ICOAS '18

6th International Conference on Organic Agriculture Sciences

DYNAMIC DEVELOPMENTS IN ORGANIC RESEARCH

Strengthening partnerships across Europe and beyond

BOOK OF ABSTRACTS

7 – 9 November 2018
Esterházy Palace
Eisenstadt, Austria

Foreword

The present Book of Abstracts includes the abstracts of the scientific contributions presented at the 6th International Conference on Organic Agriculture Sciences (ICOAS), held 7 – 9 November 2018 in Eisenstadt, Austria. The 80 contributions, oral and poster presentations alike, from 26 countries show that ICOAS is an important hub for presenting significant research results on organic agriculture in Europe and beyond.

As the big challenges of organic agriculture cannot be addressed by single researchers, the main purpose of ICOAS is to share latest research results on organic agriculture in Central and Eastern Europe among scientists and other stakeholders. ICOAS, therefore, fosters the strong partnership across stakeholders in these countries. Knowledge dissemination and capacity building along the value chain in Central and Eastern European countries are the main focal point of ICOAS.

For the first time ICOAS 2018 is held in Austria. After a longstanding collaboration in various agricultural fields, the Austrian Research Institute on Organic Agriculture (FiBL) and Esterhazy Betriebe GmbH decided to jointly organize ICOAS 2018. Eisenstadt, located in Eastern Austria, was chosen as it is the perfect location for ICOAS – building a bridge between Central and East European countries.
In the present Book of Abstracts you find the scientific contributions presented at ICOAS 2018 compiled. From the numerous submissions following the open call for abstracts, the contributions presented were selected in a two-step reviewing process. Each abstract was reviewed by two independent reviewers before a final decision was made by the Scientific Committee. The organisers of ICOAS 2018 would like to thank all the reviewers for their support in the reviewing process – you can find the list of reviewers at the end of this book.

The first part of the Book of Abstract includes the abstracts of the oral presentations given during the 16 parallel sessions. The second part contains the abstracts of the two poster sessions. Within the two parts the abstracts are sorted in alphabetical order according to the authors' names.

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Oral Presentations

Content overview

Poster Presentations

Content overview

Regional and supra-regional market relations of dairy farms in two Austrian regions

Bartel-Kratochvil, R.; Markut, R.; Scheuch, M.; Schweiger, S.; Drapela, T.; Weisshaidinger, R.
Research Institute of Organic Agriculture (FiBL), Austria

Regionally labelled food – food linked to and branded with specific localities – gain increasing attention by politics as well as marketing and consumers. However, the definition of "regional" referred to by labels or production standards is mostly fuzzy. In the present study we focus on input- and output-side market relations of dairy farms producing regionally labelled milk as well as the implications exerting from underlying private production standards.

We used the SMART-Farm Tool (Schader et al. 2016) to assess the sustainability of dairy farms, located in the Austrian regions "Osttirol" and "Ötscherland" (n=13 farms per region). For our analysis we choose 13 indicators of 327 SMART indicators, representing the farms input- and output-side.

The results for the sale-side indicators suggest a relatively weak interconnectedness of the farms with their surrounding region although farms seem to be well grounded concerning their market relations in general: The majority of the farm sales are sold to the main customer (ID 751 and 83, Table 1), the dairy 100 km (and more) away. Direct sales and on-farm processing (ID 141 and 145) are of minor importance. In both regions, farmers are able to fall back on certain sources of income besides farming (ID 158), are gaining relatively high producer prices (ID 161) and established long-term relationships to their customers (ID 149). If buyers drop out, farmers will most likely find alternative markets for their products (ID 84).

Similar to the customer side, supply of farm inputs is evaluated to be quite secure (ID 88). Inputs stem from contracted or stable long-term suppliers to a high extent (ID 93). Whereas the mean of the farms prioritize and purchase their most important farm inputs within their region (ID 794, 792), the inputs are mainly produced outside the region, especially in the case of Osttirol (ID 793). One of the main reasons therefor is that the brand´s standard requires concentrate feed solely of national origin. Due to the region's peripheral position, farmers have to purchase it from arable regions in the north-eastern parts of Austria instead of neighbouring Italian regions. Thus, taking national borders as preconditions for production standards should be questioned. In contrast, we suggest to orient regional definitions for such production standards towards the stakeholder's everyday life-perception of a region or functional relations (e.g. market relations of farm input and outputs).

ID	Indicator	Osttirol				Ötscherland			
		Mean	Maximum	Minimum	StDev.	mean	Maximum	Minimum	StDev.
83	SalesDiversification	0,62	0,75	0,50	0,13	0,67	0,75	0,50	0,12
84	AvailabilityAlternativeMarkets	1,00	1,00	1,00	0,00	1,00	1,00	1,00	0,00
88	FarmInputsSecureSupply	0,92	1,00	0,00	0,28	1,00	1,00	1,00	0,00
93	CooperationSuppliersQuality	1,00	1,00	1,00	0,00	0,98	1,00	0,80	0,06
141	DirectSales	0,04	0,25	0,00	0,09	0,06	0,50	0,00	0,16
145	OnFarmProcessing	0,00	0,01	0,00	0,00	0,13	0,80	0,00	0,31
149	LengthCustomerRelationshios	0,87	1,00	0,00	0,33	1,00	1,00	1,00	0,00
158	DiversificationIncome	0,67	1,00	0,00	0,40	0,77	1,00	0,00	0,27
161	ProducerPriceVsMarketPriceLevel	1,00	1,00	1,00	0,00	1,00	1,00	1,00	0,00
751	DependencyMainCustomer	0,37	0,50	0,15	0,11	0,31	0,50	0,13	0,10
794	LocalProcurementAwareness	0,52	0,75	0,25	0,26	0,75	0,75	0,75	0,00
793	LocalProcurementProducerLevel_Calculated	0,19	0,51	0,01	0,14	0,90	1,00	0,70	0,09
792	LocalProcurementSupplierLevel_Calculated	0,93	1,00	0,75	0,10	1,00	1,00	0,97	0,01

Table 1. Mean, Maximum, Minimum and Standard Deviation of the Indicator Scores for Osttirol and Ötscherland

Schader C., Baumgart L., Landert J., Muller A., Ssebunya B., Blockeel J., Weisshaidinger R., Petrasek R., Mészáros D., Padel S., Gerrard C., Smith L., Lindenthal T., Niggli U. and Stolze M. (2016) Using the Sustainability Monitoring and Assessment Routine (SMART) for the Systematic Analysis of Trade-Offs and Synergies between Sustainability Dimensions and Themes at Farm Level. Sustainability 2016, 8(3), 274.

Community financing in the German organic food sector – an alternative to traditional credit financing?

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Farms and firms along the value chain for organic food in Germany increasingly complement or substitute traditional credit financing with financing models which base upon citizen participation. These community financing models range from pure financing instruments such as crowdfunding or profit participation rights to community supported agriculture or cooperatives which provide land to organic farmers at a reasonable price. While an increasing body of literature deals with so-called alternative food networks which mainly refer to alternative modes of food production or provisioning and usually imply a reduced distance between producers and consumers (Forssell and Lankoski 2015), research on the role of consumers or citizens as investors is quite limited.

Against this background, we conducted an online survey among firms which have already gained experiences with community financing models. It aimed at understanding why firms choose these models, to which extent they contribute to the overall financing of the firm and which kind of investment projects they are used for. A total of 45 firms responded to the survey.

In order to explore the investors' perspective and further examine the legal, organizational and social characteristics as well as potentials and challenges of particular community financing models, we currently carry out a series of in-depth case studies. Considering the state of research of the different financing models and their relevance in practice, we selected four models (cooperatives, crowdfunding, profit participation rights and so-called 'Bürgeraktiengesellschaft') as cases in an embedded multiple-case design (Yin and Campbell 2018). For each model, we consider 2-4 firms and their community financing projects as units of analysis.
Our results suggest that motives for utilizing community financing are as diverse as the models themselves. While a considerable share of respondents in our online survey mention economic reasons, e.g. community financing as a marketing instrument to increase customer retention or their lacking access to finance, others emphasize ideological reasons such as their disapproval of the conventional economic system. Furthermore, community financing complements rather than substitutes traditional credit financing. However, most respondents regard community financing as important or very important for their firm, e.g. due to its relevance in terms of marketing.

These first results are validated and complemented by doing case study research. In our presentation, we will also provide first insights from the case studies.

Forssell, Sini; Lankoski, Leena (2015): The sustainability promise of alternative food networks: an examination through "alternative" characteristics. In Agriculture and Human Values 32 (1), pp. 63–75.

Yin, Robert K.; Campbell, Donald T. (2018): Case study research and applications. Design and methods. Sixth edition. Thousand Oaks, California: SAGE Publications, Inc.

Employment effects relating to organic market development in Eastern Europe – The case of Ukraine

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There exists broad evidence that organic agriculture has a positive environmental impact. Employment effects relating to organic sector development are documented for Western European contexts, arguing that organic agriculture is more labor intensive, and thus contributes positively to employment generation. For Eastern European conditions, where rather big farm structures dominate, linked mainly to arable crop production for export, such information is lacking. In the context of the Swiss Ukrainian Organic Market Development project, a socio-economic study was elaborated to assess the development, competitiveness, and employment effects of the organic sector in Ukraine during the last 10 years.

The study relies on different sources of information. Most important are the findings obtained through an online survey sent to more than 600 sector stakeholders, from which 140 completed the survey. The information obtained by this mean, using simple comparative statistics, was complemented with information acquired through expert interviews, company case studies, literature review, and focus group research.

Findings show that especially in the initial years export opportunities for different arable crops has motivated the development of the organic sector in Ukraine. Organic land has grown in average by 13 % per year, reaching 400'000 hectares of organically certified land in recent years. Since shifting from conventional to organic production involves commonly important investments in machinery to improve weed management, net employment effects directly relating to organic arable crop production are very low or can be even negative, as less labor is required in crop management. Overall, as less than 1.5 working days are required in average for arable crop production, big employment effects found rather relate to new organic business ventures relating to labor intensive crops, such as berries and herbs, both cultivated and wild collected. Here, employment effects per ha are very high, with almost 500 working days in case of organic raspberry production and around 300 working days in case of organic strawberry production. Moreover, highly relevant new jobs were created relating to processing, retail and the development of new sector services. Driven by both export opportunities and an increasing interest and demand for organic produce in recent years within Ukraine, many new businesses were started, thus creating new jobs 'from scratch'. All in all, the study calculates the creation of around 2'600 newly created Full Time Equivalent (FTE) jobs thanks to organic sector development in Ukraine.

The study concludes that net employment effects relating to organic arable crop production in well-managed big Eastern European farms are much lower than the ones reported for other countries, with small production structures, where organic production tends to involve more labor by facing constraints in efficient mechanization. In any case, interventions aiming to boost employment through organic sector development requires a crop-specific reflection, prioritizing competitive crops where cultivation or processing create important employment effects. This reflection should also carefully consider where jobs are created (i.e. rural versus urban areas), for whom (e.g. youth) and what development perspective these jobs create for both the persons and geographical contexts involved.

Collaborative short food supply chains

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The University of Hohenheim (UHOH), SMARTCHAIN Coordinator, has a long experience in different type of EU projects (e.g. FP7, H2020, EIT Food, ERASMUS+, SUSFOOD2). For the successful implementation of SMARTCHAIN, UHOH will use collected results and tools from previous EU projects, as for example FP7 TRAFOON project (www.trafoon.eu). TRAFOON was an accompanying measure project focused on the knowledge transfer of research results on traditional foods to food producing SMEs with a focus on food products made of grains, fish, fruits, vegetables and mushrooms. Its partnership was made of a network of 30 research institutions, technology transfer agencies and SME associations. Among other results and tools, SMARTCHAIN will benefit from TRAFOON Consolidated Strategic Research and Innovation Agenda at European Level and the INFOSHOP (web-based tool – Information Shop, www.trafoon.org).

