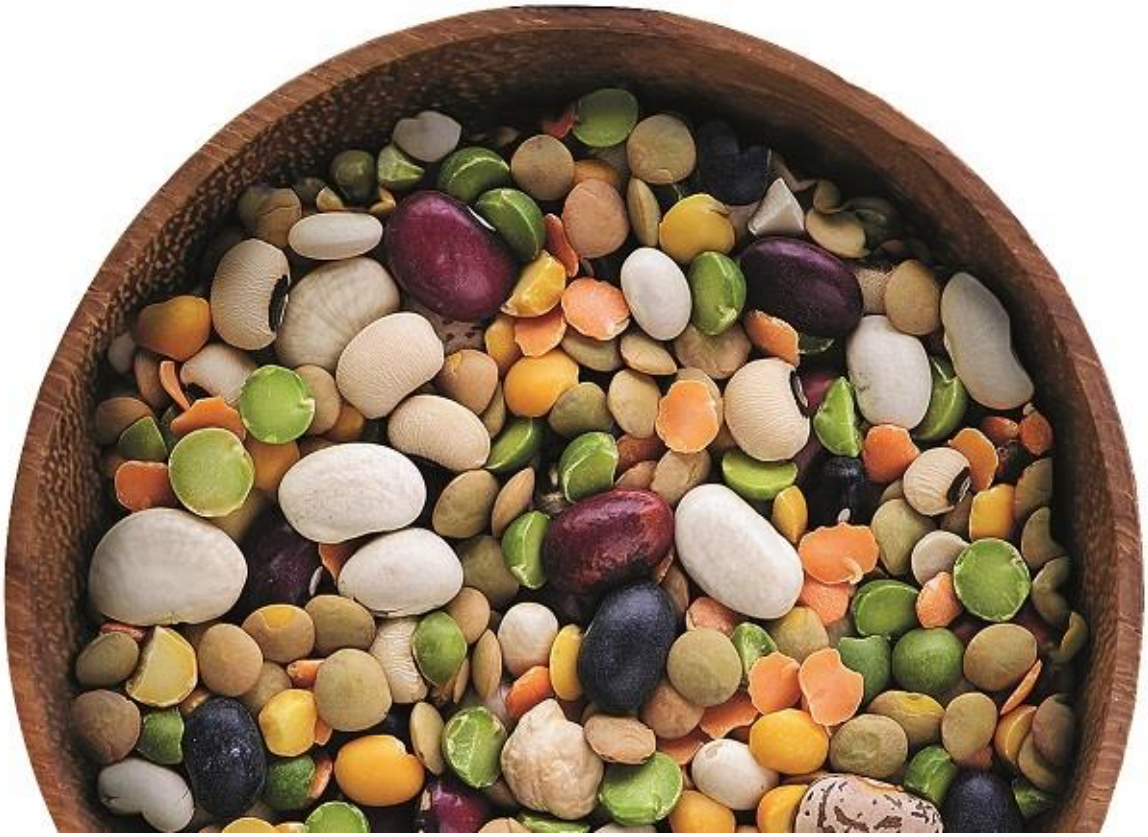
TRansition paths to sUstainable
legume-based systems in Europe

Report of the Continental Legume Innovation and Networking (LIN) Workshop

21 - 22 November, 2017
University of Hohenheim, Stuttgart



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1. Executive Summary

The first Legume Innovation and Networking (LIN) Workshop of the Continental region took place on November 21 and 22 2017 at the University of Hohenheim. It was co-hosted by national legume networks, which are part of the German protein plant strategy and the regional agricultural authority, which is responsible for the protein initiative of Baden Württemberg.
The main objectives of the participatory workshop were to exchange knowledge about innovations around legumes and on the changes needed to increase legume production and consumption in Europe. The workshop convened 70 participants which included TRUE members and stakeholders across the whole legume-based value chain. In addition to 8 oral presentations, 22 poster presentations and a field trip to a local lentil farmers' cooperative, dialogue among stakeholders was facilitated through three "World Café" rounds divided in three parallel groups with different perspectives (production, markets and policies).

The main **challenges** raised by the **presenters** included yield uncertainties and unfavourable climatic growing conditions, lack of knowledge about cultivation, lack of qualification of consultancy services, low level of cooperation along the supply chain due to different interests, low economic competitiveness of pulses compared to high input crops and the pesticide ban on ecological focus areas of the CAP Greening. Proposed **solutions** were the adaption of production standards; to spur innovations and investment in breeding, technology and product development; the improvement of promotion, marketing and trade structures; the inclusion of ecosystem functions of the whole rotation in economical and sustainability assessments; fair payment for quality parameters; and incentives for increased legume processing and human consumption.

The contributions from the **discussions** can be clustered into 4 topics. The main **suggestions** regarding **supply/production** were to increase the training of future farmers, scientists and farming advisors regarding legume cultivation; cover the costs of extension services for legumes; establish research programs on breeding new legume varieties to overcome instability of yield and disease pressure; create better links between the actors in the supply chain and build producer groups; establish a reliable and consistent supply; and increase the quality of production. In terms of **demand/products** the stakeholders' ideas were to increase consumer awareness about legumes and provide more appealing products with improved taste and texture; to change people's diets through governmental quotas on legumes in public procurement; to improve processing technologies to provide better food products; and to look for big volumes in food and feed to develop a continuous demand in the market. Suggested **policy instruments** included to focus subsidies on a results-based agri-environmental payment system instead of hectare based subsidies; to give monetary incentives like higher prices for N-fertilizer; higher market prices for legumes and compensation or payments for ecosystem services of (sustainable) legume based systems through an internalization of external costs. In addition, participants called for a broader range of policy instruments like incentives, nudges or role models in nutrition-education and to ban intensive production methods typically used for soybean production in CAP Greening ecological focus areas. The stakeholders' contributions regarding a **sustainability assessment of legume based systems** included, to acknowledge that ecology is the most important pillar of sustainability for agricultural production as the environment cannot be substituted by financial capital or social wellbeing; that yield and productivity analyses need to take the whole crop rotation into account to evaluate the effect of legumes; and that a focus on a whole-meal instead of ingredients is needed.

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2. Introduction

2.1 Background & Objectives

TRUE is funded by the European Commission's Horizon 2020 Programme over four years until March 2021 to explore strategies to reduce the EU's dependency on imported protein food (soy) and synthetic nitrogen fertilizers. In this context, TRUE aims to identify the best routes, or "transition paths" to increase sustainable legume cultivation and consumption across Europe and includes the entire legume feed and food value chains. During the course of the project **Legume Innovation and Networking (LIN) Workshops** are organised to involve relevant stakeholders in a multi-actor approach. They take place in three geographical regions with different pedo-climatic conditions: Atlantic, Continental and Mediterranean. In 2020 there will be a final common European Workshop to build a European Legume Innovation Network. The workshops are intended to help

- share legume focused activities with other **networks and actors**
- exchange insights from **legume based innovations**
- collate **challenges and needs** regarding legumes across the entire value chain
- gather stakeholder assessments on **legume markets and policies**
- identify key leverage points for **improving framework conditions for legume-based food- and feed-chains**.

2.2 Workshop framework, participants and methodology

The first Legume Innovation and Networking Workshop of the Continental Region took place on the 21st and 22nd of November in Stuttgart, Germany, hosted by the University of Hohenheim. The workshop was co-hosted by the German networks[1,2,3] for legumes, which were founded as a major part of the German "protein crop strategy". Another collaborator was the Centre for Agricultural Technology Augustenberg, which is implementing the "protein initiative" for the federal state of Baden Württemberg.

The workshop brought together 70 TRUE members and stakeholders across the whole legume based value chain to exchange ideas on how to increase legume production and consumption in Europe. The represented stakeholder groups spanned producers, advisors, breeders, processors, machinery-suppliers, retailers, consumers and scientists.

Besides oral presentations, poster sessions and a field trip, participants shared the challenges and needs in a World Café with 3 parallel groups focussing on the different aspects of legume production environment, legume markets and economics, and legume policy and society.

[1] Demonstration and knowledge transfer network for expanding and improving cultivation and utilisation of field peas and field beans in Germany
[2] Soy Network to improve the cultivation and utilization of soybeans in Germany
[3] Exemplary demonstration network for cultivation and utilization of lupins in Germany

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3. Presentations & Posters

A list with links to pdf files of the presentations and posters can be found in Annex III on page 46.
The pdf-files can also be found directly on the TRUE website:
https://www.true-project.eu/lin-workshops/continental/documentation/

3.1 Presentations summary

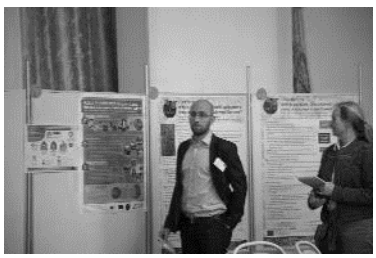
The **challenges and leverage points** identified in the presentations were:

- **Yield uncertainty** for legumes and pulses must be reduced
- **Climatic growing conditions** are not favourable everywhere
- Adaption of **standards** (e.g. harvest time, intercropping)
- Farmers lack **knowledge** about cultivation (including rotation), crop protection, harvesting and drying of legumes
- Need for qualification of **consultancy services** regarding legume based systems and value chains
- Innovations/**Investment** in breeding, technology and product development
- **Promotion, marketing and trade structures** must be improved
- Low level of **cooperation** along the supply chain due to different interests
- Low **economic competitiveness** of pulses compared to high input crops
- Calculation of **ecosystem functions** (whole rotation)
- **Fair payment** for quality parameters (e.g. non-GMO, energy and protein)
- **Incentives** for increased legume processing and human consumption
- **Greening, pesticide ban** on ecological priority areas from 2018 onwards
- Nitrogen crisis is also a **protein crisis** with huge import dependency of both in the EU

3.2 Poster session impressions





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3.3 Presentations' abstracts

The Protein Initiative in Baden-Württemberg and similar projects

Verónica Schmidt-Cotta[1], Joachim Raupp[1]

[1]Center for Agricultural Technology Augustenberg (LTZ), Germany

The protein initiative in Baden-Württemberg is a project running from June 2012 until December 2018 and is financially supported by the government of Baden-Württemberg. It is performed by two governmental institutes: 1) for grass land; and, 2) for arable farming.

1) The activities within the protein initiative of the "Agricultural Centre for cattle production, grassland management, dairy management, wildlife and fisheries Baden-Wuerttemberg" are to improve the protein yield of grassland, carry out experiments on demonstration farms and at the University of Hohenheim, publish publications and organise events.

2) The "Centre for Agricultural Technology Augustenberg" is contributing to the protein initiative by improving pulse crops, coordinating 19 demonstration farms for events and analyses, organising field days and discussions, creating leaflets, lectures, papers and carrying out field experiments.

