, producers, processors, retailers, and the full value chain. Emphasis was placed on the role of agricultural producers, identifying practices and cooperation models that foster high crop diversity. Together with other partners, JLU tests and interprets the BIOVALUE tool and develops actionable recommendations, ensuring they are co-designed with stakeholders to enhance real-world uptake.

Beyond value chain strategies, JLU also led the climate change and biodiversity impact tasks in WP6. The team developed high-resolution, bias-corrected climate projections on daily, monthly, and seasonal timescales for the project's pilot countries, assessing the impacts of climate change on biodiversity, soil, and water conditions. Special attention was given to the spatial and temporal evolution of extreme weather and compound events, given their critical influence on farming practices and agricultural production and thereof the whole agri-food value chain. These datasets were not only shared with project partners but also served as key inputs for the BioValue modelling framework.

Furthermore, JLU contributed to the plant breeding program in WP7, promoting the use of underutilised species to strengthen genetic diversity. In Germany, the team led pilot studies on Lathyrus species (e.g., Lathyrus sativus or grass pea), coordinated with parallel/paired experiments in Spain, and supported trials on eggplant landraces alongside pilot plots in Cyprus. This work reinforces JLU's commitment to biodiversity-driven, climate-resilient agri-food systems.





·What unique expertise does JLU bring to the project?

JLU provides a distinctive interdisciplinary skill set crucial for tackling biodiversity challenges in agri-food value chains under climate change. Its expertise spans climate variability and extreme events and their impacts on biodiversity and food systems, ensuring long-term risks are effectively integrated into resilience planning. It also contributes deep knowledge of crop diversification strategies, and the economic and systemic levers needed to integrate underutilised species into value chains. JLU adds value through its capabilities in policy analysis and governance frameworks, supporting the development of practical and context-sensitive policy recommendations. Its experience in sustainability metrics and the management of field-level pilot studies strengthens the project's grounding in real-world agricultural systems. By combining natural and social sciences, JLU enables a holistic and applied approach to advancing climate-resilient, biodiversity-rich agri-food value chains in BioValue.

·How has JLU contributed to enhancing biodiversity in the whole agri-food value chain?

All of JLU's tasks in the BioValue project supported the enhancement of biodiversity and particularly crop diversity, at multiple interconnected levels of the agri-food value chain. Its interdisciplinary contributions were embedded in both empirical research and strategic systems analysis.

Field level: JLU led pilot studies in Germany within WP7, generating practical evidence on the viability of underutilised crops and varieties such as Lathyrus sativus and traditional eggplants. These trials assessed parameters such as productivity, sustainability, and nutritional quality, which are key for informing decisions about crop diversification under diverse environmental conditions. Farmer level: Through close engagement with producers, JLU identified the key challenges farmers face when introducing underutilised species. It also examined coping strategies and developed targeted recommendations to support farmer-driven biodiversity enhancement within agricultural production systems.

Value chain level: In collaboration with CAPNUTRA and UNIBO under WP8, JLU explored biodiversity-related challenges and solutions across the entire value chain, including processors and retailers. Recommendations were iteratively refined through engagement with stakeholders to ensure their practical relevance and acceptance.

In addition, JLU contributed to the co-development and tested the BIOVALUE tool. JLU also contributed bias-corrected climate projections and analysis of extreme weather events to ensure that biodiversity planning is climate-resilient.

By addressing crop diversity at multiple levels and integrating empirical, social, and climate-informed perspectives, JLU played a key role in enabling actionable strategies for more diverse, sustainable, and climate-resilient agri-food systems.



2. Interview with JLU



·What future developments or outcomes does JLU anticipate from the BioValue project

JLU anticipates several key outcomes from its involvement in the BioValue project, particularly in promoting crop diversity and biodiversity across agri-food value chains.

A notable development already visible is the growing interest in underutilised crops. As evidence on their viability, sustainability, and nutritional value increases, stakeholders, that is from farmers to policymakers, are becoming more open to integrating such species into production and processing systems. BioValue's case studies revealed that awareness-raising and practical, fundable research were among the most critical strategies identified by value chain actors to support this transition.

JLU expects the BIOVALUE agent-based modelling tool to continue evolving as a practical resource for simulating decision-making processes and assessing biodiversity outcomes across different value chain contexts. This tool holds potential for future application in both research and policy development. Further, the high-resolution climate projections developed by JLU will support long-term climate-resilient biodiversity planning, particularly in identifying areas and actors vulnerable to extreme events. Taken together, JLU sees BioValue as a catalyst for expanding interdisciplinary collaborations, informing biodiversity-friendly policy, and fostering more resilient and diversified agri-food systems across Europe.





3. Our Pilot Cases - Eggplants

What is cultivated within BioValue?