SMARTCHAIN is an ambitious, project with 43 partners from 11 European countries including key stakeholders from the domain of short food supply chain as actors in the project. The central objective is to foster and accelerate the shift towards collaborative short food supply chains and, through concrete actions and recommendations, to introduce new robust business models and innovative practical solutions that enhance the competitiveness and sustainability of the European agri-food system.

Using bottom-up, demand-driven research, the SMARTCHAIN consortium i) will perform a multi-perspective analysis of 18 case studies of short food supply chains in terms of technological, regulatory, social, economic and environmental factors, ii) will assess the linkages and interactions among all stakeholders involved in short food supply chains and iii) will identify the key parameters that influence sustainable food production and rural development among different regions in Europe.

The project aims to establish 9 national communities of short food supply chains (Innovation and Collaboration Hubs) in different partner countries (France, Germany, Greece, Hungary, Italy, Netherlands, Serbia, Spain and Switzerland) and a virtual innovation hub in order to facilitate stakeholder engagement, bringing farmers and consumers together in a trust-enhancing environment enabling them to generate demand driven-innovations.
Combination of scientific and practical knowledge and the use of innovation workshops will enable the development of practical innovative solutions as well as the promotion of a framework for different forms of collaborative short food supply chains in urban and rural areas. SMARTCHAIN will generate concrete actions for knowledge transfer, through the organisation of multi-stakeholder workshops and training activities for farmers and short food supply chain entrepreneurs.

Development of indicators set for assessing sustainability of organic and conventional farms

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In this study, we develop a Sustainability Indicator (SI) set to assess the sustainability of organic farming systems holistically in a developing country. The literature in this area is lacking in three aspects. Firstly, most studies rely on SI sets that are applicable to developed countries, and are not customized for developing nations. Secondly, most studies ignore the concerns of the farmers by using a top-down assessment relying on expert opinion. Thirdly, existing studies pay insufficient consideration to the social dimension in sustainability assessment. We seek to address these issues by developing a SI set to compare the sustainability of organic and conventional farms in the Middle Gujarat Agro-climatic region in India. We develop SI indicators at the farm/parcel level for an annual time scale. Assessing sustainability at the farm level is important as it is the unit where management decisions regarding farming are taken. A time period of 1 year ensures that all cropping seasons are covered. We use the MESMIS systems framework (López-Ridaura, Masera and Astier, 2002) to conceptually ground our SI set. The MESMIS framework allows for a comparative assessment of sustainability and enables us to customize our indicators for Gujarat by integrating a top-down and bottom-up view of sustainability. The framework assesses sustainability based on seven attributes of Productivity, Resilience, Stability, Reliability, adaptability, self-reliance and equity. We use a participatory approach combining top-down and bottom-up views to guide the identification of indicators. We take inputs from multiple stakeholder groups comprising experts, policy makers, farmers, and members of NGO's to identify Critical points and possible indicators. We also develop an external list of indicators linked to the identified Critical Points. We select indicators for the SI set from the above list by assessing them for relevance, practicality and end user value. We check the developed list of indicators for sufficiency by ensuring that all attributes identified in the MESMIS framework are covered. Our final set contains twenty two SI linked to the seven attributes of Productivity (Benefit to Cost ratio, land productivity); Resilience, Stability, Reliability (Soil Quality, Soil Conserving Practices, Groundwater conserving practices, Groundwater use, Energy use, Crop-diversity, farm income diversification, Value addition, Channels for selling produce, presence of assured market, satisfaction, health, and Organizational support); adaptability (Access to information and training, and No of Innovations Adopted), self-reliance (% own Inputs/ % Total Inputs and External subsidy /ha) and equity (Working Condition, Treatment to Workers and Gender equality) covering the three dimensions of sustainability. We believe our study can help in comparative assessments of sustainability for developing country contexts.

Lessons learned from phase-outs – the case of the peat phase-out in the United Kingdom.

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Peat has not always been widely used as growing media. In the 1940s, ready-mixed composts started to become available to purchase in the United Kingdom and peat often featured as an ingredient. By the 1970s, many of the products on sale contained a high percentage of peat, due to its low cost and because it behaves in a predictable way. Lowland raised bogs are the most common source of peat and are unique habitats as well as important sites of sequestered carbon. Peat accumulates at a typical rate of just 1mm per year, so a 1m layer takes 1,000 years to form - it is not a renewable resource and can be better described as a young fossil fuel. Around 94% of the UK's area of lowland raised bog has been destroyed or damaged to some extent and extraction is still ongoing to supplement imports of peat from overseas.

Peat is still a permitted input in commercial organic growing, being particularly important in media for vegetable transplants and in mushroom production. In addition, the nation's gardens are increasingly recognised for their value as habitat for wildlife and there is some awareness among gardeners that using peat is an ecologically poor choice, although uptake of peat-free growing media is still low. There have been problems with the quality and reproducibility of peat-free compost but for several years, a range of brands derived from materials such as composted bark, coir and municipal 'green waste'; these are generally of good quality and perform consistently from year to year, receiving consumer awards and being comparable in price to those containing peat. The expanding availability of these peat-free blends means that more and more professional growers are phasing out their use of peat. Many high-profile gardens, including those run by the Royal Horticultural Society and the National Trust, have operated without the use of peat for many years. Despite this, in 2018, most garden centres still only stock one brand of peat-free growing media but sell a wide range of high peat content products, including some which are 100% peat.

In 2010, the government of the United Kingdom set targets to phase out peat from the amateur gardening market by 2020 and from professional horticulture by 2030. These targets, however, are voluntary and rely on the action of the industry itself. Progress has been slower than anticipated by many as will be discussed in the presentation. The use of peat as growing media is in organic growing is one of the contentious inputs to be addressed by the Organic-PLUS project.

PROVE. Empowering local networks for a more sustainable future

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Small scale farmers can play a crucial role in establishing local sustainable food systems, allowing the decrease of the distance between producers and consumers and the implementation of more ecological and context-specific organic agro-practices, with implications in the environment and the health. Small scale farmers, especially small scale organic farmers however, have many difficulties to respond to the needs of consumers and to compete with the offer of big scale producers. PROVE is a project designed to address those challenges. PROVE program provides tools, training, and partnerships to empower small scale farmers in organized local networks for direct commercialization of local seasonal fruits and vegetables, based on collaborative work and TIC tools. After 14 years, PROVE grown to a national-wide project, comprising 153 small scale farmers organised in 97 local groups across the country, and more than 4000 consumers in 2018. The number of organic farming units as also increased significantly in the same period.

INHERIT research project (www.inherit.pt) identified PROVE as one European promising practice in the consuming area, with expected intersectoral impacts in environment (more sustainable farming), health (promoting fruit and vegetables consumption) and health inequalities (empowering lower socioeconomic farmers; improving access of seasonal fruits and vegetables). In this communication we present the evaluation research of PROVE processes and impacts developed under INHERIT inter-sectorial perspective. Based on Behaviour Wheel Model, key theoretical pathways under which PROVE can influence farmer network collaboration and consumers diets are addressed. Two surveys are specifically devised to account for these dimensions and applied to the universe of PROVE consumers (N=4.015) and producers (N=153). Equation Structural Models are conducted to study the hypothesis that PROVE shapes opportunities, capabilities and individual motivation of consumers and farmers for more sustainable behaviours. Additionally, impact assessment is analysed with the comparison of PROVE users and PROVE, resorting to complementary data collections (European Social Survey, INHERIT Household survey). Matching group techniques are applied to ensure comparability between primary and secondary data ad logistic regression models are applied to evaluate PROVE influence in farmers work empowerment resorting (European Social Survey) and in consumers diets (INHERIT Household survey). PROVE role in promoting sustainable local consumption and production is discussed.

Effect of cover crops on the level of soil moisture in a Hungarian vineyard

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It is well known that one-sided mechanical soil cultivation of vineyard inter-rows has many disadvantages. Farmers can choose from alternative tillage technologies, such as the usage of green manure, or covering the inter-rows with straw mulch. Another option is to use species-rich seed mixtures. Species rich cover crop technology has many advantages: 1) it helps to prevent erosion and creates easier cultivation circumstances, 2) it has a positive effect on soil structure, soil fertility and ecosystem services, 3) we can create native mixtures from local provenance, adapted to the local climate/ vineyard which enhances the nature conservation value of the site. However, sown species should not compete significantly with the grapevines, or negatively influence produce quality. In 2012 we created and started to study three different cover-crop mixtures in Hungarian wine regions under on-farm conditions, compared to a control treatment. The results of the botanical surveys, yield and pruning weight were already published (e.g. Miglécz et al. 2015). Moreover, we investigated soil moisture (vol %) of different treatments (Biocont-Ecovin mixture, Mixture of Legumes, Mixture of Grass and Forbs, compared to coverage with Lolium perenne, and Control (spontaneous weed flora) at the Feind Winery in Balatonfőkajár (Hungary). The investigated variety is Welschriesling on loamy soil (Tihany Formation), planted in 2010. The seed mixtures were sown in the spring of 2013. We measured soil moisture in 2015, at two sampling dates (April and June) using a digital measuring device (Kapacitív Ltd.). For 2015 the rate of sown species in the inter-rows were as follows: Biocont-Ecovin mixture, 65%; Mixture of Legumes, 89%; Mixture of Grass and Forbs: 79%; Lolium perenne: 96%. During sampling soil moisture content was measured every 10 cm depth per sampling point in five replicates, from 10–70 cm. A one-way multivariate analysis of variance was run to determine the effect of seed mixtures on soil moisture contents. We found significant differences of soil moisture in case of the Lolium perenne treatment compared to the Grass-forb, and Control treatments in 40–70 cm depth: $F(24, 402) = 2{,}497$, $p < .0005$; Wilks' $\Lambda = .616$; partial $\eta^2 = .114$. Lolium treatment proved to allow significantly less moisture accumulation in soil on these leveles. The results are in accordance with previous research that state that the use of Lolium perenne in the inter-rows can be sustainable only in case of at least 7-800 mm precipitation/year, or under irrigated conditions. Among the three species-rich mixtures we have not found significant differences, but the results show that the Grass-forb mixture (with Plantago lanceolata domination) utilized the least moisture from the soil.

Miglécz T, Valkó O, Török P, Deák B, Kelemen A, Donkó Á, Drexler D, Tóthmérész B: Establishment of three cover crop mixtures in vineyards. SCIENTIA HORTICULTURAE 197: pp. 117-123. (2015)

Biodiversity performance of organic farms in Austria – results from eight years of biodiversity assessment

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Assessing the biodiversity performance of agricultural farms has gained importance in recent years since conserving and promoting biodiversity and associated ecosystem functions in cultural landscapes is a key aspect in making agriculture more sustainable – a demand expressed in science, politics and society. This contribution presents results from eight years of biodiversity assessments on organic farms in Austria applying a method developed at FiBL that estimates the biodiversity potential of agricultural farms (Schader et al. 2014). The assessment method covers the entire farm and its core consists of 99 parameters concerning agricultural practices and semi-natural habitats and their impacts on the diversity of eleven indicator species groups (e.g. soil fauna, vascular plants, birds, grasshoppers and spiders). These impacts were evaluated semi-quantitatively by expert judgements and aggregated for each parameter across all eleven indicator species groups based on food-web relationships between these groups in agricultural ecosystems in Austria. A farm gets a share of these parameter scores according to the agricultural practices carried out on the farm and a biodiversity potential is calculated ranging from 0 % to 100 %, where 100 % would be reached with the highest possible scores for all parameters.