Overview of similar projects in other regions:

Launch	Project Title	Where	Website
Feb. 2011	From the Field into the Feeding Trough	North Rhine Westfalia	www.vom-acker-in-den-futtertrog.de
March 2011	Baverian Protein Initiative	Bavaria	www.stmelf.bayern.de/agrarpolitik/001128
June 2012	Protein Crops Strategy	BMEL	www.bmel.de
June 2014	Protein Feed from Lower Saxony	Lower Saxony	www.eiweissfutter-aus-niedersachsen.de/home.html
March 2015	Protein Initiative Hessia	Hessia	https://umweltministerium.hessen.de/presse/pressemitteilung/mehr-heimisches-eiweiss-fuer-hessische-tiere
2012	Dansk økologisk protein til økologiske husdyr	Denmark	http://lbst.dk/fileadmin/user_upload/NaturErhverv/Filer/Indsatsomraader/GUDP/Om_GUDP/Arrangementer/Konference_2011/OEkoProtein.pdf
2011	LegoLux	Luxemburg	http://ibla.lu/_res/uploads/2016/07/zimmer_legutag_2016.pdf

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Demonstration and knowledge transfer network for expanding and improving cultivation and utilisation of field peas and field beans in Germany

Ulrich Quendt[1]

[1]Peas and Beans Network, LLH Hessen, Germany, Ulrich.Quendt@llh.hessen.de

→ *see poster abstract No. 12 on page 20 for more details*

Challenges

- "Never change a running system": the trade and use of standardized soy bean meal is proven long-term and useful, huge amounts of soy beans are available and there are many research studies of feeding soy bean meal.
- Consultancy services often lack experiences in how to crop legumes, make feed rations with legumes for cattle, pigs and poultry and about the economic value of legumes.
- There is a low level of cooperation along the supply chain due to different interests.
- The economic competitiveness of pulses is low compared to high input crops.

What Opportunities do we have?

Feed	Human consumption	Market
- Non-GMO feeding components - Farm's own fodder production - volatile prices of soybean meal	- rich in proteins, energy and fibre - Increasing vegetarian diets - New products out of legumes - Raising awareness for how food is produced	- Food retailers looking for differentiation - Local and non-GMO - short distances to supply feed - transparent and authentic supply chain

Soy Network to improve the cultivation and utilization of soybeans in Germany

Sylvia Tschigg[1]

[1]Soy-Network, Lfl Bayern, Germany

→ *see poster abstract No. 11 on page 19 for more details*

Drivers influencing expansion of legume cultivation

Constrains: Growing conditions are not everywhere climatically favourable; There is a lack of knowledge on farms about cultivation, weed control and soybean harvesting; Greening, pesticide

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ban on ecological priority areas from 2018 onwards. Also yield uncertainty for lupine and field bean; sales / marketing infrastructure

Supportive: The protein strategy of the federal government, projects dealing with legumes and their cultivation; Soy bean cultivation profitable for farmers with suitable machinery and know-how. Regional marketing, GMO -free soy in the EU and Germany. Increasing knowledge of soybean production among growers

Proposed strategies: Improvement of cultivation and processing of protein crops; Promotion of local GMO-free protein to reduce soybean imports; Breeding for stable yields and higher profitability of legumes

Legume production, markets and policies – TRUE approach

Sabine Zikeli[1], Karen Hamann[2], Bálint Balázs[3]

[1]University of Hohenheim, Germany; [2]Institute for Food Studies and Agroindustrial Development, Denmark; [3]Environmental Social Science Research Group, Hungary

As a preparation for the World Café Groups TRUE members gave their thoughts about the TRUE approach and some inputs for the discussion. *→The World Café notes can be found in the pages below.*

Legume Production in TRUE

Innovation in legume *production* is not a central topic in TRUE, but specific aspects are covered in the case studies (regional and context-dependent). Existing data is collected in WP 2 Case Studies with a database on field trials and field studies previously done by the consortium partners available to a wider audience.

→ Questions regarding legume production techniques (breeding, diseases, rotation, N-fixation and fertilization) are important for future development of the sector.

The World Café Group "Production environment" is about the development of new value chains for legumes and improvement of old ones. Legume production (conventional and organic) is essential. Open questions on production technologies exist.

Therefore, today's agenda invites an exchange of positions and views, to define and discuss bottlenecks regarding legume production, to discuss future options to increase legume production and to strengthen the network.

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Legume Markets in TRUE

The TRUE approach wants to be holistic, complex, integrated and forward-looking about food and feed-markets, innovation, consumers and ingredients. The legume markets are dynamic, local and global. Supply chains are essential for competitiveness. How can they be profitable? Possible market drivers could be consumer demand, protein demand for feed, environment and climate challenges, business opportunities and an EU legume strategy.

Legume Policies in TRUE

There are many problems and contradictions in the current food systems. Legumes have become protagonists of food policy debates (meat analogues, #IYP2016, Protein Transition, Protein Challenge 2040, Green Protein Alliance, FOOD2030, Soya Declaration). The Policy Paradox: policy that supports legume-based food production failed to increase legume-based diets. Which policy innovations could help transition? (Examples: vegetarian option in canteens, legumes in the food plate, Pulse & Grain Pioneers in UK: top quality ingredients and delicious foods with fava beans and black badger peas).

TRUE aims to establish a science-policy interface to achieve co-design in the elaboration of the research agenda, co-production as joint knowledge generation in various levels, co-creation of new governance solutions, co-dissemination and synthesis for facilitating the validation, application and reception of the results.

Leverage points for legume based food- & feed chains – Experiences of the Lupin Network in Germany

Annett Gefrom[1]

[1]Exemplary Demonstration Network for Cultivation and Utilization of Lupins ("Lupin-Network"), MV RC for Agriculture and Fisheries, Germany

→ *see poster abstract No. 9 on page 18 for more details*

Needs for legume-based food- and feed chains

Needs in terms of **support** are a) adequate and long term frameworks, b) adaption of standards (harvest time, intercropping), c) qualification and consulting/ promotion, d) demonstration networks research.

Needs in terms of **cultivation** are: a) seeds availability, b) innovations, c) breeding success (feed value), d) successful weed and pest control, e) solve problems to harvest dry (alternatives/ technology for drying), and f) calculation of ecosystem functions (hole rotation).

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Needs in terms of **organisation of a market** are: a) cover quality, quantity and continuity, b) incentive for increase of lupin/ legume processing, c) development of processing capacity (local, mobile) and large area of trade structure, d) innovations/ investment in technology, product development (cleaning/ drying/ storage/ processing) and improvement of feed value, e) fair payment for quality parameters (non GMO, energy + protein), f) no additional work and expense for feeding, g) mix of legumes for optimal dietary composition, h) dismantle prejudice, and i) promotion and information for consumers.

The Lupin Network project **tasks for 2018** are: a) winning of partners from industry, b) investigation of GMO-free facilities (www.leguminosenmarkt.de), c) data pool/ analytics, establishing of consulting for lupin farming, d) communicate advantages of lupins for marketing, e) communicate optimize/ new processing and feeding ration, f) demonstration of value chains, g) round tables, h) promotion, i) cooperation with research, j) creation of guidelines, k) teaching and l) implementation of the Lupin-Network.

Application of sustainability indicators to legume-based systems

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The report of the World Commission on Environment and Development (1984) defines sustainable development as development that "meets the needs of the present generation without compromising the ability of future generations to meet their own needs". The World Summit on Sustainable Development (2002) upgraded the definition with the triple bottom line concept where the people, the planet and prosperity components of sustainable development are represented with social, environmental and economic sustainability pillars. In addition, to the sustainability pillars three supplementary components of sustainability have been recognised: bearability (environment and society are well established, while economic activity is not well defined); viability (strong economic and environmental aspects, but it neglects issues relating to society); and equitability (strong economic and social development, but it neglects issues about the environment).

Assessment of the sustainability of the legume quality chain involves both agricultural and industrial sustainability systems. Sustainability assessment of both production systems requires the use of appropriate sustainability indicators. The selection of indicators should be based on: i) principles for achieving sustainability that consider the ecological, economic, and social sustainability dimensions; ii) criteria about the sustainability objectives; iii) indicators which are variables that can be induced from the sustainability criteria; and iv) reference values, which describe the desired level of sustainability for each indicator.

When the selection of sustainability indicators is completed, they can be applied for the assessment of sustainability. However, the assessment must follow a procedure based on systems theory, which requires that the assessment consider the definitions of the boundaries of the system, the

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hierarchical aggregation of the sustainability dimensions, description of the hierarchical levels and description of the interactions between the different levels.

According to these theoretical constraints, the sustainability assessment should be accomplished as described in the following steps: i) selection of the system under investigation; ii) setting of optimal social, economic and environmental sustainability goals; iii) selection of assessment strategies that could follow an absolute (a comparison with previously defined margins of tolerance or distinct threshold values) or relative (comparison of different systems among themselves or with selected reference systems) evaluation procedure; iv) determination of sustainability indicators; v) validation of indicators using self-validation, independent experts' validation and social validation through public participation; vi) final selection of a minimum set of indicators; and vii) selection of a methodology to develop the assessment tool (e.g. Multi-Criteria Decision Analysis, Multi-attribute value theory, Decision expert system).

What are the best indicators of sustainable legume-based systems?

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The development of sustainability indicators for assessment of legume-based systems in Europe should follow the conceptual model of information and knowledge through the legume quality chain. A suite of indicators covering environmental, economic and policy pillars, as well as their interactions (bearability, viability and equitability), should be developed for each node in the quality chain.

The development and selection of indicators will follow a procedure comprising five steps. In Step 1, each node in the quality chain will be defined as a basic unit of the sustainability assessment. Step 2 will set the sustainability goals that should be achieved at different nodes. Different sustainability aspects (pillars and interactions) will be prioritised for different nodes according to their position, level and function in the quality chain. In Step 3, a selection of the strategy for sustainability evaluation will be made. This is a very central step because the selection of the sustainability reference system determines the constraint conditions for the selection of new indicators. To complete this step, a definition of a reference system is needed, as well as determination of its relative sustainability level.

When the definition of the system and a clear description of constraints for selection and development of the sustainability indicators are made, a suite of indicators can be identified. The selected indicators should reduce the complexity of the system description and they should have a potential to integrate information about processes, trends or system states into a more easily understandable form. In addition, they must have a potential to assess the environmental, economic and social conditions of a system (or a part of the system), to monitor trends over time, to provide an early warning signal of change and to provide solid bases for decision making processes consistent with sustainable development principles at all levels.

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The nodes in the quality chain range from primary production at field level, to the market, consumer and policy nodes that are at national or even Europe level. Thus, the selected indicators at a local level should measure progress of the system toward environmental sustainability. Indicators identified at regional level should provide comparisons between the systems' performance from economic, social and environmental aspects. At national/European level, they must have the capacity to inform policy makers about the current state and trends in the national or European sector of legume systems and help to facilitate public participation in sustainability discussions.

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3.4 Poster abstracts

No. 1) Endophytic *Fusarium equiseti* stimulates plant growth and reduces root rot disease of pea (*Pisum sativum* L.)

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Abstract
Endophytism is a ubiquitous phenomenon which encompasses those organisms that infect host tissue without causing visible disease symptoms at the moment of sample collection, and whose colonization can be demonstrated to be internal. All agricultural and natural plants studied to date are colonized by a vast diversity of endophytic fungi, many of which provide multiple benefits to their hosts.