Several pilot cases have been designed to spread the underutilized and genetically diverse crops from small regions or islands all over Europe, enhancing the cultivations' biodiversity.

These seven pilot cases are water-energy efficient, environmentally resilient, highly nutritious, antioxidant-rich, protein-rich, and gluten-free. They have a high potential to enter the food value chain and be incorporated into the consumer's shopping list.



Let's get to know better the pilot case of Eggplants:

- ▶ Naturally Sweet: Unlike many other eggplants, this variety has a mild, sweet flavor—no de-bittering needed.
- ► Low Oil Absorption: Thanks to its firm texture, it absorbs significantly less oil during cooking, making it ideal for frying or roasting
- ► Few Seeds: The "White Eggplant of Santorini" has very few seeds, resulting in a smoother, more enjoyable texture.
- ► Genotype Matters: Nutrient levels vary slightly based on growing conditions and genotype, though only manganese reaches moderate daily value levels

[Pilot Case] #6 Two eggplant genotypes

Description: Eggplant, a member of the nightshade family (Solanaceae), is packed with nutrients—but it doesn't always win over everyone's taste buds. Its sometimes bitter flavor can make it less popular among children and even some adults. But not all eggplants are created equal!



"Tsakoniki" Eggplant - A Sweet Greek Classic

Hailing from the town of Leonidio in Greece, the Tsakoniki eggplant is celebrated for its sweet, delicate flavor and tender, easy-to-cook skin. This local variety is ideal for traditional Mediterranean dishes and perfect for those who typically shy away from eggplant's bitterness.

"White Eggplant of Santorini" - A Rare Culinary Gem

This rare variety from Santorini stands out not just for its unique white color, but also for its mild taste, low seed content, and firm texture. Its comparative advantages make it a prized ingredient in both home kitchens and gourmet cuisine.

3. Our Pilot Cases - Eggplants

EAT GOOD TO FEEL GOOD



Main properties: It contains water (92%), carbohydrates (6%), minimal protein, and has negligible fat.

Nutrition/health: While eggplant isn't a major source of essential nutrients—only manganese reaches a moderate level of the daily value—it still plays a role in a balanced diet. Its nutrient content can vary slightly depending on the season, growing environment (open field vs. greenhouse), and variety.

The "White Eggplant" of Santorini is not just beautiful—it's practical, too:

- ·Very few seeds, making it smoother in texture
- ·Absorbs less oil when fried—great for lighter cooking
- •Naturally sweet taste means there's no need to de-bitter it before use Whether roasted, grilled, or sautéed, this variety brings a unique, flavorful touch to your plate—no extra prep required!.

4. Our Recipes-Baked eggplant & Potato a la papa Alexie

Follow our novel recipe for preparing this delicious salad! *designed by our partner CAPNUTRA*



- 1.5 kg of potatoes
- 7 medium size eggplants
- 9 medium size onions
- 2kg tomatoes
- 3cloves of garlic
- 300 gr breadrumbs
- 300ml of olive oil
- cinnamon powder
- cumin powder
- pepper and himalayan salt





- 2. Sauté the eggplant slices in oil for about 15 minutes; sauté the potato slices for 5 minutes.
- 3. Spread the potatoes in a baking dish, with half of the sautéed eggplants layered on top.
- 4. Sauté onion and tomatoes in olive oil, season with salt and pepper, stew for 10 minutes, then add garlic and stew for another 10 minutes.
- 5. Arrange the remaining potato and eggplant slices in the baking dish, then pour the onion-tomato-garlic mixture over the layers.
- 6. Sprinkle breadcrumbs, salt, and pepper on top.
- 7. Bake in a preheated oven at 180°C for 1 hour.



5. News



BIODIVERSE AGROFOOD SYSTEMS

As part of the event "BioDiverse AgroFood Systems for a New Environmental Policy Era," the BioValue Workshop at CIHEAM MAICh brought together experts, researchers, and policymakers to explore how agrobiodiversity and underutilized crops can drive sustainable systems. Prof. K. Mattas, Coordinator, introduced Fork-to-Farm the approach, emphasizing the potential underutilized crops in creating biodiversity-friendly dishes. Dr. K. Baginetas from the Greek Ministry of Rural Development & Food highlighted the crucial role of farmers in the sustainable transformation envisioned in CAP 2028.



THE BEANS META NETWORK



Giorgos Prekatsakis from CIHEAM MAICh shared BioValue project insights on a panel about legumes at the BEANS Meta Network launch. Coordinated by CIHEAM Bari with partners like FAO, the network promotes legumes for agriculture, nutrition, and society. BioValue supports BEANS' goal to revalue legumes as a vital resource.

5. News



GENERAL ASSEMBLY IZMIR, TURKEY

The BioValue consortium held its 42-month General Assembly in Izmir, with partners attending in person and online to review progress and plan the final project phase. Highlights included updates on biodiversity exploitation, value chain innovation, product certification, and communication.