Since 2010 more than 300 organic farms have been assessed using this method. The approach proved to be feasible and efficient. It provides plausible results at the farm level and it allows for conclusions on farming practices and farming systems. The results from eight years applying the method show that the biodiversity performance of organic farms varies considerably. While most farms achieved high scores in parameters covering farming practices, there exists potential for improvement mainly regarding semi-natural habitats – which play an essential role in conserving biodiversity in agricultural landscapes. This contribution will give an overview of accomplished assessments covering a range of farm types and regions across Austria. Strengths and potentials for improvement concerning conserving and promoting on-farm biodiversity will be discussed.

Schader et al. (2014) Farm- and product-level biodiversity assessment of conventional and organic dairy production in Austria. Int J Biodiv Sci Ecosyst Serv Manag 10, 20–39

Success and failure factors of crop diversification across Europe

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Temporal and spatial diversification of crops can make farming systems more resource efficient, productive and resilient. The EU Horizon 2020 project DiverIMPACTS aims to promote the realisation of crop diversification by demonstrating its benefits along the value chain and by providing innovations that can remove existing barriers of practical diffusion. To gain overview of existing crop diversification experiences (CDEs) in Europe, we conducted an extensive on-line survey to identify and analyse factors of their success and failure.

The online survey was developed with the programme LimeSurvey. The survey included 72 questions in 3 sections. January-April 2018 altogether 129 valid responses were received from 15 European countries. The survey was analysed with SPSS Version 22.

Rotation was performed singly or in combination with multicropping and/or intercropping in 71 % of all reported CDEs, multicropping and intercropping both in around 29 % of the initiatives. Most CDEs were reported from arable cropping (86 %, among these 27 % with animals). Vegetables were cultivated in 25 % of the initiatives (among these 5 % with animals). Regarding certification statuses of areas non-organic and organic both have a share of around 40 %, with slightly more non-organic initiatives reported.

Two thirds of the reported CDEs were evaluated as overall successful or very successful (58 % and 8 %), while only 1 initiative was rated as not at all successful. The most common targeted outcomes of CDEs were improved environmental preservation (62 %), improved crop production stability (52 %) and higher economic income (52 %). Main factors contributing to failure were market conditions, amount of financial resources committed and availability of inputs (including seeds). The main factors contributing to success were commitment and professional expertise of involved actors. Agronomic expertise was reported as the most relevant expertise for successes. Respondents were asked whether their initiative encountered any drawbacks or enablers over the course of its lifetime. The most important agronomic drawbacks were climate issues (>20 initiatives), followed by weed management, crop protection and yield of agricultural products (with more than 10 CDEs each), while most important agronomic enablers (>20 initiatives each) were soil type, weed management, quality of agricultural product and expertise available on diversification.

Personal interactions were considered as the most important enablers – knowledge exchange with the actors of the initiative (mentioned >45 times), new skills acquired through the initiative (30 times), new contacts established through the initiative (>25 times), interaction and new cooperations established through the initiative (>20 times each). The fact that personal interactions were mentioned most often as enablers strengthens the finding from the analysis of success factors that human resource related aspects are core for fostering diversification initiatives.

Development and performance of new maize populations, selection method and progress

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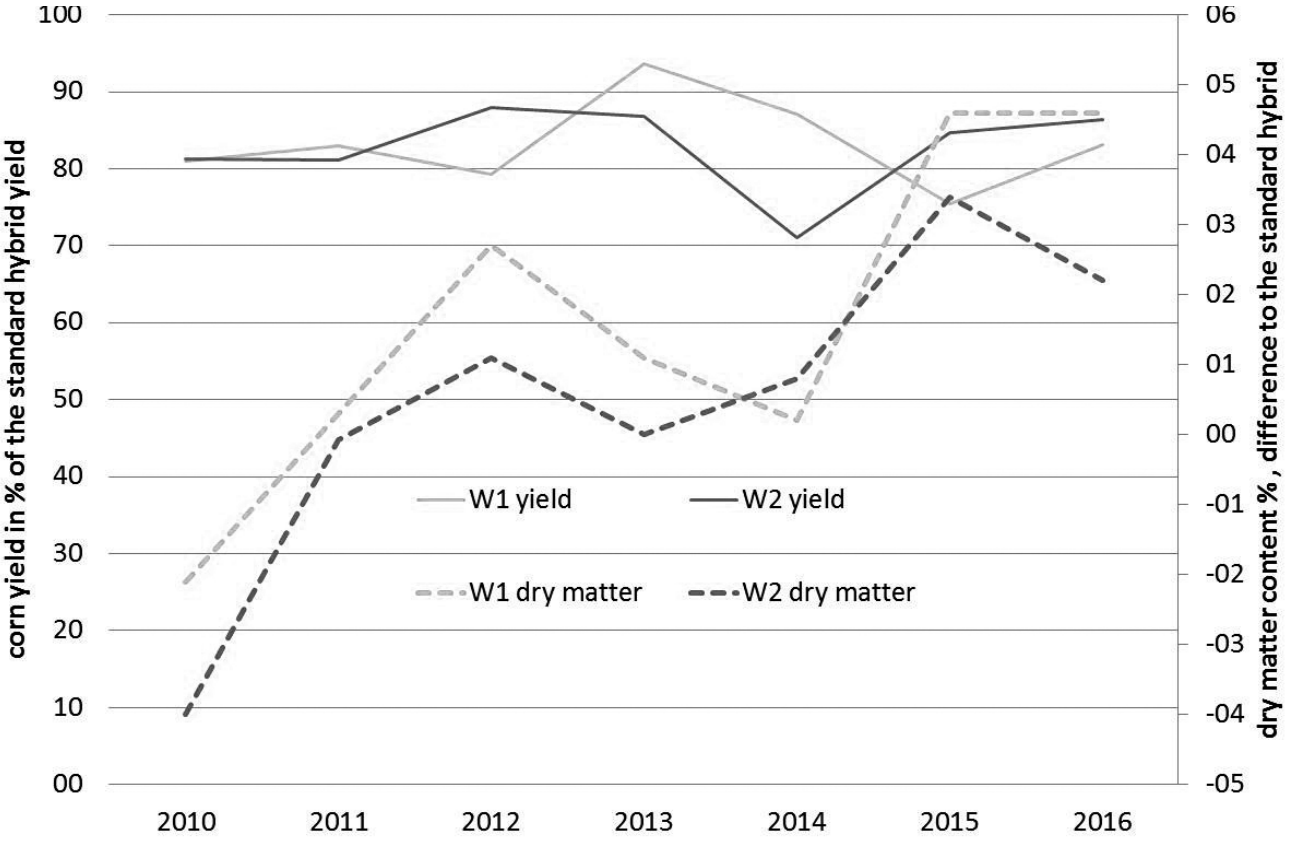
A frightening loss of diversity is increasingly observed in general, and an alarming loss of diversity of different variety types in particular. For major agricultural crops like maize, sunflower, and sugar beet no open pollinated varieties (OPV) are available in Germany. For rye, 50 % of the variety types are already hybrids. In the vegetable sector where hybrids are dominating in the open pollinating species, it is even worse. g. Open pollinated varieties are heterogeneous, genetically diverse and have a high adaptation capacity. Additionally, there is an increasingly demand for appropriate varieties for low input and organic farming.

We started to develop new OPVs and used – due to the lack of alternative breeding material- best performing hybrids. OPV W1 was set up 10 years ago and consists of 10 different hybrids from 5 different seed companies (representing 20 different genotypes). OPV W2 was developed in the same way using 8 different hybrids from 6 different seed companies. The hybrid varieties were sown randomly in isolation fields (2000 plants) to ensure cross pollination of all possible combinations. The selection method was recurrent mass selection. The results presented in this study are from the 7th selection cycle. Performance testing of the selected material was done in standardized field trials at one site for 7 years. The single cross hybrid Torres was used as check cultivar.

Torres achieved on average 130 dt/ha over 7 years. The population varieties realized about 80 % of the hybrid yield (Fig. 1). Results from other studies supported our results and showed that OPVs could even achieve up to 105 % of the yield compared to hybrids. Thus, with further breeding efforts, OPVs could be competitive to hybrids.



In cropping season 2013 with severe weather conditions, both OPVs reached 90 % of the yield of Torres indicating that populations can compensate adverse weather conditions better than hybrids. This could be due to the higher genetic diversity of population varieties. Having climate change in mind, this could become an important feature for the future.

The most important selection goals were increased dry matter yield and dry matter content. However, these traits are negatively correlated since early ripening plants have lower yield due to a shorter growing period than late ripening plants. Thus, it is difficult to increase dry matter yield and content simultaneously.

Figure 1 displays the dry matter yield relative to Torres and the difference of the dry matter content between the OPVs and Torres. A negative difference indicates later ripening than Torres. The aim would be to increase yield and the difference of the dry matter content to enhance the security for an appropriate harvest of corn. The results show that the relative yield was more or less stable across years and the dry matter content could be increased by 8 % in 7 years. Thus, the recurrent mass selection applied for developing the OPVs, provided satisfying results.

Future objectives are:

- How do OPVs perform at other environments and other cropping systems such as low input: Are they better than hybrids?
- Can we measure the adaptation capacity and is there an influence of the number of genotypes a population variety is derived from?
- How to set up OPVs? Is there an influence of controlled crosses versus open pollinated crosses?
- Can we achieve better or faster results with marker assisted breeding methods?
- What about the approval of varieties? Populations of some crops will hardly meet the requirements of the distinctiveness criteria.

Chiduza C, Waddington S.R, Mariga I.K (1994) Grain Yield and economic performance of experimental open-pollinated varieties and released hybrids of maize in a remote semi-arid area of Zimababwe. Zimbabwe J.agric.Res.32(1)(1994):33-43.

Eder B, Büttner B, Mohler V, Schweizer G, Albrecht T & Eder J (2017) Entwicklung von Populationen bei Mais (Zea mays L.), Selektionseffizienz und Leistungsfähigkeit in S. Wolfrum, H. Heuwinkel, H.J. Reents & K. Wiesinger, K.-J. Hülsbergen (2017) Ökologischer Landbau weiterdenken: Verantwortung übernehmen, Vertrauen stärken. Beiträge zur 14. Wissenschaftstagung Ökologischer Landbau, Freising Weihenstephan, 7. bis 10. März 2017, 106-109,Verlag Dr. Köster, Berlin

Capacity development strategy to promote organic sector development in Ukraine – the experience with the Leader Approach

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Growth within a young organic sector is often dependent on the potential of a few actors who spearhead commercial activities. Such actors are generally very innovative but do not always have all the necessary know-how to optimize the performance of their investments. The Leader Approach is a methodological sector- and market development approach with a strong business development focus aiming to strengthen such pioneers and spread their experience among followers – especially small and medium enterprises (SMEs) – in order to help them join the sector and contribute to its growth.

The 'Leader Approach' has been used in the context of the Swiss-Ukrainian project 'Organic Market Development in Ukraine 2012 – 2018' (www.ukraine.fibl.org), funded by the Swiss Government (State Secretariat for Economic Affairs SECO), aiming to develop new market opportunities for SMEs in the sectors of organic arable crops (for export) and milk and dairy production (for the domestic market). The goal of the project is to develop the Ukrainian organic sector, stimulate economic development and facilitate the integration of certified organic Ukrainian SMEs into world trade. Targeted leaders are influential actors, entrepreneurs and opinion makers, within the organic sector in Ukraine, eager to learn and to share, and that have the economic means to drive innovation using their own resources, i.e. playing a pioneering role in developing new markets and activities.