In the present study we investigated the nature of interaction between three strains of endophytic *F. equiseti* (Fe) and two major root rot pathogens of pea, *Fusarium avenaceum* (Fa) and *Peyronellaea pinodella* (Pp). The experiment was conducted under controlled conditions. Fe was inoculated following sowing, while Fa and Pp were either inoculated simultaneously with Fe (day1) or 5 days after Fe (day5). Four weeks after inoculation disease symptoms were assessed, and plant growth parameters measured. Alone, two of the Fe isolates significantly increased pea biomass. Fa inoculation alone reduced pea biomass by 83 % at sowing but only 14 % if inoculated five days after sowing. Co-inoculation of Fa, both at day1 and day5, with Fe1, Fe2, or Fe3 significantly decreased root rot. All three Fe isolates significantly increased pea biomass (4.6, 3.2 and 3.7 fold, respectively) at day1, while at day5 only plants in the treatment with Fe2 had significantly higher biomass compared to the control plants inoculated with Fa alone. In contrast, in the treatment with Pp, root rot symptoms were significantly reduced by co-inoculation with Fe at day5 only. None of the Fe isolates had significant effect on biomass in the Pp co-inoculated treatments regardless of the time at which the pathogen was inoculated.

No. 2) Susceptibility of potentially useful cover crop species to soil-borne pathogens

Adnan Šišić[1], Jelena Baćanović-Šišić[2] and Maria R. Finckh[1]

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Abstract
Modern cropping systems mainly rely on growing a narrow range of crop species and genotypes while the possibility of using novel crops particularly leguminous species, which have the potential to play a major role in more diversified and sustainable food production systems, has been neglected. These species could provide multiple beneficial services to agroecosystems when used

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as cover crops, green manures or living mulches. Before introduction, it is important, however, to assess if such species share important difficult to manage pathogens.

A total of 62 accessions belonging to ten species were screened under controlled conditions for their susceptibility/resistance to major legume root infecting pathogens. The plants were inoculated with $2x10^4$ spores g^{-1} substrate one day after transplanting pre-germinated seeds. Two pea varieties, the resistant *EFB 33* and the susceptible *Santana*, were included as additional controls. Five weeks after sowing, disease symptoms were assessed, and plant growth parameters measured. Almost all plant species and accessions tested were highly susceptible to *Fusarium avenaceum*, with notable exceptions of *Crotalaria ochroleuca, Lotus pedunculatus* and a few *Trifolium* and *Medicago* accessions. *Fusarium oxysporum* caused variable disease severity on some *Trifolium* species, otherwise, infections were low, while *F. solani* caused overall higher disease severity with some variation among accessions. *Peyronellaea pinodella* and *Didymella pinodes* most severely affected *Lathyrus*, otherwise infections were low with *D. pinodes* appearing to be more specific.

No. 3) Legume production in Croatia *(TRUE case study 16)*

Mislav Marelja[1]

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Legume production in Croatia has significantly increased over the last few years. Soybean is grown on almost 80 000 ha and the highest increase comparing to 2015. Legume production was in dried pulses (46%). With EU support of legume production and quality supply chains soybean production became the most rentable crop grown in central and eastern Croatia.

Luma-prom ltd. is founded in 1994. My goal was to present you problems in Croatian market and how our company developed and worked through years. Today we have soybean production on around 100 ha every year and we are interested in growing other legume crops in following years.

No. 4) Usage of the leguminous plants in green manuring at homefarm Vukelić

Amalka Vukelić, dipl. Ing. Agr.[1]

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Key words: legumes, green manuring, biodynamical farming, orchards

In order to increase total amount of the humus in the soil, biodynamical farming approaches sustainable system of fertilization through usage of the compost and green manure. Leguminous

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plants fixate nitrogen, loosened heavy soil structure and optimized water-air regime in the soil. Their usage is justified as they are very good for attraction of the pollinating bugs and increase biodiversity in the long lasting orchards. Green manuring is conducted together with biodynamical preparation 500 which is used as microbiological soil activator.

No. 5) Pulses in short food supply chains – from small-scale farms to urban gastronomy *(TRUE case study 17)*

Gábor, BERTÉNYI[1]; Attila KRÁLL[1] and Orsolya SZUROMI[2]

[1]Agri Kulti Nonprofit Ltd., [2]Ministry of Agriculture, Hungary

Despite their known nutrition value and environmental benefits, food legumes play a disproportionately small role in domestic agriculture and nutrition in Hungary. The production volume of food pulses has dropped in the last two decades to a minimum level: known crop area of all food legumes in Hungary is less than 2000 hectares (2015). The overall proportion of legumes (green and dry) in the yearly food consumption is hardly above 2 kg/year as a general average (2015). In premium gastronomy, legumes are assumed to have a similarly perceptible role. On the top of these low consumption rates, majority – presumably around 80% of commercially available dry pulses (beans, lentils, chickpeas, etc.) are imported from a number of countries all over the world. In the Centre of Plant Diversity (Tápiószele, Hungary) (www.nodik.hu/english) – one of the significant collection of genetic samples in Europe – as many as 10.000 different legume varieties (local and/or traditional types) are stored, mostly from the Carpathian Basin.

One possible leverage point into this system is to revitalize these special legumes in organic cultivation and sell them as premium dishes and/or marketable product in premium gastronomy. In the frame of TRUE project Agri Kulti Ltd. will examine the possibility of introducing and enhancing those traditional legume varieties into urban gastronomy and to reveal the conditions of this from the producers' and consumers' perspectives. Traditional/local pulse varieties will be pre-selected in cooperation with the National Plant Diversity Centre. Altogether 30-40 traditional varieties of 6 different species will be tested in production between 2018-2020, along the on-farm protocol of the Hungarian Research Institute of Organic Agriculture (www.biokutatas.hu/en) by 4-5 contracted small-scale farmers and the National Plant Diversity Centre.

Data will be collected on cultivation circumstances, nutrient requirement, water demand, phenology, production volume, crop safety, resistance and plant protection, human labour requirement, etc. Nutrition content and gastronomic potential of different harvested crops will be evaluated through nutrition analysis and sensory laboratory examinations. Raw produce will be processed by HÁZIKÓ (www.haziko.farm/en) into high-quality food products in cooperation with mainstream chefs and gastro-bloggers and tested by consumers at various scenes of urban gastronomy: from street food through catering to leading restaurants. Consumers' feedback will be supported by Agri Kulti's community-supported quality assurance system.

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No. 6.) Why is lentil (*Lens culinaris*) cultivation a story of success in south-west Germany? *(TRUE case study 13)*

Rieps, Ann-Marleen[1]; Gruber, Sabine[1] & Zikeli, Sabine[2]

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Lentil production in south-west Germany

Lentil is a traditional crop in Germany. However, since the 1950s it is no longer commonly produced. In 1985, a farmer from the Swabian Alb restarted growing lentils and carried out own experiments. In the following years, he reintroduced old varieties which survived in a gene bank in St. Petersburg and started to multiply the seeds. An organic producer group was founded which has about 90 members today. Also in cultivation in conventional agriculture there is again some lentil cultivation. Some features make lentil cultivation more attractive for both the farmer and the agroecosystem; such as diversification of crop species on farmland, symbiotic N_2-fixation, very short supply chains, or provision of nutritious food. One specialty of lentil cultivation in Germany compared to dryer climates is the risk of lodging and thus the need of a companion crop in a mixed cropping system. Common companion crops are barley, oats, or camelina.

Objectives and methodology of the case study

The major objective of the case study is to illustrate new approaches which can help to stabilize, optimize and expand the lentil cultivation in Europe by means of the case here in Germany. This aim should be achieved by describing the status quo of lentil cultivation and by identifying agronomic factors which contribute to the success of lentil cultivation in south-west Germany. Moreover, the farmers' motivation and obstacles of lentil cultivation will be identified. The study focuses on both conventional and organic farming.

Three major methods will be used to achieve the mentioned objectives:

1) Questionnaires with farmers to get data regarding the site, cultivation techniques and utilization of the lentil
2) Semi-structured interviews which focus on personal motivation and obstacles during their decision process to start lentil growing, the present cultivation and about future developments
3) Netchain-analysis to identify important stakeholders. A netchain is a set of networks as a combination of vertical supply chain networks and horizontal ties between actors linked to a specific part of the value chain (Lazzarini et al. 2001)

References

Lazzarini, S.; Chaddad, F.; Cook, M. (2001): Integrating supply chain and network analyses. The study of netchains. In: Journal on Chain and Network Science 1 (1), pp 7–22. DOI: 10.3920/JCNS2001.x002.

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No. 7.) Why is soybean (*Glycine max*) cultivation a story of success in south-west Germany? *(TRUE case study 14)*

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Soybean production in south-west Germany

In Europe, the self-sufficiency rate of soybean protein is only 4 % and of all plant-based protein approximately 40 % (Bernet et al. 2016). Hence, there is a high import of soybean which was about 36 million tonnes in 2014 (EC 2016). In order to increase the self-sufficiency rate of protein sources the Protein Plant Strategy ("Eiweißpflanzenstrategie") of the German government supports research and development activities for soybeans since 2013. The area cultivated with soybeans is growing and was 16,000 ha in 2016 of which 73 % is located in Baden-Württemberg and Bavaria in southern Germany (Destatis 2016).
Advantages of supporting the domestic soybean production are e.g. the supply of GMO-free soybean, the reduction of dependence on imported soybean and the production of a high nutritious resource for feed and food.

Objectives and methodology of the case study

The major objective of the case study is to illustrate new approaches which can help to stabilize, optimize and expand the soybean cultivation in central Europe by means of the case here in Germany. This aim should be achieved by describing the status quo of soybean cultivation and by identifying agronomic factors which contribute to the success of soybean cultivation in south-west Germany. Moreover, the farmers' motivation and obstacles will be identified. The study focuses on both conventional and organic farming. Three major methods will be used to achieve the mentioned objectives:

1) literature review, questionnaires with farmers, and data processing of existing data to get data regarding the sites, cultivation techniques and utilization of the soybean;
2) semi-structured interviews which focus on the farmers' personal motivation and obstacles during their decision process to start soybean growing, the present cultivation and about future developments;
3) netchain-analysis to identify important stakeholders. A netchain is a set of networks as a combination of vertical supply chain networks and horizontal ties between actors linked to a specific part of the value chain (Lazzarini et al. 2001)

References

Bernet, T.; Recknagel, J.; Asam, L.; Messmer, M.: Biosoja aus Europa. Empfehlungen für den Anbau und den Handel von biologischer Soja in Europa. 1st ed. Edited by Forschungsinstitut für biologischen Landbau (FiBL).
Destatis (2016): (Statistisches Bundesamt); Land- und Forstwirtschaft, Fischerei. Wachstum und Ernte – Feldfrüchte. Subject-matter series 3. Series 3.2.1.
EC (European Commission) (2016): Genetically modified commodities in the EU. Brussels.
Lazzarini, S.; Chaddad, F.; Cook, M. (2001): Integrating supply chain and network analyses. The study of netchains. Chain and Network Science 1 (1), pp 7–22. DOI: 10.3920/JCNS2001.x002

This Project has received funding from the European Union´s Horizon 2020 research and innovation programme under grant agreement No 727973

No. 8) The global field project in Berlin and the proportion of protein plants globally.