Partners demonstrated the BioValue Tool and shared insights on farming, food systems, and policy. Final decisions aligned work packages for impactful outcomes. Thanks to Ege University for their hospitality and coordination. This meeting was crucial for consolidating knowledge and ensuring a strong finish in promoting biodiversity and sustainable agri-food innovation.

5. News



We are proud to share that Prof. Mattas, our project coordinator, was a keynote speaker at the IX International Horticulture Symposium. His talk, "Unveiling the Power of Vegetables in Biodiversity and Healthy Diet," showcased BioValue's findings on the role of vegetables in biodiversity, sustainable food systems, and health. The event brought together over 100 global scientists, sparking lively discussion and highlighting BioValue's growing impact in promoting sustainable, healthy diets.

XVIII EAAE CONGRESS 2025

BioValue, alongside the Horizon 2020 project RADIANT and led by JLU Giessen, will co-host a workshop at the XVIII EAAE Congress in Bonn on August 26, 2025, focusing on diversifying agri-food chains through underutilized crops. The event will feature case studies, interactive tools, and insights from top European research institutions to address socio-economic challenges and policy solutions. Open to all congress attendees, the workshop aims to promote sustainable food systems and innovative agricultural policies.





6. Must reads- Our Latest Publications

Underutilized crops for diversified agri-food systems: spatial modeling and farmer adoption of buckwheat in Italy

Marta Verza1*, Luca Camanzi1, Luca Mulazzani1, Antonio Giampaolo2, Santiago Rodriguez3, Giulio Malorgio1 and Konstadinos Mattas4

Check it HERE.

Monoculture farming has led to biodiversity loss and fragile ecosystems. Introducing underutilized crops like buckwheat into crop rotations can help restore soil health and build more resilient agricultural systems.

A recent study led by Marta
Verza and collaborators from
Italy, Spain, and Greece
explored the potential for Italian
farmers to adopt buckwheat.
Using a spatial agent-based
model, the research examined
how financial incentives, peer
influence, and farmers'
motivation impact buckwheat
adoption across nine regions.





6. Must reads- Our Latest **Publications**

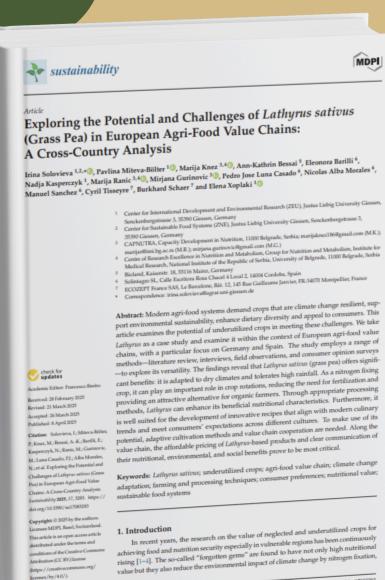
Exploring the Potential and Challenges Lathyrus sativus (Grass Pea) in European Agri-Food Value Chains: ACross-Country Analysis

Irina Solovieva 1,2,*, Pavlina Miteva-Bölter 1, Marija Knez 3,4, Ann-Kathrin Bessai 5, Eleonora Barilli 6 , Nadja Kasperczyk 1 , Marija Ranic 3,4 , Mirjana Gurinovic 3 , Pedro Jose Luna Casado 6, Nicolas Alba Morales 6, Manuel Sanchez 6, Cyril Tisseyre 7, Burkhard Schaer 7 and Elena Xoplaki

nability 2025, 17, 3283

Check it HERE.

This article examines Lathyrus sativus (grass pea) in European agri-food chains, focusing on Germany and Spain. Grass pea thrives in dry and wet climates, improves soil fertility through nitrogen fixation, and appeals to organic farmers. When properly processed, it offers nutritional benefits and suits current culinary trends. To maximize its potential, adaptive farming, value chain collaboration, affordable pricing, and clear communication are key. The study highlights grass pe promising crop for susta climate-resilient food sv Europe.



https://doi.org/10.3390/su17083283

MDPI

FORK-TO-FARM AGENT-BASED SIMULATION TOOL AUGMENTING BIODIVERSITY IN THE AGRI-FOOD VALUE CHAIN



The Consortium



































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- General Assembly: All Partner Leaders form the project's General Assembly
- Executive Management Board:
 All Work package Leaders form
 the Executive Management
 Board (EMB)
- Exploitation and Dissemination Team (EDT): AXIA [Leader], AUTH, CIHEAM/MAICH form the EDT
- Scientific Internal Committee (SIC):
 AUTH [Leader], MAICH, JLU, CAPNUTRA form the SIC
- Data protection officer: Project's Data protection officer is IDENER



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