The experience with the 'Leader Approach' in organic sector development in Ukraine reveals that the approach is highly valuable to foster the dissemination of information and knowledge among a wide range of sector stakeholders. This in a context where solution oriented (private and public) extension services in regard to organic agriculture are absent. Thanks to supporting leading companies in areas of their interests, primarily with information and contacts, effective partnerships are built serving as 'learning hubs', as not only 'best practices' but also challenges are shared in the context of field days, company visits, and other events linked to leading companies. For working with 'real experiences', i.e. not sharing primarily theory or experiences from other countries, the Leader Approach is a powerful, market-oriented tool to accelerate not only learning within the sector, but it also essentially helps to build relationships among sector stakeholders to foster continuous sector growth.

Effects of earthworms and cover crops on plant pathogenic fungi Sclerotinia sclerotiorum

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For sustainable agriculture, ecosystem services that suppress fungal diseases become increasingly important. White mould (Sclerotinia sclerotiorum) is a harmful soil borne plant disease threatening over 400 crop species worldwide, including soybeans (Glycine max), rapeseed (Brassica napus) and sunflowers (Helianthus annuus). Sclerotia, the few mm long survival body of S. sclerotiorum can stay viable for five years, depending on its burial depth in soil (Cosic et al. 2012). In a laboratory food choice test we investigated the potential of the earthworm Lumbricus terrestris to reduce S. sclerotiorum. We hypothesized that depending on its moisture content sclerotia would be a food source for earthworms. Additionally, we determined the relationship of earthworms and sclerotia in field plots.

In the food choice arenas, we conducted two experiments, therefore we fed two sclerotia sizes (2 mm or 4 mm). We submerged the sclerotia into moistened soil and stored them for 0, 5, 7, 9 and 13 weeks for hydration. For the field trial, we inoculated sclerotia in July 2016 in mesh tubes (earthworm accessible: 3 x 10 mm; non-accessible: 1 x 1 mm) in 3 cm depth in cover crop plots (N=6). In October 2016 and March 2017, we excavated the remained sclerotia and excavated soil monoliths for earthworm sampling.

Hydrated and non-hydrated sclerotia of 2 mm and 4 mm were reduced but hydrated were clearly preferred by L. terrestris. Furthermore, earthworms showed a stronger interested in the substrates containing sclerotia and especially hydrated sclerotia than in soil only.
Results of the field experiment showed that more sclerotia decomposed in the earthworm accessible inoculation tubes than non-accessible tubes. However, we found no evidence that the decaying process of sclerotia were correlated with earthworm populations in field plots. Furthermore, earthworm abundance was not affected by the presence of sclerotia, but by Brassicaceae cover crops.

Despite the size of sclerotia (2 mm or 4 mm), L. terrestris showed a clear feeding preference for hydrated sclerotia suggesting that earthworms can actually reduce the soil borne pathogens. Our finding may be related to previous studies of the consumption of L. terrestris on dark pigmented fungi (Bonkowski et al. 2000) and food with smooth surfaces such as melanin layer of sclerotia (Shumway and Koide 1994). Many aspects of the potential pathogen suppression of sclerotia by earthworms are still unclear and deserve further investigations.

Bonkowski, M., Griffiths, B.S., Ritz, K., 2000. Food preferences of earthworms for soil fungi. Pedobiologia 44, 666–676.
Cosic, J., Jurkovic, D., Vrandecic, K., Kaucic, D., 2012. Survival of buried Sclerotinia sclerotiorum sclerotia in undisturbed soil. Helia 35, 73–78. https://doi.org/10.2298/HEL1256073C
Shumway, D.L., Koide, R.T., 1994. Seed preferences of Lumbricus terrestris L. Appl. Soil Ecol. 1, 11–15. https://doi.org/10.1016/0929-1393(94)90019-1

Organic – what consumers think

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In order to get organic products from the niche, it is important to promote communication and interaction with consumers1. Despite the long-cited „power of consumers", very little is known about them: What do they expect from organic food? Which lifestyles and eating habits will they prefer in the coming years? How do they react to crises?

As part of the market development project „Bio 3.0 – New ways to more organic", a qualitative consumer and image study was carried out. The aim was to create basic knowledge about habits, motives, attitudes, experiences and expectations of consumers and to jointly develop strategies for the future of organic agriculture.

In addition to extensive desktop research, the qualitative study included 24 group discussions of 2 hours each with 8-10 participants (16 with urban organic consumers, 6 with rural organic consumers and 2 with non-organic users). In order to deepen and validate the results, 18 expert discussions were held.

The most important buying motives for organic products are taste, enjoyment and sustainability. However, the price represents a major purchasing barrier – only heavy users are immune to higher prices. There is also some scepticism as to whether the additional price of organic food corresponds to an actual added value, whether the purchase of organic food really "pays" itself.

While the different organic brands of supermarkets are the most important point of reference when buying organic – and their brand-specific standards often seem more important than the EU organic regulations – the obligatory EU organic label is not always known to even declared organic consumers. Organic non-consumers know neither labelling nor guidelines; the various organic brands and labels are more likely to cause confusion than information for them. This results in a general distrust of organic food, while in principle they are in favour of sustainable food production.

Regional foods are generally very popular among the participants: in case of doubt, they are preferred to organic foods from abroad. But while regionality relies above all on feelings, assumptions and romantic ideas, organic food production is not just a production issue for consumers, but a comprehensive sustainability concept.

Organic consumers are convinced of their sustainable lifestyle, but often reach their limits: in many cases it is demanded that the legislator assumes more responsibility. At the same time, the consumers surveyed emphasize the importance of independent education and a comprehensive exchange of knowledge on the production and consumption of organic food in order to be able to influence developments in agriculture and to overcome purchasing and social barriers in terms of organic consumption.

Franke-Petsch, F.[1],*, Martos, A.[1],*, Eichinger A.[2], Klingbacher E.[3], Greger, L.[3], und Geßl, R.[2] (2017): Bio 3.0-KonsumentInnen-und –Imagestudie 2016-2017.

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Mass catering as a driver for Austrian organic agriculture

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In Austria, around 1.8 million meals are consumed daily in public and private mass catering facilities (such as canteens in schools, hospitals, nursing homes or company kitchens). Not only because of its high demand of food, but also for the supply of high-quality food, catering facilities play an important role for a nutritionally balanced diet for the public.

The aims of this study were (1) to show and assess the current status and (2) to calculate the potential of public catering procurement regarding Austrian organic food. The central question was which share of organic food in mass catering would lead to what increase of organic agricultural area in Austria. These growth potentials were calculated with two scenarios: a monetary organic share of 60 % and 100 % in food procurement.

For the calculation the nutritional recommendation of the ‚The German Nutrition Society' (DGE) for children and adults was used. Since the amounts of these nutritional recommendations represent an „ideal consumption", the following two factors were additionally taken into account: (1) the actual per capita consumption of meat of the Austrians today and (2) the avoidable food waste of Austrian canteen kitchens. For the data concerning the share of national and organic sourced products, expert knowledge as well as secondary literature had been collected. The results refer only to ingredients of Austrian origin that are currently used in the catering sector.

The results show that 4.9 % of the total Austrian agricultural area (132,139 ha) is already consumed by public catering facilities in 2017 and thereof 1.3 % for organic food. An increased organic share of 100 % in terms of monetary procurement in the public catering sector would theoretically lead to an only slight increase in the total utilized agricultural area need for catering food (from 4.9 % to 5.3 %). Concurrently, this would mean 3.8 times more demand of organic area (100 % scenario compared to the current state). It shows that an increase of the share of organic food from Austria would result in a high increase in the share of organic agricultural land. This study shows that public and private mass catering can give incentives for a change in agricultural production systems.

As these results include data uncertainties and relates only to the goods already sourced from Austria, a more comprehensive survey of the quantities used in the public catering and the examination of further framework conditions are recommended. For a well-founded political claim, further studies should also include feedback and market effects arising from an increased demand in organic products.

Gusenbauer, I, Markut, T., Hörtenhuber, S., Kummer S., Bartel-Kratochvil, R., 2018. Gemeinschaftsverpflegung als Motor für die österreichische biologische Landwirtschaft. Studie im Auftrag von Greenpeace in Zentral- und Osteuropa, BIO AUSTRIA in Kooperation mit MUTTER ERDE.

Reducing particle length of the forage improves feed utilization efficiency in organic dairy cows

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Rotating grassland and intercropping are vital for a sustainable soil cultivation and can provide considerable amounts of forages for a mixed organic farm. Previously, forage-based milk production has been reported to improve the net human food supply (Wilkinson 2011). Yet, the feed intake of cows fed forage-based diets is limited through the bulky structure of forages, accompanied by the animals' restricted total chewing time and rumen capacity (Van Soest 1994). As a result, energy balance is negatively affected, resulting in decreased production efficiency and metabolic health issues related to energy deficiency and increased body mobilization. The aim of this study was to test the effects of a reduction of particle length in a forage-based diet on energy balance and production efficiency in organic dairy cows.

A feeding trial was carried out at the organic mixed farm of the secondary agricultural school in Ursprung, near the city of Salzburg. Twenty Holstein cows were randomly allocated in two different groups. The control group was fed an untreated long forage diet (LFD) and the experimental group was fed a shredded forage diet (SFD) for 5 weeks, including an adaptation period of 2 weeks. Diets were fed as total mixed rations (TMR) and differed only in forage particle length; components were included in equal amounts for both diets (hay, 43 %; grass-clover silage, 37 %; concentrate, 20 % on a DM basis). Concentrate contained field peas, sunflower cake, wheat bran and a mineral and vitamin premix. Forage particle length of hay and silage was reduced (theoretical length of cut was 0.5 cm) with a forage chopper, and hay was additionally hammer-milled (mesh size 20 mm). The TMR was fed ad libitum and provided fresh twice a day after milking. Individual feed intake and milk yield of cows were recorded on a daily basis. Live weight was recorded at the beginning and the end of the experiment. Statistical analysis of data was performed using proc mixed of SAS (Version 9.4), considering the diet and parity group as fixed effects. Corresponding data of a previous covariate period were considered to be continuous effects and the cow nested within the group was a random effect.

Cows consumed markedly more feed on the SHT diet (+ 1.8 kg DM/day). For this reason, the cows' energy balance was significantly ($P < 0.05$) improved (+5 % points), even though both diets contained the same amount of energy. Feeding SFD resulted in a significantly higher energy-corrected milk (ECM) per kg live weight, but N efficiency (milk N/N intake) and feed conversion efficiency were not markedly influenced. In conclusion, chopping forages before feeding improves feed intake and milk production as well as energy efficiency in cows, but the forage processing requires more effort compared to feeding coarse forages.

Wilkinson J. M. (2011) Animal 5:7: DOI 10.1017/S175173111100005X
Van Soest P. J. (1994) Cornell University Press 2nd edition: Nutritional Ecology of the Ruminant.