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Arable Land - a scarce Resource

Land including its diverse vegetation is like water, atmosphere and sunlight one of the central natural resources of our planet. Only 12 percent (1.5 billion hectare) of that land is arable and can be used for food production. Dividing those 1.5 billion hectare of arable land and permanent crops by the global population of currently 7.5 billion people there are around 2000 m^2 (a fifth of a hectare) of arable land available for every person. Those 2000 m^2 are where everything a person needs per year must grow. That includes not only food, like wheat, vegetables or sugar but also animal feed that does not grow on meadows and pastures, cotton and other fibres for clothes and plants that are grown for energy purposes.

If one 2000 m^2 field were to represent the global surface of arable land, what would be grown on it? Half of those 2000 m^2 are covered by only four crops: wheat, maize, rice and soybeans. Apart from rice major parts of those crops are not used for direct human consumption but go towards animal feed or energy purposes. Vegetables and fruits grow on less than 5% of the arable land worldwide.

Europe has a negative land import/export ratio: When looking at the EU alone, there are just over 2000 m^2 of arable land for every citizen (209 million hectares in 2008). Compared in hectares, agricultural products that are imported into the EU (48.99 million ha in 2007/2008) and exports (14.10 million ha) result in a deficit of 35 million hectares a year. That is a third of the arable land available within the EU. Products grown on an equivalent of 700 m^2 are imported per person despite the fact that Europe is provided with relatively good air and water quality, a higher soil fertility, favourable climate conditions and greater financial and technical resources than most other parts of the world.

Of these 700 m^2 three quarters are used for growing animal feed, particularly soybeans. One 2000 m^2 field could fatten two pigs for a slaughter weight of 115 kg.

The Global Field

The Global Field/2000 m^2 is an environmental educational project located in Berlin cooperating with multipliers worldwide. On the Global Field crop plants are grown true to scale to illustrate the worldwide land consumption. In addition, the area required for a variety of meals (e.g. Schnitzel with roasted potatoes: 2.16 m^2) is shown in order to make land consumption tangible for the individual.

The project offers: regular events and public debates on related topics, daily tours of the global field during the season, educational events for classes and school trips, training/ instructions/ tutorials for multipliers who wish to copy the 2000 m^2 idea or grow a certain meal, the Global Field Club for interested multipliers as well as a variety of info material and updates online.

This Project has received funding from the European Union´s Horizon 2020 research and innovation programme under grant agreement No 727973

No. 9) Exemplary demonstration network for cultivation and utilization of lupins: "Lupin-Network"

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Directed by the Mecklenburg-Vorpommern Research Centre for Agriculture and Fisheries and several partners, expertise facilities and private farms participate in the nationwide joint research project 'Exemplary demonstration network for cultivation and utilization of lupin'. The goal of the project 'Lupin-Network' as an element of the federal ministry's protein crop strategy, is to support the expansion of lupin cultivation and utilization. By building a nationwide 'Lupin-Network', knowledge transfer regarding the cultivation and utilization of lupin crops starting with research and including practice, along relevant value creation chains, shall be facilitated.

From seed allocation to cultivation and utilization, exemplarily selected value creation chains for lupin, based on scientific findings as well as on sound practical experience and guidelines from farming policy, will be shown. Best-practice-demonstrations regarding the seed production, cultivation, processing and utilization of lupin, in conventional and organic livestock breeding (dairy cows, laying hens, pig) as well as in the product refinement for human nutrition take centre stage at the 'Lupin-Network'. The analysed data shall provide information about economic viability, preceding crop effect and the entire ecosystem activity of lupin cultivation.

An additional element of the 'Lupin-Network' is knowledge acquisition and knowledge transfer between research, consultancy and practice. Knowledge and newly gained insight about lupin cultivation and utilization shall be made accessible to an interested audience and public in the context of farm days, seminars, lectures and symposia. Guidelines for the entire value creation chain are to follow. The 'Lupin-Network' shall be complied as a communication platform for farms and trade companies as well as for processing facilities, cultivation farms, research and information centres. In the scope of this project, the establishment of an internet portal supporting the project is planned.

Contacts to future partners at different network layers and initiatives around the topic lupin will be established at the same time. The 'Lupin-Network' shall be maintained and kept up beyond project time, in order to establish a sustainable cultivation and utilization of lupin in Germany, economically sound and open to development.

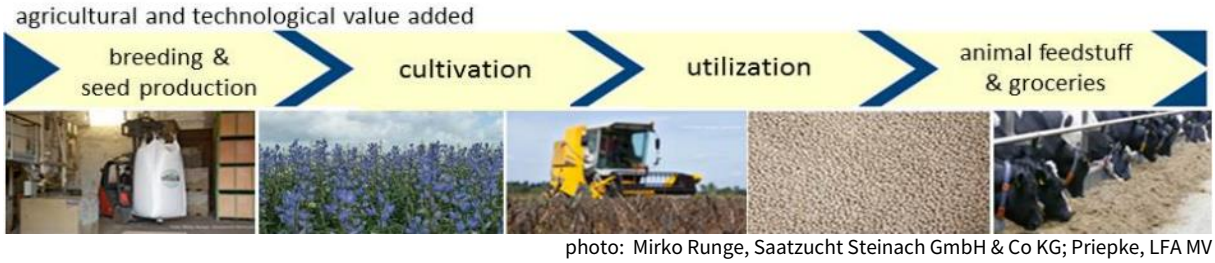

photo: Mirko Runge, Saatzucht Steinach GmbH & Co KG; Priepke, LFA MV

This Project is supported by Federal Ministry of Food and Agriculture by decision of the German Bundestag.

No. 10) Science, economy and society – making ecosystem services from legumes competitive (A research strategy of the German Agricultural Research Alliance, DAFA)

The Legumes Expert Forum of DAFA

Deutsche Agrarforschungsallianz, Braunschweig, Germany. E-mail: *info@dafa.de*

DAFA is representing the agricultural science institutes with public funding in Germany. Legumes experts' forum developed a research strategy in order to increase the production of legumes in Germany. The ultimate goal is to use the ecosystem services of legumes in agriculture with benefits for biodiversity, soil fertility, and pest suppression (broadening of crop rotation). This addresses the demand of consumers for agriculture that provides high-quality products in a sustainable way.

The strategy posits that research on legume productivity cannot be isolated from other parts of the food value chain and that research results must end up in practice. This requires a strategy addressing breeding, field practices, processing and marketing. The strategy (available from http://dafa.de) addresses goals in food and feed production and industrial uses in the areas of plant production resource conservation and socio-economy. The German federal "Leguminous Plant Strategy" co-evolved with DAFA's strategy and led to a funding stream worth 27 M€ from 2014 to 2020 https://www.bmel.de/DE/Landwirtschaft/Pflanzenbau/Ackerbau/_Texte/Eiweisspflanzenstrategie.htm. The funded research includes farm-practice networks which garner attention by other farmers and research into enhancing regional marketing efforts.

DAFA will follow the progress of research in the area of the strategy and revise the strategy (or goals) accordingly. Researchers are invited to use DAFA's atlas of experts for collaboration (http://expertatlas.de).

No. 11) Soy-Network: A demonstration network to expand and improve the cultivation and utilization of soybeans in Germany

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1.1 Overall objective of the project

The aim of the project is to expand and improve the cultivation and processing of soybeans in Germany. To this end, a nationwide network of demonstration farms is set up to ensure the knowledge transfer between research, consulting and farmers.

1.2 Work objectives of the project

A nationwide demonstration network of agricultural enterprises, processing and converting companies as well as consulting and research institutions will facilitate and improve the transfer of knowledge between research, consulting and farmers. The demonstration network includes four

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project partners and 118 demonstration farms from 11 federal states in Germany. The focus is on cultivation regions in Bavaria and Baden-Württemberg that are favourable for soybean cultivation.

The project contains the following tasks. Transfer knowledge from previous research projects on cultivation and utilization of soybeans to consultants and implement new practices on demonstration farms. With appropriate events (field days, information events, seminars, etc.), the knowledge should be spread beyond the demonstration farms. Data on the cultivation and profitability of soybean production are collected and evaluated on the demonstration farms. Furthermore, soil and plant samples are collected for monitoring purposes.

In order to demonstrate and further develop the cultivation and utilization possibilities of domestic soy, model value chains for feed and food soy are established.

No. 12) Establishment of a knowledge transfer network for cultivation and utilisation of field peas and field beans in Germany - DemoNetErBo

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Starting in March 2016, a knowledge transfer network consisting of 75 conventional as well as organic farms growing field peas (*Pisum sativum*) or field beans (*Vicia faba*) is currently established in Germany. Cultivation of peas and beans has been on a rather low and stagnating level in Germany in the past years. This is due to some challenges during cultivation, but also to low economic incentive for the farmers. This network (DemoNetErBo) shall expand and enhance the cultivation as well as the usage of field peas and field beans sustainably and improve the value gained by the farmers when growing peas and beans. Special focus is therefore on the development and presentation of legume value chains for feed and food production spanning all levels from breeding until the usage by the consumer. Hence, the farms are demonstrating diverse best practice examples for cultivation, processing, and utilisation of those two grain legumes. The overall aim of this project is to meet the growing need for regionally produced non-GMO protein crops.

DemoNet Erbse Bohne

The project is supported by funds of the Federal Ministry of Food and Agriculture (BMEL) based on a decision of the Parliament of the Federal Republic of Germany via the Federal Office for Agriculture and Food (BLE) under the Federal Protein Crop Strategy.

No. 13) LeguAN Project

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Backgrounds, aims, material and methods
The content of the current CAP reform and country-specific agri-environmental measures have resulted in an increased interest in faba beans, peas and lupins in agriculture, although lack of economic attractiveness is often cited as a reason against the cultivating these crops. In the research project „LeguAN“, it could be analysed, why conventional farms are currently growing grain legumes. In addition, the economic viability of faba beans, peas and lupines was examined on the basis of accounting data in these farms. Between 2012 and 2014 a total of 97 data sets of conventional farms could be evaluated on the basis of direct- and labour-cost free benefits (DLB). The fertilization was calculated by nutrient removal. To show the difference in DLB the legumes were compared to alternative crops.

Summary of results

- In 2012-2014 the farmers achieved on average positive DLB for grain legumes.
- The preceding crop effect was calculated to 205 €/ha for faba beans, 180 €/ha for peas and 151 €/ha for lupines. Unconsidered are other positive effects like pesticide-saving, labour organization.
- Grain legumes reached the best profit on the best locations, combined with higher yields and achieved adequate prices (sale or feed)
- The comparison of grain legumes and alternative crops clarifies the:
  - attractiveness and economic stability of faba beans (64-100% higher DLB than alternative culture);
  - economic potential of peas, depending on year of cultivation (38-78% higher DLB than alternative crops);
  - economic uncertainty for lupines, 20-33% higher DLB than alternative crops.

No. 16) Innovative cooking with pulses

Cecilia Antoni[1]

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Modern Recipes
The number of cross allergy sufferers is growing rapidly. For them, it is vital to know what is really in their food. Beans, peas and lentils are a perfect plant based nutrition - as long as not highly processed. BEAN BEAT develops recipes for a modern, delicious and healthy life-style with legumes. Furthermore BEAN BEAT is specialized in testing the various kinds of broad beans, soybeans and peas to find the perfect preparation type.