Enhanced fraud prevention through combining supply chain and satellite information – a pilot project for Kazakhstan

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The presentation will present the hypothesis that effective fraud prevention in organic supply chains relies on a mass balance approach based on the combination of two types of data: certification data and transaction data. The mass balance calculation is based on field size and yield to determine the plausibly produced organic production volume of an organic producer. Therefore, the integration of satellite data that proves the existence of the certified acreage and identifies production data can enhance the efficiency of such an integrity management system. This hypothesis will be field tested against the pilot case of Kazakhstan, where an organic integrity system with the objective to prevent fraud is under way and will be finalized by the end of 2018. The study involves a range of stakeholders in Kazakhstan including the Ministry of Agriculture, the Kazakh Accreditation Body, the National Centre for Certification, private certifiers, the Agrarian University, traders and farmers. The pilot project is funded by the FAO, Italy with Naturland Association, Germany as partner organization. The two service providers TALAP, Kazakhstan and Organic Services, Germany are responsible for implementing the project. The study builds on a previous study conducted in the framework of the EU-funded FoodIntegrity project. Following more than 25 qualitative interviews with supply chain actors and industry experts of four different food industries, the FoodIntegrity study concluded that Check Organic can prevent and/ or detect fraud in food supply chains. The study also identified prerequisites for the successful application of the mass balance checks of Check Organic. One prerequisite is that a relevant part of production and trade of the concerned product and within the defined system (either national or company based) must be recorded. Where this data is not available, the integration of GIS systems with Check Organic was identified as a possible means to ensure the presence of this prerequisite. The conclusions drawn in the FoodIntegrity study have then helped to shape the new project: Organic Services partners with a GIS system provider, to develop and implement an integrity system for the Kazakh organic market with the objective of fraud prevention and hence brand protection of Kazakhstan as producer of organic food. The GIS system will be integrated with the Supply Chain Monitor (list, graph, dashboard) and Supplier Volume Monitor (mass balance) of Check Organic. The presentation for this conference will first condense the conclusions drawn from the FoodIntegrity project into several hypotheses which have served as assumptions to inform the integrity system developed for Kazakhstan. Secondly, the field experience from the pilot project in Kazakhstan, will be used to discuss and test these assumptions. Finally, conclusions will be drawn from the discussion of this field test.

A comparison of human edible feed conversion efficiency between organically and conventionally managed livestock

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Livestock can contribute to human food supply and food security. However, a large proportion of livestock feed is based on sources that are not "absolute feed", i.e. which cannot be directly consumed by humans, e.g. cereal grains of low quality, kitchen leftovers, by-products from bioenergy- or plant oil production, etc. We analysed the human edible feed conversion efficiencies (heFCE; i.e. outputs related to inputs of energy and crude protein) for different livestock categories, based on the method by Ertl et al. (2016). A heFCE value above 1 indicates a positive net food production, i.e. the animals' diet contains less human edible protein or energy than the animals provide with their products. Data was collected on a random sample of organic production systems (PS), which deliver products for the organic brand "Zurück zum Ursprung": 22 milk PS (most farms producing hay-milk without silage feed), 27 beef PS and 11 pig PS. Finally, we compared the heFCE results for organic PS with results for an Austrian average (dominated by conventional PS) from Ertl et al. (2016). We tested two hypotheses for the comparison: (1) organic PS show higher heFCE values than conventional PS; (2) organic beef PS show a positive net contribution to human food supply, whereas conventional beef PS do not provide net food. Both hypotheses have been confirmed. We found increased heFCEs for organic products by factors ranging from 3.7 (protein conversion of milk) to 1.3 (for energy conversion of pork) in comparison to the corresponding conventional products. The reason for the better efficiency of organic PS is the substantially lower dietary proportions of potentially human edible concentrates, i.e. a higher proportion of absolute feeds (roughage and by-products). The results for organic PS are probably not significantly different from the Austrian average, as organic PS showed a high variability. The Austrian average as well as the observed results from organic farms are given in Table 1.

The differences between PS emphasise the relevance of integrating indicators for net food supply in sustainability assessments and the respective advantage of low input – moderate output, e.g. organic PS.

	Austrian average: Ertl et al. (2016)		**Sample of organic farms: Mean and ranges for standard deviation**	
	heFCE-protein	***heFCE-energy***	***heFCE-protein***	***heFCE-energy***
Milk	1.98	1.44	7.38 ± 270 %	2.02 ± 260 %
Beef	0.45	0.26	3.26 ± 297 %	3.68 ± 262 %
Pork	0.36	0.35	0.59 ± 21 %	0.42 ± 10 %

Table 1: Human edible feed conversion efficiencies (heFCEs) for energy and crude protein for the Austrian averages of milk, beef and pork as well as results from organic farms.

Ertl P, Steinwidder A, Schönauer M, Krimberger K, Knaus W, Zollitsch W (2016): Net food production of different livestock: A national analysis for Austria including relative occupation of different land categories. Die Bodenkultur: Journal of Land Management, Food and Environment 67, Issue 2. 91–103. DOI: 10.1515/boku-2016-0009

Defining criteria and indicators to assess partnerships along food value chains

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In the food sector, the topic of fair trade and socio-economic sustainability is of increasing interest for consumers. On the other hand, the number of initiatives and certification schemes that explicitly embrace fair partnerships (with regard to domestic fair trade) is still low. Additionally, the relationship between trading partners in food value chains (i.e. farmers, processors, traders) is often characterized by power imbalances between small and large actors. Ways to overcome these problems are on the one hand political regulations (e.g. EC, 2018), and on the other hand private initiatives and certification schemes. Prominent examples are "organic & fair" certification schemes, e.g. Kröger & Schäfer (2013). Also, a number of (sustainability- and CSR-) awards address the subject of fair trading relations.

In a current project, we elaborated criteria, indicators and a rating system to assess the quality of partnerships and socio-economic sustainability in food value chains. Based on a review of scientific literature, existing projects and certification schemes as well as exploratory interviews with representatives of six Austrian food chains, a draft of criteria and indicators was elaborated and further developed in a participatory process together with the project advisory board and external experts. As a result of the participatory process, a set of criteria, indicators and a rating scheme was defined that can serve as evaluation tool for labels or awards in the future. The evaluation system consists of 3 themes, 11 criteria and 27 indicators (Table 1).

Discussion and conclusions: This evaluation system can be applied to all kinds of food value chains. Still, the application procedure should be simplified for smaller and less formalized projects to reduce the necessary time effort. The acceptance of the evaluation system is expected to be high, as relevant actors in the agriculture and food sector in Austria were involved in the development of criteria and indicators. The elaborated criteria and indicators for fair partnerships in food value chains can serve as a basis for further efforts to integrate aspects of fair trading relationships and socio-economic sustainability into the organic agriculture and food sector.

Themes	Criteria	Indicators
Quality of the partnership	Objectives of the partnership	Joint definition of objectives
		Analysis of opportunities and threats in advance
	Partnership arrangements	Content and arrangement of agreements
		Contact persons and responsibilities
		Agreements on cooperative partnership
		Arrangements on rights
	Risk distribution	Measures to distribute risks
		Measures to reduce dependencies
	Commitment to agreements	Measures to ensure commitment
		Measures in the case of non-compliance
	Communication and conflict management	Communication flow, information transfer and tansparency between partners
		Management of crises and conflicts
Economic sustainabiltiy	Benefit for the partners	Benefit for the partners involved
		Benefit for the farmers involved
	Development of the project	Joint development of the project
		Sales development (since project start and in the future)
		Investments (since project start and in the future)
		Economic indicators verifying the project's success
	Pricing	Measures to achieve stable prices
		Measures to achieve appropriate prices
Societal impact	Regional, social and environmental benefits	Impacts on the employees
		Impacts on the environment
		Impacts on the region
	Dialogue with consumers	Information for and dialogue with consumers
		Increasing appreciation for food / food production
	Innovation	Innovation of the project compared to the ordinary
		Widespread impact of the project

Table 1: Set of themes, criteria and indicators to assess the quality of partnerships along food value chains.

European Commission (EC) (2018): Proposal for a directive of the European Parliament and of the Council on unfair trading practices in business-to-business relationships in the food supply chain. Brussels, 12.4.2018, COM(2018) 173 final, 2018/0082 (COD).
Kröger, M. & Schäfer, M. (2013): Between Ideals and Reality: Development and Implementation of Fairness Standards in the Organic Food Sector. J. of Agric. and Environm. Ethics, 27(1):43-63.

Digitalization in organic trade in Ukraine as a key to improve transparency and integrity

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Nowadays the global organic product flows are suffered from fraud. Especially, organic supply chains in countries like the Ukraine might be extremely complex. In complex supply chains with up to 3 intermediaries, manipulations and irregularities are difficult to detect for importers and certification bodies as well. In the consequence, international importers and control authorities consider Ukraine as a "risky country" with "risky suppliers".

The author analyzed during the last years the risk exposition of different types of organic supply chains in Ukraine. On the basis of the risk assessment, a new digital tool has been developed to increase the transparency and traceability of organic supply chains form Ukraine. Each year, online platforms are created to bridge the international organic supply and demand, which bases on the existence of valid organic certificates of the exporters. However, these platforms are not applicable for Ukraine and therefore Ukrainian farmers cannot take advantage of them. They are not adapted to the mental and infrastructural realities of the Ukrainian market and do not guarantee the traceability of organic supply chains to the buyers and reliability of sellers (Table 1). As a solution to this problem a mobile tool called Agroportex.bio has been developed with the support of the author.

The new tool in contrast to analyzed platforms guarantees free trade among the proven users, being matchmaking assistant for them with a lot of additional services. It is a niche marketplace for a B2B market which guarantees direct access for buyers from all over the world to primary organic producers. The handling of this tool for farmers is quite simple. Farmers just would need to upload their organic certificate after registration. When it is verified by the system, their products will appear in the list available for sale. Here Buyers could find necessary goods among the proven organic producers using their own language and receive push-notifications with new offers. The Seller profile already will contain all the information in accordance with his certificate: the list of products, its validity period, as well as scanned copies of the certificate itself. All Buyer orders will also contain the terms of the deal proposed and information about the Buyer: his rating, comments of his partners on previous deals and all his current requests on the platform. Both producers and buyers will form a reputational history of each other by ratings and reviews upon the deal completion. By this, it will create transparency for international buyers about the integrity and the quality performance of Ukrainian organic operators and will support to build up reputation easily in a few clicks.

What platforms does market propose?		*Example: UBER model*	Germany	Ukraine		Ukraine
Features \ Platforms		*uber.com*	A	B	C	Agroportex.bio
	Organic verification	⊗	★	⊗	⊗	★
	Verification by ID	☆	★	★	★	★
	Reputational history	☆	★	★	★	★
	Multi-language	☆	⊗	⊗	Through Google. translate	★
	Notifications	📱	✉	✉📱	✉	📱
	Mobile-friendly	☆	⊗	★	⊗	★
	Conditions of usage	%	User fee +% from the deal	User fee	User fee	User fee +% from difference at auction

★ - Feature which is present (available) in the selected platform type
⊗ - Feature is not presented (available) in the selected platform type
📱 - Feature describing the presence of mobile phone notifications
✉ - Feature describing the presence of e-mail notifications
▬ - Example color of the features described for UBER platform used for taxi service industry

Table 1: Comparison between Agroportex.bio and other online trading platforms working at Ukrainian market

ECOBREED – increasing the efficiency and competitiveness of organic crop breeding

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The ECOBREED project is coordinated by the Agricultural Institute of Slovenia and is carried out in collaboration with 25 partner organisations representing 15 countries: AT, CN, CZ, DE, ES, GR, HU, IT, PL, RO, RS, SI, SK, UK and USA.
ECOBREED will improve the availability of seed and varieties suitable for organic and low- input production. Activities will focus on four crop species, selected for their potential contribution to increase competitiveness of the organic sector, i.e. wheat (both common Triticum aestivum L. and durum Triticum durum L.), potato (Solanum tuberosum L.), soybean (Glycine max (L). Merr), and common buckwheat (Fagopyrum esculentum Moench.).
The project will develop (a) methods, strategies and infrastructures for organic breeding, (b) varieties with improved stress resistance, resource use efficiency and quality and (c) improved methods for the production of high-quality organic seed. The objectives of the project are:

- To increase the availability of seeds and varieties for the organic and low-input sector
- To identify traits and combinations of traits suited to organic and low-input production environment including high nutrient use efficiency and weed competitiveness/ allelopathy
- To increase breeding activities for organic and low-input crop production.
- ECOBREED will increase the competitiveness of the organic and low-input breeding and farming sectors by:
- Identifying genetic and phenotypic variation in morphological, abiotic/biotic tolerance/resistance and nutritional quality traits that can be used in organic breeding
- Evaluation of the potential of genetic variation for enhanced nutrient acquisition
- Evaluation of the potential for increased weed competitiveness and control
- Optimisation of seed production/multiplication via improved agronomic and seed treatment protocols
- Developing efficient, ready-to-use farmer participatory breeding systems
- Pre-breeding of elite varieties for improved agronomic performance, biotic/abiotic stress resistance/tolerance and nutritional quality
- Development of training programmes in (a) genomic tools/techniques, (b) PPB and (c) use and application of improved phenotyping capabilities.
- Ensuring optimum and rapid utilisation and exploitation of project deliverables and innovations by relevant industry and other user/stakeholder groups.