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No. 17) ECOTOAST®: "Roast your legume on your own farm" - The first compact roast (Toast) plant in the world

Lutz Wudtke[1], Marion C Winter[2] and design by Josef Neubauer

[1] agrel GmbH agrar entwicklungs labor; Deutschland, 94424 Arnstorf [2] EST GmbH, Österreich, Geretsberg, E-mail: *wudtke@agrel.de*

The thermal treatment of Legume (special Soy) is necessary to use this for human and animal nutrition.
The essential treatment from soy is commonly known. But also the toast of other grain legumes results in better digestibility. With the ECOTOAST system this can become the regional standard. This is a way for the GMO free protein supply.

No. 18) SILATOAST (Pea/Field Bean): Combined fermentation and thermal treatment

Kuhnitzsch C.[1], Martens S.[1], Steinhöfel O.[1], Bachmann M.[1] u. Zeyner A.[1]

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Aim of the project:

- Investigation of decentralized grinding and ensiling of fresh or re-moistened grain legumes as a processing, preservation and storage method.
- Improvement of feed value and feeding in dairy cattle and monogastric nutrition trough the combination if silage and heat treatment.
- Reduction of ruminal CP degradation and anti-nutrients.
- Increased digestibility and starch resident to ruminal degradation.
- Establish the combined treatment process for grain legumes produced on farm.

No. 19) Blue lupine (*Lupinus angustifolius*) as ingredient in aquaculture feed

(TRUE case study 15)

Monika Weiß[1]

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Fish and shellfish are the world's most important animal protein source, and the majority of the fish humans eat now comes from aquaculture (FAO 2016). Large amounts of feed are needed to grow aquaculture fish and fishmeal is still one of the most important protein sources in aquaculture feeds. Fishmeal prices are high and its sustainability is highly questionable. Therefore, our case study investigates the use of legumes as a replacement for fishmeal in formulated diets for feeding shrimps, salmon and sea bass in large recirculating aquaculture (fish farming) systems in northern

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Germany. Legumes such as lupines, soya or pea meal are particularly promising ingredients for diets for aquatic animals grown in fish farms. They generally provide the optimal mixture of amino acids for good growth, and if treated correctly can be very efficiently absorbed by fish and other aquaculture animals (Glencross et al. 2005).

In our first experiment, we fed 4 formulated diets containing different amounts of lupine meal (LM) (Control (0% LM), and at 10, 20 and 30% inclusion levels (L10, L20, L30, respectively) to the white leg shrimp *Lithopenaeus vannamei* for 8 weeks. Growth was significantly reduced in shrimp fed diets with high lupine content (L20, L30). Results indicate that a replacement of fishmeal with lupine meal is possible up to 10% without losses in growth performance. Analysis of metabolic and immunological parameters will give us more detailed information of the consequences of lupine feed on the shrimp metabolism at organ and cellular levels and hopefully will reveal reasons for the reduced growth.

No. 20) Cereal-legume intercropping for more environmentally- and economically-sustainable brewing and distilling *(TRUE case study 3)*

Kirsty Black[1,2,3], Geoff Squire[1], Philip White[1], Graeme Walker[2], **Pietro Iannetta[1]**

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Sufficient Nitrogen (N) fertiliser is essential for high crop yields, and spring cereals such as barley (*Hordeum vulgare* L.) receive around 110 kg N ha^{-1}. However, '*intercropping'*, cultivating two or more crops in the same field at the same time, can allow cereal production without added man-made N fertiliser. For example, barley can be sown with a legume crop such as peas (*Pisum sativum* L.). The legume can meet its entire N demand using a natural process called "*biological nitrogen fixation*". Here atmospheric nitrogen, a renewable resource, is fixed into biologically useful forms. The legume can also deliver nitrogen to its companion non-legume crop (barley), which cannot fix nitrogen biologically. The average carbon footprint (carbon dioxide equivalents, CO_2e), for applied nitrogen (as ammonium nitrate, AN), is 5.6 kg CO_2e kg AN^{-1}. So, for every hectare of AN (110 kg) application avoided, 616 kg CO_2e ha^{-1} is also offset. In the UK, the spring barley area was 682 kha (2016), and so approximately 75 kt of N would have been applied. If the same area was sown with a pea-barley intercrop without N fertiliser application, 420 kt CO_2e would be saved. To put this into a tangible context, this is equivalent to removing 176k cars from the road annually. Financially, and without accounting application costs and pesticide savings accrued by intercropping, with AN fertiliser cost saving would be a £13.5 million, at the current low prices of around £180/t. Important questions remain: *is intercropped grain of suitable quality for malting, brewing and distilling?* We report on the results of barley pea-intercropping malting and distilling trials. If successful, the approach would represent a major contribution to ensure spirit production in the most sustainable of manners.

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supported by: a joint PhD studentship between Abertay University and The James Hutton Institute; and, '*TRansition paths to sUstainable legume-based systems in Europe*' (TRUE; www.true-project.eu), and '*Designing InnoVative plant teams for Ecosystem Resilience and agricultural Sustainability*' (DIVERSify, www.plant-teams.eu) projects, both of which are funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreements 727973 and 727284, respectively.

No. 21) Schwarzwald-MISO

Peter Koch[1]

[1]Schwarzwald-MISO, Germany, Villingen-Schwenningen. E-Mail: peterkoch@schwarzwald-miso.de

Lupine Miso
The world still thinks about miso made from soy. We use German soy, around 100 kilometres from our production site. Why not think a step ahead? So we introduced several years ago our lupine miso to the world. Still it is one of our best selling products. The sweet-bloomy taste, the charming yellow colour and the beautiful taste – but what is the main reason why people fall in love? Maybe nobody knows, but the legumes can make you happy and feed the world.

Main interests in legumes grown in Germany
We are interested in all kind of legumes which can especially grow in Germany. As a local small scale producer we are looking for organic certified local suppliers. We are happy to find you here.

No. 22) Premium Fava beans

Alexander Rosenow

FAVA-TRADING GmbH & Co. KG, Altenwisch 1, 21730 Balje, Germany. rosenow@fava-trading.com

The roots of our young and growing company lie in the agricultural production and trade. Our production site lies in the heart of a significant bean cultivation area close to the North Sea. Our beans ripen in ideal conditions in the sea climate. We are in direct contact with the producers and can thereby influence and ensure the high quality of our produce. Gapless transparency all the way to the origin are just as important to us as a very strict permanent quality management - this on every single production step.

We use highest standard sorting- and packaging-technology at our production site - and can adjust to your individual wishes. The FAVA-TRADING offers a) Fava beans pure ware in HPS-quality, b) Peeled and split Fava beans, c) Diverse other pulses, d) By request other refined products like flour, wholemeal and oats can be offered. From 500 grams bags with individual printing for the food retail trade to a 24-ton container: We fill our products as requested to all possible packaging units! For fast delivery we maintain additional storage capacity in major ports in the United Arab Emirates. www.FAVA-TRADING.com

This Project has received funding from the European Union´s Horizon 2020 research and innovation programme under grant agreement No 727973

4. Outputs of discussions

4.1 Summary of discussions

Supply / Production

- **Education of future farmers & scientists and farming advisors** regarding legume cultivation should be increased; **costs** for extension services for legumes should be **covered**.
- Research programs on **breeding new legume varieties** could promote growing by overcoming instability of yield and disease pressure**.**
- **Communication, regional legume networks** between key players including farmers (conventional and organic), consumers, researchers, processors, politicians, advisors) and **producer groups** is very important to promote legume cultivation.
- Create **better links between actors in the supply chain** (at local, national and international levels), and include industry, retailers, food service, logistics and consumers. (This is also the case for the feed sector.)
- Increase production and establish a **reliable and consistent supply**. Increase **quality** of the production.

Demand / Products

- To really make a change: look for the **big volumes in food and feed**, and develop a **continuous demand** in the market (especially possible in the feed industry).
- Changing people's diets with public support, e.g. **through public food procurement and catering** (governmental quotas on legumes in school feeding) and fight nutritional misinformation.
- **Improved technologies** and more **processing** are needed to provide better food products.
- Increase **consumer awareness** about legumes through better marketing, recipes and education about legumes and provide more appealing **products with improved taste and texture.**

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Political Instruments

- **Results-based agri-environmental payment system** instead of hectare-based subsidies → money should go more to public goods.
- **Greening of CAP** – ban the production of soybean in ecological focus areas OR **ban the intensive production methods** typically used for soybean production.
- Give **monetary incentives** like higher prices for N-fertilizer, higher market prices for legumes, and compensation or payments for ecosystem services of (sustainable) legume based systems. For this, an **internalization of external costs** should be facilitated by policy.
- Changes in **nutrition education: a broader range of policy instruments** should be used (going beyond providing information but also use other incentives, such as nudges or role models –).

Sustainability Assessment

- "Strong sustainability" should be integrated in this discussion, taking **ecology as the most important pillar of sustainability for agricultural production**. The environment cannot be a substituted by financial capital or social wellbeing.
- **Yield and productivity analyses** need to take whole the crop rotation (or at least the succeeding crops) into account to evaluate the **pre-crop effect of legumes** which is a major advantage compared to other crops.
- Focus on **protein quality in a whole meal**, not as a simple ingredient → we should show that legumes are not as good as meat, but even better.

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4.2 Full reports of the World Café Sessions

In three groups and three rounds, the participatory discussions aimed to collect the participant's contributions. The overall questions of these rounds were:

- Round 1-2: **Which current circumstances hinder and or promote legume use in your part of the legume food and feed chains?**
- Round 3: **Which future changes are needed? Which actions can be undertaken now and which actions are needed in the future?**

Group 1: Production environment

*Summary by **Ann-Marleen Rieps** (University of Hohenheim, TRUE Case Study 13+14)*
Group facilitation: Sabine Zikeli, Henrik Maaß, Ann-Marleen Rieps
The production sessions had between 10 and 20 participants.

How do legumes contribute to more sustainable cropping systems?

- Legumes provide agro-ecological benefits with effects on soil fertility ("fantastic" rooting system, biological N fixation etc.), biodiversity, etc.
- The integration of legumes in crop rotations goes hand in hand with a systems approach for agriculture. This takes not only the yield of one crop in one year into account, but also the interactions and relations between crops and between crops and the environment as well as other important factors. Sometimes the yields of legumes itself are not very high or very instable over the years, but the effects on the succeeding crop has to be taken into account.
- The flowers of legumes can be feed for pollinators.
- Legumes can be grown as cover crops and could reduce the need of ploughing.
- Legume production is sustainable, if it is grown for human consumption. If most of the legumes, like soybean, are fed to livestock, it is less sustainable.
- Especially small seeded legumes leave behind nitrogen in the soil which makes them beneficial also for the succeeding crop.

Stimulating factors for the production of legumes:

The discussion focused on legumes in general as well as on specific species. The following statements were made regarding all grain legumes.

- Climate change could enable new options for growing other legume species
- Due to the ability of legumes to fix nitrogen in symbioses with rhizobia, less nitrogen fertilizer has to be applied in the crop rotation. If fertilizers have to be purchased, this has also a positive financial aspect. Legumes have a beneficial pre-crop effect.
- Legumes can be grown in mixed cropping systems which can result in higher yields per ha
- Due to a more diverse crop rotation and also higher biodiversity there can be a better biocontrol. The agricultural system can be more resilient.

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- Pulses are valuable crops
- Another possibility could be to use small seeded legumes also for processing

Hampering factors in legume production:

- The yield of legumes fluctuates a lot between the years. This is influenced mainly by weather conditions.
- There are not many varieties on the market, e.g. compared to cereals. It is not possible to use varieties which are specifically well adapted to environmental conditions of cropping sites.
- Diseases can be a problem due to mismanagement of crop rotation or unsatisfied seed quality. The integration of legumes in organic crop rotations is usual. But sometimes, the portion of legumes is getting to high in the rotation which can cause severe disease pressure. To reduce the risk of diseases, it is crucial to ensure breaks between legume species. Besides, if there are already diseases, they are not easily to treat with pesticides as its availability is rather limited or these are not available at all. For organic growers this is mostly not an option anyway.
- Legumes are often not very competitive against weeds, which makes weed pressure or lacking possibilities of weed control a hampering factor.
- A precondition for growing legumes is that postharvest technology is available (in the region). This is often not the case. This factor relates also to the supply chain. If there is no processor, there is no growing.
- There can be also a lack of knowledge of the farmers which can result in low yields due to mismanagement or due to missing awareness of the possibilities or reasons why to grow legumes in the first place. Additionally, there is a lack of experience because it is not so common anymore to grow legumes.
- For conventional farmers it is an inhibiting factor that they do not get greening subsidies for growing legumes when they apply pesticides.
- When beans or peas are cultivated in mixtures, there is the question which pesticide to use and if there is the right one on the market. Additionally, in case of mixed cropping there is the challenge of harvesting and separation of the different crops.
- For some legumes like soybean the question raises which strain of rhizobia is most effective for inoculation. Rhizobia which are species specific for soybean and are, because of this, more effective are missing.

Who are the key actors?

Important actors who were mentioned are **consultants** who have the required knowledge about legumes, **breeders**, **seed producers** and **policy-makers**. Especially for breeding and seed production the dependencies of farmers on a few companies were mentioned.

Which changes are needed?

1) Communication:

   An exchange of knowledge in all possible variations is really important. This means exchange of the knowledge of legume cultivation between farmers, also between organic and conventional farmers. Also the communication between farmers and consumers can help. Furthermore, there has to be an exchange of the farmers with researchers so that science can focus on the actual needs of agricultural practices.

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2) Regional legume networks

Networks of scientists, farmers, processors, politicians and advisors can promote and facilitate the above-mentioned communication (exchange of knowledge, obstacles, needs, and possibilities). Examples of those networks were presented during the conference (e.g. Soybean network in Germany).

3) Education and extension services

More time in lectures in universities and farmer schools to train future farmers and scientists with more knowledge and skills regarding legume production. Furthermore, agricultural advisors have to have the capacities and knowledge to tell the farmers the options of legumes cultivation and support them when the decision is made to grow them. The costs for the extension service for legumes should be covered. For both of the mentioned measures, it is necessary that advisors and teachers also get advanced trainings on the integration of legumes in cropping systems as well as their management.

4) Producer groups for specific pulses

A producer group is useful for the marketing of legumes, especially when there is little or no infrastructure available for processing and distribution of pulses. Within the group farmers can exchange not only machinery and the work for marketing and promotion, but also their knowledge.

5) Research

More research programs on breeding of new legume varieties could promote cultivation. The instability of yield and disease pressure (e.g. for some grain legumes like yellow and white lupine) are hampering factors for cultivating them. Regarding research which is analyzing yields and the productivity of legumes, it is important to take the whole crop rotation (or at least the succeeding crops) into account. This is important to evaluate the pre-crop effect of legumes which is a major advantage of legumes compared to other crops.

6) Monetary incentives

If there would be higher prices for N-fertilizer, this could result in an increase of legumes production. Besides, a higher market price for pulses would increase the willingness of farmers to produce legumes. Another measure is the compensation or payments for ecosystem services. It means that farmers get direct payments for practicing more sustainable agriculture and the production of ecosystem services which are important to society but have no monetary value yet on the market. To achieve this, an internalization of external costs is necessary on the policy side.

7) Definition of sustainability

Especially for agricultural production, it is important that ecology is not seen at the same level as the other two pillars of sustainability (society and economy). The environment is fundamental for sustainability because agriculture has no future without an intact environment. Agriculture depends on healthy soils, climate, and resilient ecosystems which are not polluted or destroyed. That means that the term of a strong sustainability should be used in this discussion and that the environment cannot be substituted by financial capital or social wellbeing.

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Group 2: Markets and Economics

*Summary by **Karen Hamann** (IFAU, TRUE Work Package 4 leader)*
Group facilitation: Karen Hamann, Maria Gerster-Bentaya
The market sessions had between 15 and 25 participants.

Factors hindering legumes in the supply chains and markets

- Lack of (quality) standards is a barrier for large volume purchasing in the food service market (and probably also for the procurement of the food industry companies).
- There is a lack of cooking skills with professionals in the food service industry; therefore menus with legumes are not developing as fast as anticipated.
- Many suppliers only provide small quantities for processing. This means that many lots are too small for processing and this leads to a disconnected supply chain.
- Croatia can produce more legumes, but there is no processor asking for legumes (due to lack of technology?). There is an issue related to organic legumes: Organic pulses are more expensive than conventionally produced pulses, and the Croatian consumers cannot afford to buy organic pulses. Still, organic producers (in Croatia) have to fulfill the internationally recognized standards for organic production and this is very expensive for a Croatian producer. How to solve this?

***Most important hindering factors** for more legumes in food supply chains and food markets:*

- *Low volumes*
- *Inconsistent quality and lack of quality standards*
- *Lack of knowledge (about processing, cooking and use)*
- *Bad taste and texture*
- *Inconsistent supply chain*

Factors promoting legumes in the food supply chains and markets

- In Germany there is a market for pre-cooked legumes targeted at the population with Arab roots, but also making pre-cooked legumes available to the general public.
- A new market for legumes (plant protein) is sport nutrition. Other innovations in the legume-based assortment are lupine-bread and lupine-pasta, lentil-pasta, and new extrusion technologies for processing yellow peas.
- The trend “flexitarian diets” can promote the use of legumes.
- This company (participant) imported hand-picked beans from North Africa and sold the beans in Germany. The company also marketed regionally grown pulses. The challenge of a supply chain for imported foods was the lack of connection/links between international traders and shops.

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- This big retailer has a sustainability agenda and has implemented an own label "Bio Suisse" for organic products. The retailer sources organic products within the shortest possible distance. Key customers to the products sourced under the sustainability scheme are health conscious and affluent consumers in Switzerland.
- Strong interest in "regional" products, but how to define "regional"? A suggestion is to focus on reducing transportation distance and to make the consumer feel related to the producer (farmer).

Special issues about the feed market:

- There is a need to explain to farmers about how to include legumes into feed rations and the prices for this.
- There is a strong demand for alternative proteins to soybeans particularly in organic livestock production. Legumes form a natural part of organic farming (especially in dairy farming).
- The feed market is more dependent on policies than the food market – particularly due to the growing of legumes and importing of soybeans. There is a need for incentives to stimulate the demand for (European) legumes in the feed market.
- There is a need for investments in machinery for using legumes in feed manufacturing (on farm or in industry?).
- The demand for legumes in the feed sector is highly price sensitive.
- It is not possible to offer locally produced legumes in a feed context – there is simply not enough grown volumes.
- Legumes do have a potential as a non-GMO protein source and as part of a short supply chain.
- Using legumes for feed offers an opportunity to explore new markets for European legume crops.

Which market changes are needed?

- Croatia will stimulate local projects and facilitate bridge-building along the supply chain.
- Portugal: menus in food service are a good entry point for making a change. Here you find volumes, and demand for standardized products. Enough volumes (i.e. supplies of legumes) are essential for creating a real impact. Policy actions have contributed to promote healthy eating in public food service, and this has included promotion of legumes as part of the menus.
- It is necessary to include the small-scale producers into the supply chains by linking them up with market actors (retailers?).
- There is a need to include cooking skills in projects targeted at increasing the use and consumption of legumes, particularly dried legumes. Also consider to work with children as they are the future consumers by providing education about legumes in schools.
- Improved processing technologies are needed to inhibit the anti-nutritional factors of pulses, this technology could be enzymes.
- There is a need for a (price) competitive alternative to soybeans and soya-food.

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- If health is a key argument in the marketing of the legume-based product, then information on the packaging needs to be evidence-based.
- Transparency is a key issue in production and through the supply chain. Transparency and authenticity of regional products are fundamentals for a price difference compared to mass-produced legumes.

Most important changes needed for more legumes in food and feed supply chains and markets are:

- To really make a change: **find the big volumes in food and feed, and develop a continuous demand in the market** (especially possible in the feed industry).
- Increase production and establish a reliable and consistent supply. Increase quality of the production.
- Create better links between the actors of the supply chain (at local, national and international level), and include industry, retailers, food service, logistics and consumers. (This is also the case for the feed sector).
- Increase consumer awareness about legumes and provide better and more appealing products with improved taste and texture.
- Provide better marketing, recipes and more education to convince consumers about legumes.
- Improved technologies and more processing are needed to provide better food products.

Group 3: Policy and Society

*Summary by **Eszter Kelemen** (ESSRG, TRUE WP 7 deputy leader)*
Group facilitation: Bálint Balázs, Alicia Kolmans, Eszter Kelemen
The policy sessions had between 10 and 20 participants.

Hindering factors from a policy perspective:

- external costs of agriculture are not currently internalised;
- CAP is focused on production but there is a lack of capacity and funding across the supply chain, and no focus is put on the demand side;
- compartmentalisation of policy is an issue (shared responsibilities across ministries and regional actors), no coherence in policies; policy initiatives do not converge;
- polarisation: relevant policies operate at different levels (e.g. health policy, environmental policy, agricultural policy is driven from different decision-making levels – i.e. EU is a stronger player in one policy field, and national/regional authorities might be influential players in other fields);
- E.g. health policy: risks of eating meat is not communicated in Hungary, too frequent meat eating is the recommendation → inform and improve dietitian strategies;

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- time frames are essential (policy cycle vs time needed for education, vs time needed for transforming the supply chain);
- children are not educated on how to eat/use legumes incl. gardening, cooking etc., bring the whole topic into education;
- farmers lack knowledge on how to produce and process legumes → include legumes not only in the regular curriculum but also in the agricultural education;
- anti-nutrients inactivate during cooking and have a positive effect on human health, which should be promoted.

Stimulating factors from a policy perspective:

- incentivising legumes production by reducing the nitrogen use (focus on the nitrogen cycle) → issue stronger restrictions, this makes water and agricultural policies also relevant;
- incentivise the processing of legumes → economies of scale need to be considered;
- trade policies – we have free markets (is it good or bad? No conclusion reached);
- adaptation of legal standards for greening (e.g. harvesting time);
- to be open-minded to other sources of animal protein sources and combine them with legumes;
- system effects of farming: greenhouse gas emission and climate change adaptation to be used as arguments for a shift towards more legume production (CAP reform needed), subsidies could be lined up;
- generating demand;
- the cost side of production – legumes decrease the CO_2 emission of farming which makes farming more cost-effective → CO_2 certificates for food production would help consumers to choose food products on better information bases;
- better chances for organic farming.