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Organic farming development in Latvia: prospectives and limitations

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Organic farming as more sustainable agricultural production system shows considerable growth on the global and EU level, including Latvia. It has been widely argued by scholars and politicians that the sustainable and environmentally friendly farming can provide rural development benefits through enhanced entrepreneur activities and growth of jobs. Besides, organic farming generates environmental and socio-economic benefits to society and provides various ecosystem services (e.g., food, recreation and tourism). The study regards to assessing the issues and perspectives of organic farming, particularly organic food, and related activities' development in Latvia. The hypothesis of the study is that local food systems or short food supply chains are a suitable tool for further development of organic farming, as well as rural areas and society. The aim of the study is twofold: 1) to assess the latest development trends and issues of organic food production and processing, as well as its spatial aspects; 2) to evaluate the status, development and the impact of local food system or short food supply chain, as well as to identify the main limitations, on the further perspectives of the sector. The principal materials used in the studies are as follows: different sources of literature, e.g., scholars' articles, research papers and the reports of institutions, as well as web pages and the internet. The data have been obtained from: Eurostat online database, online database of Central Statistical Bureau of Latvia, Food and Veterinary Service and unpublished data from the Latvian Rural Support Service. The appropriate qualitative and quantitative research methods for certain tasks have been used in the process of study: monographic; content analysis and synthesis; logical and abstractive constructional; data grouping; correlation and linear regression; spatial analysis, using GIS, etc. In order to estimate the results of innovative approaches of the organic food distribution and sale several case studies have been carried out. The benefits of creating the organic farmers' cooperative 'Green Basket'; and consumers direct purchase groups' development were estimated. The sustainability initiatives of organic farmers that in many cases have economically, environmentally and socially innovative character, have been identified. The role of mutual interaction and impact among the organic farmers' per se, various stakeholders and consumers for the creation of short food supply chains is evaluated. Special attention is paid to the different types of cooperation forms and networks, including the collaboration with rural tourism providers. The results show that various cooperation and collaboration forms and networks support the distribution channels of the organic food and increase the supply of the processed food, mainly home-made and artisan. Accordingly, these activities boost the added value and consequentially, the income of organic farmers.

Farm-level sustainability assessments in Hungary: SMART assessments of organic, conventional and permaculture farms

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Agricultural sustainability is a pressing issue, however current sustainability assessment tools are often limited in their thematic scope. It is essential to consider sustainability in a holistic manner which accounts for environmental, social and economic factors, as well as measure sustainability at both a micro and macro level. We present two studies which made use of the Sustainability Monitoring and Assessment Routine Farm Tool (SMART), a tool which comprehensively measures the micro-level performance of a farm in respect to the 58 multi-thematic and science-backed sustainability goals contained in the 'SAFA' Guidelines developed by the Food and Agriculture Organisation. In the first study, we evaluated the applicability of SMART to the Hungarian agricultural context, focusing on a comparison of organic and conventional farming. For this purpose, 25 organic and 25 conventional farms of 10-300 ha which made use of both plant production and animal husbandry were selected. Organic farms were further differentiated between intrinsically-motivated organic production and organic production primarily motivated by financial return. Results found that a) SMART could be successfully implemented in Hungary, with some room for adjustments, and b) that organic farms out-performed conventional on certain sustainability sub-themes. Results were higher for organic farms in 12/14 environmental (11 significant), 11/14 economic (8 significant), 16/16 social (7 significant) and 13/14 good governance sub-themes (7 significant). In addition, there were 13/58 sub-themes where intrinsically-motivated farmers significantly outperformed organic farming with a primarily financial motivation. However, it should be emphasised that this was not a representative sample and so a conclusion cannot be drawn about the comparison between organic and conventional agriculture in a broader sense. Our second study built upon these results, incorporating the recommended improvements to the SMART methodology and testing the applicability of the tool to permaculture in Hungary, which had not yet been studied. 10 farms in each category (conventional, organic and permaculture) of < 20 ha and mixed agricultural activity were selected. Results showed that a) SMART could be successfully applied to Hungarian permaculture with some adjustments to account for smaller scale farming, and b) that organic agriculture and permaculture in the sample out-performed conventional. Results were higher for organic farms in 6/6 environmental (5 significant), 4/4 economic (3 significant), 6/6 social (1 significant) and 5/5 good governance themes (4 significant). Permaculture farms performed similarly compared to organic farms but in most themes the degree of significance was stronger compared to conventional. We conclude that SMART can be applied more widely in Hungary with additional auditor training to support expansion, although the tool could be fine-tuned based on the findings of the two studies.

Four years of model organic regions in Bavaria – an interim report and first results

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Model organic regions (MORs) are a component of the state program "BioRegio Bayern 2020", initiated by the Bavarian State Ministry of Food, Agriculture and Forestry in 2012 in order to double organic production in Bavaria and to increase sales of regional organic food products by 2020. By implementing MORs the Ministry aims to increase local production to meet the growing demand for organic food products. Another goal is to increase consumer awareness of locally produced organic products.
A broad variety of projects have been established within the MORs, ranging from production and processing, marketing and community catering to education and campaigns to raise awareness. The activities in these regions, however, do not only focus on increasing the area farmed organically but also on the connection between origin and organic production. The Bavarian MORs project aims to expand local potential, stimulate existing networks and active participants, and to develop new networks and structures. The MORs enable the integration and support of new stakeholders, both public and private, so that the organic food sector is developing at a regional level. The interest in these topics is increasing and a third public competition is already planned, to be held in 2018. More than 20 regions already showed serious interest. This fact and first results of the MOR activities arouse expectations, that this specific and regional based approach might help facing the future challenges of rural development in Bavaria.

Reduced Rhizoctonia solani and Streptomyces sp. infection by using combined microbial inoculums on organic potato

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Soil biological functions and proper agrotechnical management are of key importance in organic agriculture. Beneficial microbial inoculums are used either as plant strengthening products (psp, biofertilizers) or also as plant protecting products (ppp, biorationals). The question is, which type of microbes could be applied to improve yield or reduce the disease of soil-born plant pathogens? Objective of the present study was to compare the effect of inoculum-mix 1 and inoculum-mix 2 in organic potato production, used in 2 consecutive years.

Field experiments were conducted at the Organic Research Station of the Szent István University (Babatpuszta, Hungary) in 2016-2017. Growth and quality of potato (Solanum tuberosum var. Demon) was studied in the two microbial treatments and control, in four replicates of 9 m^2/plot. The inoculum-mix 1 (PPS) included Pseudomonas protegens, Ps. jessenii and Strenotrophomonas maltophylia, with known plant growth promoting (PGPR) effect. Inoculum-mix 2 (TPB) consisted of Trichoderma hartianum, Pseudomonas putida and Bacillus subtilis strains with mainly potential biocontrol effects. Each potato tuber was treated by 10 ml inoculum (1010 cell.ml-1) that was added to 100 ml water with only water at the controls. Yield of plots and tuber quality, i.e. the percentage ratio of scab (Streptomyces scabies), black scurf (Rhizoctonia solani), and Fusarium sp. infection was estimated. General soil biological, physical and chemical characteristics were assessed in soil samples, collected four times during vegetation.

Among soil-biological parameters, a strong seasonal variability was recorded in connection with plant growth and development. Most Probale Number (MPN) counts of bacteria and fungi was affected by the applied fungal and bacterial inoculums. Among the used soil-enzyme parameters, the soil-dehydrogenase (DHA) activity showed best relation with plant yield and microbial activities. There was no significant yield difference among treatments. The number of Streptomyces and Rhizoctonia infected tubers differed according to years and inoculum treatments. In 2016 the infection of Streptomyces was higher in PPS plots and the Rhizoctonia infection was significantly lower in the TPB treatment, however in 2017 this positive beneficial effect was not supported statistically. The Streptomyces infection was reduced by PPS and no significant reduction was found in the case of Rhizoctonia by TPB.

We assumed that the presence of the Trichoderma-Pseudomonas combination which has biocontrol potential, in TPB inoculum was the reason for a significant reduction of Rhizoctonia infection in 2016. Further studies are required, however, regarding the annual variability of parameters and differences in soil-health data, including the microbial status of potential biocontrol/biorational species.

Thematically belongs to Biofector (GA 312117) project.

Knowledge transfer in organic farming in Estonia

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In Estonia, the land area under organic production has expanded by 2.5 times over the last ten years, and is currently 199,947 ha, representing ca 20% of the total agricultural area in 2017. This percentage makes Estonia one of the three leading countries in the EU for organic agricultural production. In 2017, there were 1888 organic farmers and 165 organic processors in Estonia.
The Estonian University of Life Sciences and some vocational schools offer organic farming courses, but it is not currently possible to obtain a degree or to specialize in organic farming. In addition, a specialised organic farming advisory system does not exist in Estonia. But the demand for new knowledge is very high, and all farmers applying for organic farming support are obliged to participate in training events.

In order to improve the training and knowledge transfer system, the Ministry of Rural Affairs prepared a long-term programme of knowledge transfer in organic farming for the period 2016–2019. The programme, financed from the Rural Development Plan, has been implemented in cooperation with five organisations. All the programme's activities are targeted to each part of the organic food production chain: farmers, processors, caterers and distributors.

Programme activities:

- training days on organic production, processing and marketing,
- demonstration trials, introducing cropping systems, cereal varieties, berry and fruit varieties and their agrotechnologies,
- presentations to organic operators (e.g. milk processing, meat processing),
- yearly organic farming conference,
- study groups (e.g. for cereal growers, beef cattle growers),
- study trips to organic farms in Estonia and abroad,
- information materials (booklets and electronic materials) in plant and animal production, processing, marketing etc.,
- webpage, www.maheklubi.ee, providing information on events, published materials and other practical topics.

During 2016-2017, 146 training days were organised and, on average, 27 people participated each day, there were a total of 3,878 participations (one person could participate in more than one activity). The activities covered all counties in Estonia, and half of them were organised on farms as field days. Methods used were e.g. field visits and practical soil sampling, observations, seminars and discussions. This programme also helps to disseminate the results of research projects, e.g. TILMAN-ORG which studied the effects of green manure cover crops on soil, biodiversity and yield, and FertilCrop investigating the effects of cover crops on soil, weed control and yields. In addition to the new knowledge, all the activities give an opportunity to meet, discuss and share experiences. Common interests and cooperation are an important part of the development of the organic food sector. Experience and knowledge gained will help farmers and processors to produce more organic food and increase their competitiveness in the local and export markets.

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Is bio-certification of subsistence farms a good strategy to conserve traditional landscapes and bio-diversity? A case study from Transylvania, Romania

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Traditional extensive agriculture and livestock husbandry has led to a very high biodiversity at the landscape level in the Transylvania region of Romania. Traditional agricultural landscapes comprise mostly open habitats like hay meadows and pastures, reflecting the main occupation of rural populations in this area for many centuries. However, presently, traditional land uses like mowing and grazing are declining either through abandonment, intensification (mostly intensive grazing with sheep) or conversion to intensive cropland. All these changes lead to a decline of grassland biodiversity. Many previous studies have documented this decline, mostly by using indicator groups of organisms like plants and insects (particularly butterflies). The causes of this decline lie in the political, social and economic contexts. Changes in the rural demography and low profitability of subsistence farming are among the most significant factors leading to abandonment of subsistence or small-scale farming. Agricultural subsidies' schemes, on the other hand, put a pressure towards intensification of agriculture, pushing it in the hands of large companies. The possibility of bio-certification might represent a good strategy both for sustainable rural development and biodiversity conservation in Transylvania. Our present study investigates the available options and challenges for small farms to implement bio-agriculture. To do that we combined ecological and sociological data collection methods. We used butterfly species inventory methods to estimate biodiversity and interviews and official statistics records to collect sociological data. Our results show that the growing average age of the rural population, high bureaucracy and subsidies' pressure are the main challenges that prevent bio certification from being a feasible biodiversity conservation measure. We suggest that bio-certification, correlated with appropriate marketing, would lead to an improved rural living standard and ensure a long-term survival of the biodiversity associated with traditionally managed grasslands.

Pleasurable Cooking Lessons work! Findings from the Pilot Phase of Schule des Essens (School of Eating)

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Schule des Essens (lit. "School of Eating") is a concept of pleasurable nutrition education in compulsory schools. It was initiated by the nutritionist Theres Rathmanner and developed at FiBL Austria. The overall objective is that children and adolescents acquire knowledge and skills in the field of sustainable nutrition by working practically with food, i.e. mainly cooking with organic produce. In the pilot phase from 2015 to 2017 we wanted to find out if our School of Eating works as we expected and the findings from comparable international projects suggest.
From 2015 to 2017 we conducted a pilot phase with 111 children aged 6–12 in 6 grades in 3 schools. They all underwent at least 5 school days during a semester of hands-on activities with mainly organic food (mostly cooking, but also shopping, field trips, games and videos), conducted by FIBL. We evaluated our activities quantitatively and qualitatively, the outcomes and the process, with questionnaires, conversations, and a logfile.

The School of Eating-hands-on activities were very successful in terms of acceptance and motivation. 60–92 % of the pupils loved the activities, and all the involved teachers and headmasters reported positively. Our activities generated some knowledge gain: Before our intervention, 34 % of the pupils we asked correctly identified the EU organic farming logo, after the intervention 100 % did. Also, it was obvious that the pupils extended their food processing skills. We did not, however, detect substantial changes in the pupils' nutritional behaviour, with two exceptions: Of the 23 pupils in 6th grade initially not a single one reported to like vegetarian food, after the intervention every second did. Also, we observed that the pupils tended to overcome their food neophobia, when they were involved in the preparation. Due to the setting in compulsory schools, we successfully involved children and adolescents from families with lower socio-economic status. The pupils and the parents reported some knowledge transfer from school to their families.

In the pilot phase of our innovative concept School of Eating we confirmed that pleasurable hands-on activities that take place mainly in the kitchen are feasible to create gains in knowledge and skills in pupils aged 6–12, to selectively overcome food neophobia, and to also reach the pupils' families. The number and frequency of our activities were too short to generate substantial changes in nutritional behavior.

We therefore postulate that nutrition education like our School of Eating should be promoted in Austrian schools.

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The content of bioactive compounds in the apples variety Gold Millennium® and in the apple polyphenolic preparations produced from these apples

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Apples are considered as healthy component of a diet due to the high concentration of different polyphenols exhibiting strong antioxidant activity (Wojdyło and others 2008). The aim of study was to examine the content of bioactive compounds in the fresh apples variety Gold Millennium® from organic production and in polyphenolic preparations produced there of.

These preparations are metabolites of dried apple pulp variety Gold Millennium® exposed to a special treatment tending to increase biological activity. The treatment and composition of bacteria are a trade secret – a procedure is patented and marketed under the trade name PectinGOLD.

Phenolic compounds were determined in fresh apples and preparations by the HPLC method (Hallmann and Rembiałkowska 2012).

The results indicated that fresh apples variety Gold Millennium® from organic production contained significantly more bioactive compounds such as vitamin C, flavonoids, carotenoids and phenolic acids than fresh apples from conventional production. These results are in line with many other studies showing the higher content of bio-compounds in the organically vs. conventionally produced crops (Barański and others 2014).

The PectinGold preparations were also analysed in terms of their polyphenol content. The following preparations have been investigated: JP2, JP5, JP7, JPG, HERB and HERB MAX. The study indicated that JPG compared to other preparations was especially rich in polyphenols and malic acid, as well as total and reducing sugars. The level of polyphenols in the preparations was much higher than in the fresh apples. It can be explained by the biochemical changes and densification during the treatment of apples.
It can be concluded that organic apples and preparations produced thereof are a very good source of polyphenols, so they can be recommended in a healthy diet.

Improving organic food integrity and quality management by better understanding the root causes of residue findings. – The case of Ukraine

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The paper bases on a study conducted in 2017, which aimed to improve the understanding situation concerning residues found in organic food products exported from Ukraine to Western Europe. The primary data, which are used, originates from residue cases notified in the European Commission's Organic Farming Information System (OFIS) as well as data and information, gathered by a survey among certification bodies, which are operating in Ukraine.

Not surprisingly, the combination of various factors such as (i) the additional sampling required by the new EU import guidelines, (ii) the growing number of exported organic lots from Ukraine, and (iii) the improved analysis technology, led to an increase of the total number of cases of irregularities notified in OFIS in comparison to previous years. Nevertheless, the number of notified irregularities in Ukraine in 2016 is moderate (affecting estimated < 1 % of all exported consignments from Ukraine). Two thirds of the affected lots were ultimately released as "organic" after additional investigations by the respective export certification body (CB). A majority of OFIS cases from Ukrainian exports seems to be linked to an insufficient management of handling procedure during the storage processes and the transport. However, drift on the field or the intentional use of unauthorized substances are also potential sources of irregularities related to exports from Ukraine.

Yet, if analysis results of samples taken by the CB's prior the export, i.e. from crops during the growing season and from lots before they are released for export are included in the risk assessment, Ukraine and also its neighbouring countries with similar production structures do need to be considered as relatively high-risk countries in terms of contamination and irregularities.

An interesting result of the study is further, that the likeliness of residue findings varies a lot among different CBs, which are operating in Ukraine. The reasons why some CB's have a high share of residue findings whereas for others proportionally much less residues are found are unclear and should be the subject of further assessments.
Based on the study, a risk-based sampling from field to storage is recommended for those operators, which have a high rank in the risk assessment. Especially sampling during the production process (field/leafs and dust) in combination with a risk assessment of the operator effectively supports organic integrity. Hence, recommendation resulting from this study is to start with samplings already on the field during the period of crop cultivation. CB's should develop risk-oriented guidelines on how and when leaf samples should be best taken and share these experiences in a peer learning process.

Transdisciplinary development of organic agriculture through participatory research: Case of Armenia

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The study that was carried out in 2017, was aimed at presenting effective strategies for capacity building of organic stakeholders based on the needs identified.
To reveal the needs existing in organic agriculture sector, 5 focus group discussions with University faculty, organic sector stakeholders, students, organic farmers and women farmers, and in-depth interviews with local NGOs, organic processors and representatives from international organizations were organized. Qualitative data received from focus-group discussions and in-depth interviews was then categorized by industries, then coded and analysed with excel.

Study revealed a big need for national organic plan that is developed in a participatory manner and promotes active participation of stakeholders involved in organic sector. Furthermore, discussions with sector representatives showed that the major challenge that organic sector in Armenia faces is low level of awareness and trust towards organic products produced in Armenia. Armenian market is still full of products that have ''bio'' and/or ''organic'' label which are not certified organic causing major mistrust towards organic production and hindering sector development. Lack of knowledge among Armenian consumers about organic products is yet another obstacle for the processors to increase the scales of organic production or to diversify it.

Lack of professionals with knowledge in organic agriculture continues to be a vital problem for Armenia as discussions revealed. As of now there are no educational programs in organic agriculture in Armenia, the sector heavily relies on self-educated organic producers and short trainings offered by local and international NGOs. Furthermore, the collaboration between academia and industry is weak hindering the growth of scientific and applied research and reducing opportunities for student career placement.

Organic agriculture is a priority sector under Armenia's "2010-2020 Sustainable Strategy Program for Agricultural and Rural Development" program, but the sector still lacks state support for strategic clarity and coordination of a unified organic movement. The role of social media and offline awareness raising campaigns for consumers should be prioritised (e.g. social events at farms, organic agro-tourism activities) to strengthen consumer-producer bonds. Implementation of transdisciplinary training and sharing of best practice in organic agriculture should be organised to fill the gap in knowledge and build capacity of the main players of the sector. Steering committee of organic stakeholders should be formed to foster mutually beneficial collaboration and develop successful learning environment.

Organic-PLUS project: Pathways to phase-out contentious inputs from organic agriculture in Europe – Research overview and preliminary results

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Across Europe, there has been an ongoing discussion regarding inputs into organic agriculture and horticulture, which are considered more or less contentious. These discussions have contributed to the decision by the European Horizon-2020 research programme to invest 8 million Euros into two 4-year projects, starting in 2018.

This presentation provides an overview of research approaches from one of those Organic-PLUS (O+) The research work in O+ includes alternatives to the use of copper and mineral oils used for plant protection, with a special focus on potatoes, perennial Mediterranean crops like olives and citrus and greenhouse crops like tomatoes and aubergines. Further research is on better organic fertilisers such as non-animal derived fertilisers, which are compatible with 'Vegan Organic Standards', but also other 'bio-economy fertilisers', which make use of existing resources, like fishpond sediments and marine-derived fertilisers. Alternatives to peat as a growing media, an area where peat replacement is most challenging i.e. in specialised nursery crops will also be researched and discussed, and also the increasing use of plastic mulch materials and potential impact of plastic and alternative mulch materials on soil pollutants.
The research on livestock covers contentious inputs used in the major animal production systems, considering the use of natural plant sources of vitamins as an alternative to synthetic products, the use of anti-infective and immune-stimulatory molecules from plant products as an alternative to synthetic antibiotics and the use of alternative and novel bedding materials in place of straw from conventional farms.

The O+ project is also committed to research broader public concerns about contentious inputs and to further develop science-society dialogue around contentious inputs.

The presentation will also present first results from the ongoing contentious input mapping tasks to map the use of contentious inputs across Europe.
The presentation will invite discussion on further contentious inputs and possible phase-out scenarios to strengthen the contribution organic agriculture and horticulture (including conventional) can make to a true 'Bio-economy'.