Who is a responsible/powerful actor to issue policy changes?

- Relevant policy sectors at each level: environmental policies, health policies, nitrogen directive, conservation policy (Natura 2000), protein policies?
- EU Commission is vital to engage as well as national/federal governments
- Policymakers (and their interplay – interlinkages) at different scales, from regional to national and to EU level (considering the polarisation of policies)
- Association and extension services (esp. in the organic sector) & consultation is an important policy actor, also paying attention to info on marketing possibilities (which products can be sold at a high price on the market)
- Organic farmers & small-scale farmers – bottom-up initiatives to policy change, good examples, small-scale farmers are an ideal group to test new varieties and production/processing methods
- The policy should incentivise research institutes and gene banks to test alternative legume varieties → key players who control research funding to make legumes research of priority
- Final users (consumers?) – like in a concept of Payments for Environmental Services (PES), the final users could contribute financially to the support of farmers to grow
- Consumers (cannot be easily influenced by policy) – keywords can be traditional vs new food; they need information on the way of production, nudge

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Issues not addressed in rounds 1 and 2

- **technology**
- raw material to sell to the consumer
- policies to support domestic markets – regulating capitalism to generate sustainable businesses
- **jobs and growth** – how to link this to legume production?
- **SDGs**

Which Policy changes are needed?

Which changes are needed in short and long-term to have more legumes in the EU agrifood system?

- greening of CAP – ban the production of soybean in ecological focus areas OR ban the intensive production methods typically used for soybean production
- more legume varieties to produce
- changes in nutrition education: a broader range of policy instruments to use (going beyond providing information but also use other incentives, nudges or role model)
- changing people's diets with public support, i.e. through public food procurement and catering (governmental quotas on legumes in school feeding)
- results based agri-environmental payment system instead of hectare based subsidies → money should go more to public goods
- focus on protein quality in whole meal, not as a simple ingredient
- fight against nutritional hoaxes
- we should show that legumes are not as good as meat, but even better.

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4.2 Results of the final open discussion

Indicators of a well-functioning legume based system

- To identify indicators, we must find crucial categories of indicators. Developed indicators should be able to be applied in many steps in the quality chain so data collection will be very efficient. At the moment a specific **(the best) indicator to assess sustainability is not defined**. It needs meetings and collaboration with WP 5, 6 and 7 to define methods and indicators to then be able to focus on the topic itself.
- Indicators are hard to define but those that seem important to the participating stakeholders could be named and implemented, which can be an opportunity. The endpoint indicators could then be used as a starting point to **work back to the system**.
- At the end of the TRUE project, if you want indicators also to be used by farmers and consumers you need simple indicators, something **easy to understand**. Farmers are always interested in hectares and quantities, such as **percentage of legume grown on the farm**. If it is too abstract, then you can't explain it to people who should understand it in the end.
- One important thing is ecology in this context. Ecology is fundamental for sustainability. One should look for indicators that describe **soil fertility**, **nutrient balances** and so on. This should come first as a base, before looking at economics.
- Suggestion for an indicator: **sum of nitrogen lost** to the air and to groundwater. This could indicate amount of leguminous nitrogen and maybe even animal slurry.
- Recently discussed by some project partners was a **nutrient density environmental index**. Tells health value of a food plus the environmental impact of that food as a traffic light system. Idea is still developing but might be an easy tool for consumers and also retailers, and could then be used to influence both groups as well.

Upscaling regional/national Legume Networks

The networks which were presented are very interesting initiatives and nice to see how well they are rooted in the farming system with the potential to develop both, the processing system and the farming side of this. There must be outcomes from them on best farming practices and how to bridge the gap between different actors in the supply chain in the future. How can we grasp hold of these findings and transfer them to a larger European scale? Because what these networks achieve and challenges which are overcome by them are also big problems in other countries. Maybe through an international cooperation the problems could be tackled.

Changes of the Common Agricultural Policy (CAP) to support legume chains

- Change (reduce) the allowed **mineral nitrogen input**
- The **connection of crop production and livestock production** was discussed. These should not be so separated from each other as it is of now because then farmers would have to grow legumes to feed their animals
- More **direct funding** of the direct effects we want to have, like **biodiversity** or **rural livelihood**. But you would need a very smart system to do that.

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5. Field-trip Report: Insights into a successful lentil growers' initiative

Excursion to Lauteracher Alb-Feldfrüchte and the producers' association "Alb-Leisa" on the Swabian Alb, 80km south of Hohenheim. Woldemar Mammel, farmer and founder of the producers' association, gave an overview about the history of lentil growing in the region.

He reactivated the original varieties from a gene bank, invested in processing equipment and established a short supply chain.

Woldemar Mammel presenting his story

Self-made lentil and lupin pasta products

"Alb Leisa" processing site in Lauterach

History of "Alb-Leisa"

Lentil growing was common in the past but nearly disappeared since the 1950s. However, lentils are still a traditional and frequently consumed dish in South-West Germany.

1985: Woldemar Mammel started to grow lentils on only a few hectars
2001: Foundation of the **producer's association** Alb Leisa
2006: Re-discovery of two **historical Alb lentil varieties** in the Wawilow-Genebank in St. Petersburg, Russia
2007: Start of the **extensive augmentation** of the lentil seeds from the Genebank in green houses under controlled conditions
2011: The first variety of the historical **Alb lentils is sold for the first time** after more than 50 years, the second variety followed one year later
2014: The **product range is broadened** for other crops from the Swabian Alb
Today: More than **90 farmers belong to the producer's association**

www.alb-leisa.de

→ *see poster abstract No. 6 on page 15 for more details*

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Annex

Annex I - ELIN program

TUESDAY, 21 November

9:00 Registration and set-up of posters, Welcome Coffee and Snacks

SESSION I: Introduction

10:00 Welcome and opening remarks

- Alicia Kolmans, University of Hohenheim, Germany (moderation of the day)
- Pete Iannetta, TRUE-Coordinator, James Hutton Institute, United Kingdom

10:15 Protein Plant-Initiative Baden-Württemberg

- Verónica Schmidt-Cotta, Agricultural Technology Center (LTZ) Augustenberg, Germany

10:30 Market of innovators and innovations

- All participants - Presentation of legume-based innovations
(see poster session programm)

11:30 Refreshment break

SESSION II: Collating challenges and needs

11:45 Regional experiences

- Ulrich Quendt, Peas and Beans Network, LLH Hessen, Germany
- Sylvia Tschigg, Soy-Network, Lfl Bayern, Germany

12:05 Legume production, markets and policies – TRUE approach

- Sabine Zikeli, University of Hohenheim, Germany
- Karen Hamann, Institute for Food Studies and Agroindustrial Development, Denmark
- Balint Balazs, Environmental Social Science Research Group, Hungary

12:30 Working phase: World-Café Round 1+2

"Which CURRENT circumstances hinder/promote legumes in your part of the legume food and feed chains?"

Production environment (Moderation: Sabine Zikeli, UHOH/ Henrik Maaß, UHOH)
Markets & Economics (Moderation: Karen Hamann, IFAU/ Maria Gerster-Bentaya, UHOH)
Society & Policies (Balint Balazs, ESSRG/ Eszter Kelemen, ESSRG)

13:30 Legume based lunch

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SESSION III: Identification of leverage points

14:30 Assessments from the region

- Annett Gefrom, Lupin-Network, MV RC for Agriculture and Fisheries, Germany

14:40 Application of sustainability indicators to legume based – TRUE approach

- Marko Debeljak, Jozef Stefan Institute, Slovenia

15:00 Working Phase: World-Café Round 3
"Which FUTURE changes are needed for achieving more legumes in food and feed chains?"
Production environment (Moderation: Sabine Zikeli, UHOH/ Henrik Maaß, UHOH)
Markets & Economics (Moderation: Karen Hamann, IFAU/ Maria Gerster-Bentaya, UHOH)
Society & Policies (Balint Balazs, ESSRG/ Eszter Kelemen, UHOH)

15:45 Refreshment break

SESSION IV: Wrap up and conclusions

16:00 World Café summary and conclusions

- Group moderators, all participants

16:30 What are the best indicators of sustainable legume based systems?

- Marko Debeljak, Jozef Stefan Institute/ TRUE, Slovenia

16:50 General open discussion

- all participants

17:30 Closing remarks

- Alicia Kolmans, University of Hohenheim/ TRUE, Germany
- Pete Iannetta, TRUE-Coordinator, James Hutton Institute, United Kingdom

18:00 Informal get-together
(between posters and with legume based fingerfood)

WEDNESDAY, 22 November

8:00 Excursion to "Alb-Leisa"/ Lauteracher Alb-Feldfrüchte, Swabian Alb (80 km from Stuttgart)

- Insights into a successful lentil growers' initiative/ visit of growing, processing and selling sites

13:00 END OF WORKSHOP

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Annex II - Participants

Table 1: Number of participants of each stakeholder group (multiple selection allowed)

Scientist	Producer	Retailer	Processor	Breeder	Consumer	Coordinator	Advisor	Other
33	9	7	7	4	10	8	11	10

Table 2: Number of participants working with the different types of legumes (multiple selection allowed)

Faba bean	Soy bean	Lentil	Lupin	Chick-pea	Pea	Clover	Common bean	Cow-pea	Lucerne	Forages	French Pea	Others
20	22	16	14	9	24	14	15	3	11	7	4	17

Table 3: "What is your market?" Participants' main focusses

	local	national	intern.	conv.	organic	food	feed	other
peas	4	2	4	6	8	10	3	2
beans	4	6	6	6	8	8	3	-
soybeans	1	4	5	3	3	3	4	-
chickpeas	-	2	2	3	4	3	1	-
lupins	-	2	-	1	2	2	-	1
lentils	-	1	2	3	4	8	-	-
clover	-	1	2	3	2	-	2	1
alfalfa	-	1	2	2	1	-	2	1

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Annex III - Presentation & poster pdfs

The webpage on the TRUE website with the below lists of Presentation and Poster pdf files is https://www.true-project.eu/lin-workshops/continental/documentation/

Presentations

- TRansition paths to sUstainable legume-based systems in Europe - Pete Iannetta, TRUE-Coordinator, James Hutton Institute, United Kingdom
- The protein initiative in Baden-Württemberg and similar projects - Verónica Schmidt-Cotta, Agricultural Technology Center (LTZ) Augustenberg, Germany
- Demonstration and knowledge transfer network for expanding and improving cultivation and utilisation of field peas and field beans in Germany - Ulrich Quendt, Peas and Beans Network, LLH Hessen, Germany
- Soy Network to improve the cultivation and utilization of soybeans in Germany - Sylvia Tschigg, Soy-Network, Lfl Bayern, Germany
- Introducing the Production Sessions - Sabine Zikeli, University of Hohenheim, Germany
- Introducing the Market and Policies Sessions - Karen Hamann, IFAU, Denmark; Eszter Kelemen and Bálint Balázs, ESSRG, Hungary
- Experiences of the LUPIN-NETWORK/ Leverage points for legume based food- & feed chains - Annett Gefrom, Lupin-Network, MV RC for Agriculture and Fisheries, Germany
- Application of sustainability indicators to legume based systems – TRUE approach - Marko Debeljak, Jozef Stefan Institute, Slovenia

Poster

No. 1) Endophytic Fusarium equiseti stimulates plant growth and reduces root rot disease of pea (Pisum sativum L.) - Adnan Šišić, University of Kassel, Germany

No. 2) Susceptibility of Potentially Useful Cover Crop Species to Soil-borne Pathogens - Maria Finckh, University of Kassel, Germany

No. 3) Legume production in Croatia - Mislav Marelja, Luma-prom doo, Croatia

No. 4) Usage of the leguminous plants in green manuring at Home farm Vukelić - Amalka Vukelić, Centar Dr. Rudolfa Steinera, Croatia

No. 5) Pulses in short food supply chains – from small-scale farms to urban gastronomy - Attila Krall, Agri Kulti Nonprofit Ltd., Hungary

No. 6) Why is lentil (lens culinaris) cultivation a story of success in south-west Germany? - Ann-Marleen Rieps, University of Hohenheim, Germany

No. 7) Why is soybean (Glycine max) cultivation a story of success in south-west Germany? - Ann-Marleen Rieps, University of Hohenheim, Germany

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No. 8) The global field project in Berlin and the proportion of protein plants globally - Sophia Tadesse, 2000 m²/Global Field Berlin, Germany

No. 9) Exemplary Demonstration Network for Cultivation and Utilization of Lupins: "Lupin-Network" - Annett Gefrom, Mecklenburg-Vorpommern Research Centre for Agriculture and Fisheries, Project coordination LUPINEN-NETZWERK, Germany

No. 10) Science, economy and society – making ecosystem services from legumes competitive (A research strategy of the German Agricultural Research Alliance, DAFA) - Martin Köchy, German Agricultural Research Alliance (DAFA), Germany

No. 11) Soy-Network: A demonstration network to expand and improve the cultivation and utilization of soybeans in Germany - Sylvia Tschigg, Bavarian Institute for Agriculture, Project coordination "Soja-Netzwerk", Germany

No. 12) Establishment of a knowledge transfer network for cultivation and utilisation of field peas and field beans in Germany (DemoNetErBo) - Ulrich Quendt, Department for Agriculture Hessen, Project coordination "Demonstrationsnetzwerk Erbse/Bohne", Germany

No. 13) LeguAN Project - Bruno Kezeya Sepngang, University for Applied Sciences SWF, Germany

No. 14) Transition paths to sustainable legume based systems in Europe (TRUE): General project information - Henrik Maaß, University of Hohenheim, Germany

No. 15) Overview of WP3 (Nutrition and Product Development): Tasks to be developed within - Ana Maria Gomes, Universidade Católica Portuguesa, Portugal

No. 16) Innovative Cooking with Pulses - Cecilia Antoni, Beanbeat.de, Germany

No. 17) ECOTOAST®: "Roast you legume on you own farm" - The first compact roast (Toast) plant in the world - Lutz Wudtke, agrel GmbH agar entwicklungs labor, Germany

No. 18) SILATOAST (Pea/Field Bean): Combined fermentation and thermical treatment - Lutz Wudtke, agrel GmbH agar entwicklungs labor, Germany

No. 19) Blue lupine (Lupinus angustifolius) as ingredient in aquaculture feed - Monika Weiß, Alfred-Wegener-Institute for Polar and Marine Research, Germany

No. 20) Cereal-legume intercropping for more environmentally- and economically-sustainable brewing and distilling - Pietro Iannetta, James Hutton Institute, Scotland, UK

No. 21) Schwarzwald-MISO - Peter Koch, Schwarzwald-Miso, Germany

No. 22) Premium Fava beans - Alexander Rosenow, Fava Trading GmbH & Co. KG, Germany

No No.) Biofarm Lentil Project - Hans Georg Kessler, Biofarm Genossenschaft, Switzerland

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Annex IV – Results of discussions (pictures)

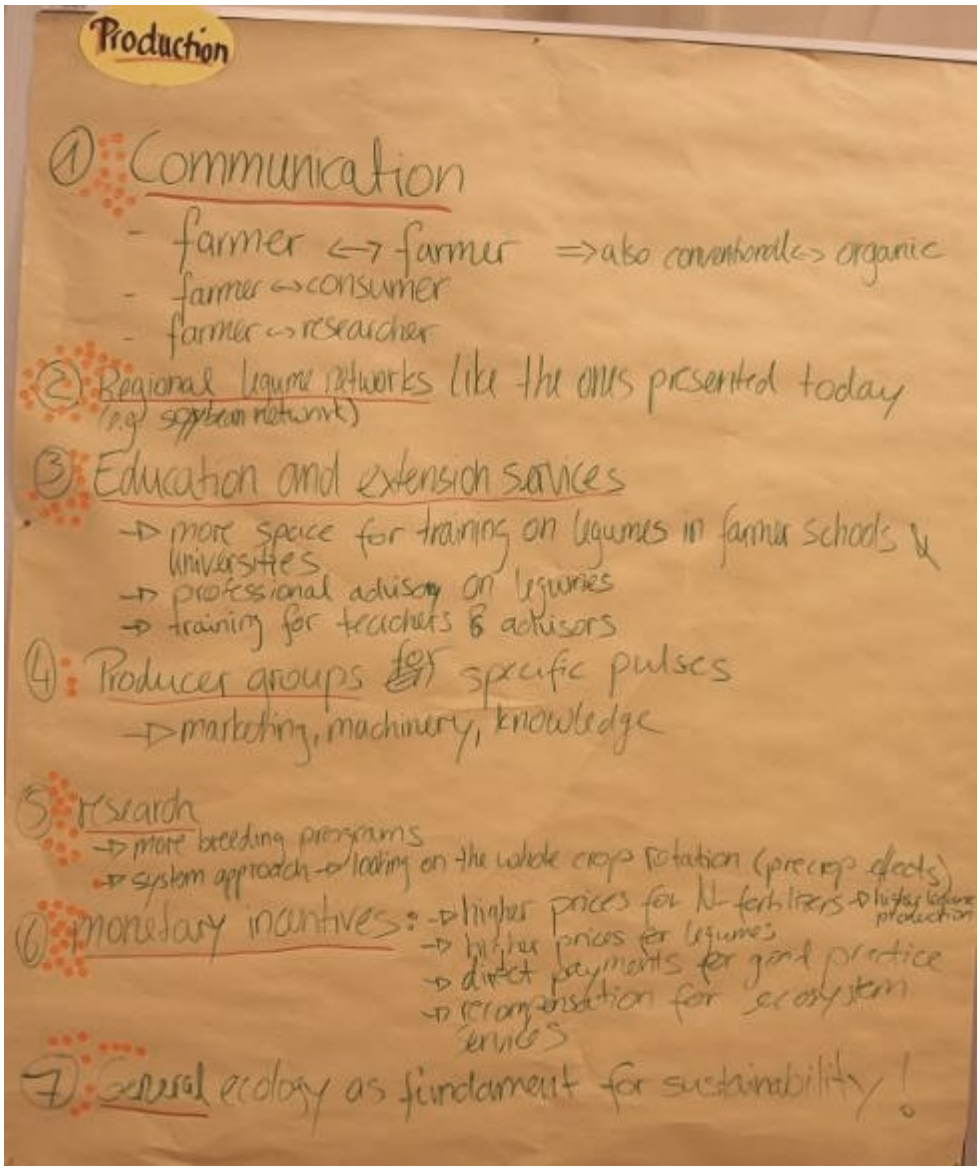

Figure 1: Final prioritisation of **production** group results : Communication=**14**; Regional Legume Networks=**23**; Education and extension services=**12**; Producer groups=**3**; Research=**14**; Monetary incentives=**16**; General ecology as fundament for sustainability=**11**

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Figure 2: Final prioritisation of **market** group results:
Production=**6**; Feed market=**3**; Infrastructure=**2**; Market supply=**3**; Marketing=**14**; Transparency=**16**; Consumer habits=**19**; Consumer education=**21**; Processing=**10**; high volume trading=**1**

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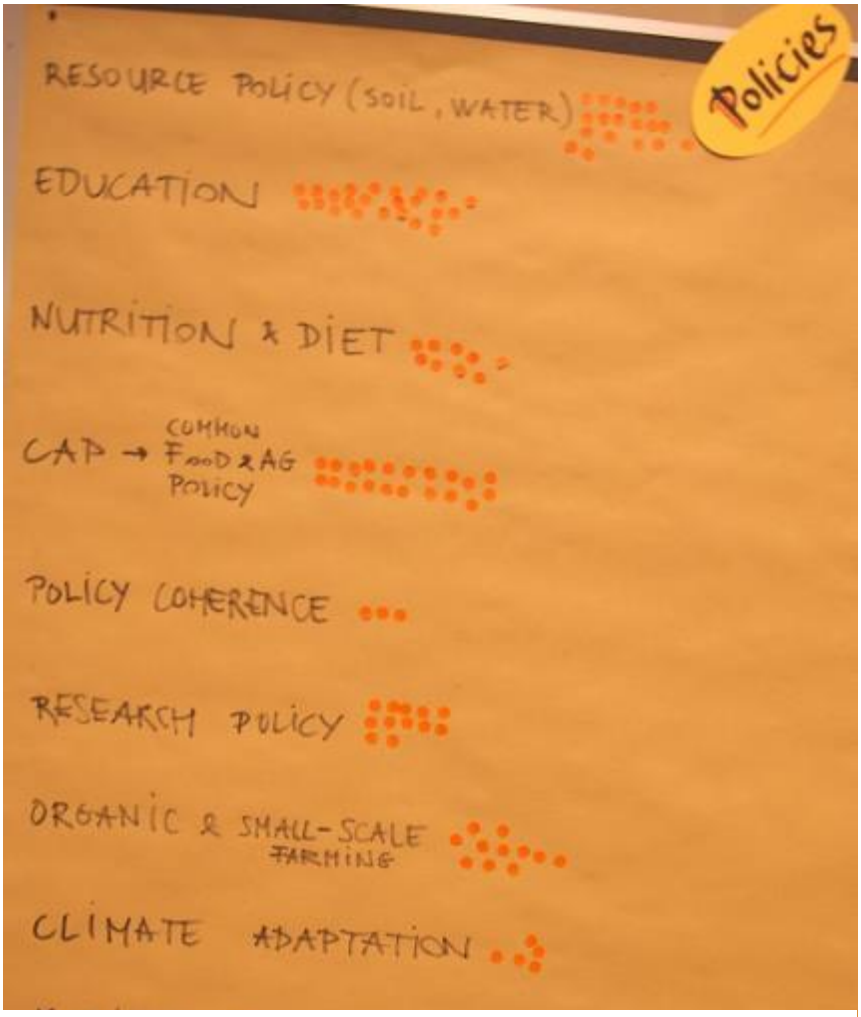

Figure 3: Final prioritisation of **policy** group results:
Resource policy=**18**; Education=**23**; Nutrition & Diet=**9**; CAP=**20**; Policy coherence=**3**; Research policy=**12**; Organic & small scale farming=**11**; Climate adaption=**5**; Market policy=**3**

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