Organic wild plant commercialization as a deepening form of farm diversification in Austria

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Wild plant products are highly appreciated by European consumers and provisional calculations suggest a market value of at least 1.66 billion Euros, with more unresolved consumer demand. Precise accounts about the commercialization of wild plants, including those with organic certification, remain punctual and scattered though. Organic wild plant certification was reported for 23 European countries, but little details are known about the plant species harvested, their volumes, kinds of products made, or characteristics of producers involved. For Austria even, basic numbers are unknown. Here, we thus aim to i) determine the relevance of organic wild plant commercialization by organic producers in Austria and ii) understand the factors supporting and limiting organic wild plant commercialization. Applying a mixed-methods approach using the concurrent triangulation design, we started out with requesting and analysing data from organic certification bodies in Austria followed up with semi-structured interviews of experts at certification bodies (n=6). Data were analysed for the year 2016 and interviews conducted in February and March 2017. About 1.5 % of all organic producers in Austria were certified for gathering 477 different wild plant items relating to 241 different plant genera in the year 2016. Three types of organic wild plant producers were identified: specialized producers gathering single species in large amounts for sale to processors or retailers; diversified producers harvesting large diversities of species in varying amounts; complementing producers – the by far most common ones – gathering small numbers and small amounts of species for self-processing. Mixed farming, deepening farm diversification, availability of gathering areas in proximity of organic producers and availability of local knowledge on wild plant gathering were identified as supportive factors, whereas the availability of market surrogates from cultivation and the documentation requirements for organic certification were found to limit organic wild plant commercialization. These results show that in Austria most organic wild plant products are gathered in low amounts, self-processed by organic producers and commercialized as niche products. Few gatherers harvest large amounts for mass markets or a large diversities of plant species. Organic producers use wild plant products mainly to complement their product ranges and to deepen their farm diversification. This paper is only a starting point in understanding the relevance of organic wild plant commercialization in Austria and supplementary perspectives, from farmers commercializing organic wild plants or representatives of local institutions, should be sought.

Linking mulch application and fertilization with organic soybean and buckwheat production

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Buckwheat (Fagopyrum esculentum Moench) and soybean (Glycine max (L.) Merr.) are regarded as multifunctional crops in organic agriculture and thus could be successfully alternate and combined. Buckwheat is grown as the main (cash) crop, cover crop, stubble crop or green manure, while soybean is used for animal feed, human food and green manure. Due to the relatively short growing season and slow initial growth, the production of buckwheat in the semiarid conditions faces a number of challenges: weeds infestation, water shortage, uneven emergence, etc. Soybean is limited with relative air humidity, slow initial growth and suppression from weed. The aim of this study is to examine yield and morphological properties of buckwheat and soybean under different mulches and application fertilizers. The experiment was set up in semiarid conditions in Center for organic production in Selenča as 2-factorial experiment with 3 type of mulches (factor A): wood chips, straw, living mulch (field peas) as well as commercial fertilizers and soil enhancers (factor B): organic NPK (5:3:8) fertilizer (Siforga), Ascophyllum nodosum extract with 2.3% N (Wuxal Ascofol) and microbiological stimulator (Natur Plasma) were used. Control plant has not received any treatment. Soybean cultivar NS Kaća and buckwheat Novosadska were sown according to recommended crop technology.

A significant influence on the yield of buckwheat was determined on a plot with living mulch (1.9 t ha-1) compared with the control, while the yield on the plots with wood chips and straw didn't show significant differences. The higher influence on the buckwheat yield across all treatments was found by application of Siforga (2.4 t ha-1), while Natur Plasma and Wuxal Ascofol had resulted in a lower seed yield.

Higher impact on soybean grain yield was observed on the plot with undersown living mulch, in which the soybean yielded 3.5 t ha-1, while application of Wuxal Ascofol resulted with higher yield (3.4 t ha-1) compared to applied fertilizers, whereas similar yield was observed with application of Siforga and Natur Plasma.

Living mulches were helpful in maintaining of soil water properties and weed suppression. Likewise, legume provides additional N for main crops and contributed to relative air humidity. Buckwheat positively reacted to NPK organic fertilization as lower leaf area was insufficient in the foliar nutrient uptake. Soybean favours foliar application of Wuxal Ascofol in early vegetative growth due to N supply as nodules are not fully developed. Mulch treatments had significantly affected morphological traits compared with fertilizers and control. However, higher yield could be achieved only in the combination of mulches and fertilization. Our results showed significant differences in terms of impact on crop yields, which could serve as the basis for improving the management of buckwheat and soybean growing in organic systems of the production in semiarid conditions.

Low Input dairy farming in Austria – Experiences from training courses and results of participating farmers

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Organic Low-Input dairy farming systems deliver multifunctional benefits to the society and the agricultural market, but technical and economic constraints still exist. To deliver an innovative toolbox of methods and knowledge contributing to the effectiveness of low-input dairy systems, training courses for farmers named (in German) "Low-Input Praktiker-Ausbildung" were started in 2015. Until 2018, about 160 participants took part in six one-year courses held in different regions of Austria. The transfer and exchange of knowledge and experience between farmers, advisors and researchers was the main goal of the training courses. The researchers and advisors stimulated active learning with discussions and the training course partners worked on integrated management solutions in the fields of feeding, housing, breeding, grassland management and economics. The participating farmers were given no strict guidelines regarding the speed and intensity of implementation of the low-input strategy. All farmers collected basic production and economic data according to the methodology of the Austrian dairy cattle network (Arbeitskreis Milchproduktion). Each course included four two-day modules were different topics were discussed indoors and additionally on low-input pilot farms (feeding – breeding; animal housing – welfare, grassland management – grazing, economics – socio-economics). After each meeting consultants supervised further "regional small group meetings" (stable schools) on different project farms.

100 % of farmers rated the training courses as "very good" or "good". Especially the intensive exchange of practical experience between the training course partners was appreciated. The current economic evaluation results show that the following aspects are particularly important key factors for the economic success of the low-input strategy: 1) feeding cost reduction through high forage quality during lactation, 2) optimal grassland and grazing management, 3) efficient concentrate and fertilizer input, 4) low-input adapted and fertile cows, 5) high milk quality and a sufficient milk yield and 6) possibility to market the milk within premium programs. In 2017, the marginal income differed between 2,819 and 1,613 € per cow and between 43.9 and 32.7 Cent per kg milk between the upper and lower quartile of the evaluated organic low-input farms, respectively. In conclusion, optimal and site-adjusted low-input strategies offer a basis for a sustainable organic dairying in Austria. Equally to experience from other countries it was demonstrated that participatory, on farm projects are powerful tools for agricultural development and knowledge transfer.

Organic Agriculture and Food Industry in Austria – attitudes, wishes, expectations and knowledge of young people and young adults

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Teenagers and young adults shape the future development of the organic sector through their behavior, their expectations and their opinions on organic agriculture and food supply. In the present study, young people (teenagers, between 15-19 years and young adults, between 20-25 years of age) from Austria were surveyed (N 1008) concerning their attitudes towards agriculture and food production, their consumption and purchasing behavior, their wishes and expectations as well as their knowledge on organic farming and food production.

Overall, the study shows a high respect and appreciation of young Austrian people for the organic sector. Those participants who self-identify as eating healthy diets, consuming little amounts or no meat and less fast food, and those who like to cook, showed the highest positive values. High percentages of interviewees self-identify as "eating healthy" and "like to cook". The "Intensive-Organic-Consumer-group" is best informed about organic regulations and they have the highest expectations of the organic farming and the food industry. At the same time, they show the highest willingness to pay higher prices for organic-products. The following aspects of organic farming are particularly important for young people: 1) free range housing in organic livestock farming; 2) no child labor, 3) fair trade/production and 4) strict controls in the organic food importing sector; 5) regional origin of foodstuff; 6) grazing of cattle, sheep and goats; 7) protection of soil, water and environment in organic crop production; 8) freshness and quality of imported products; 9) animal welfare and animal protection as well as 10) the natural taste of organic food.

According to the data, it can be assumed that the organic marked in Austria will continue to grow. 60 % of the teenagers and young adults indicate the willingness to consume more organic products in future. In contrast only 4 % suggested to "decrease" and 2 % to "significantly decrease" organic food consumption. 81 % of the teenagers and young adults said that the organic sector should be further developed in Austria. Further detailed results are available at www.raumberg-gumpenstein.at/bio-news.

Replacement of Contentious Inputs in Organic Farming Systems (RELACS) – a comprehensive Horizon 2020 project

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Organic farmers adhere to high standards in producing quality food while protecting the environment. However, organic farming needs to improve continuously to keep meeting its ambitious objectives. The project 'Replacement of Contentious Inputs in Organic Farming Systems' (RELACS) will foster the development and adoption of cost-efficient and environmentally safe tools and technologies to further reduce the use of external inputs on organic farms across Europe as well as in Non EU Mediterranean countries. Project partners will provide scientific support to develop fair and implementable EU rules to improve current practices in organic farming. Farm advisory networks in 11 European countries will reach out to farmers to ensure effective dissemination and adoption of the tools and techniques.

RELACS builds on results of previous research projects and takes far-advanced solutions forward. This will be brought about by

(i) taking forward the development of four most advanced copper alternatives, integrate these with agronomic preventive measures and develop locally adapted plant protection strategies for major crops

(ii) developing and integrating the three most advanced alternatives to mineral (paraffin) oil into pest control strategies, which take into consideration existing agronomic and biocontrol approaches, in the Mediterranean regions

(iii) assessing acceptable sources of fertilizers from recycling technologies and matching regional needs with available nutrient sources

(iv) developing integrated endoparasite control strategies for ruminants by exploiting complementary direct and preventive tools based on the use of bioactive feed plants and a biocontrol agent

(v) reducing dependency on antibiotic use in dairy cows by transferring preventive Animal Health and Welfare Planning protocols and by refining farmers' experience of use of essential oils for direct mastitis control

(vi) exploring the potential for reduction of synthetic Vitamins E and B2 usage by revising and validating the requirement definitions in livestock diets and by development of GMO-free vitamin-producing yeast strains.

The products and management practices will be evaluated in different conditions in the EU and Mediterranean third countries. RELACS will develop implementation roadmaps by analysis of the socio-economic conditions required for acceptance and adoption of alternatives and provide scientific support for relevant EU policies to develop fair, reliable and implementable rules. Rapid dissemination and adoption of techniques along the food value chain will be achieved via established dissemination structures in 12 European countries.

The project was developed by involving actors from research, farming, advisory services and industry from the very start hence implementing a truly multi-actor approach. RELACS has 29 direct and third party partners from 13 countries and is coordinated by the Research Institute of Organic Agriculture (FiBL) in Switzerland.

Soil-data can be improved by qualitative soil food web assessment of various organic cultivation practices

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A healthy soil can be the key of the safe production in organic farming. Diversity of the soil microbes is important at all of the soil functions and ecosystem services. However, information and data about diversity of soil organisms is not complete jet, comparing to the physical-chemical data of the soils. The aim of this study is to gain a database about how the soil biota react on the differently cultivated land in an ecological farm. Both quantitative and qualitative assessments of soil microorganisms can result clearer image about the development stage of the soil biota and show also, how they can become complementary with each other in the soil food web.

The soil samples were collected from field plots of different soil management (intensive tillage, recultivation plots, perennial legume plots) at the Experimental and Research Farm of Szent István University, Ecological Farming Unit. We measured the usual soil-physical-chemical parameters, the nutrient content, the humus quantity and quality. Two enzyme activities were assessed, the fluorescent-diacetate analysis (FDA) and the dehydrogenase analysis (DHA). Beside those usual soil-investigations, the qualitative Soil Food Web assessment (Soil Food Web Inc.) was also used. Taxons of SFW are identified by light microscope from the diluted soil samples.

According to our results so far, the FDA enzyme activities were found to be significantly correlated with increasing humus content (R=0,861). However, the abundance of bacteria showed a variable image. The significantly lowest number of bacteria was in those soil samples which had the highest value of humus content and enzyme activities, meaning that the biological activity was caused by other microbes of the SFW rather than bacteria. The significantly highest number of bacteria was in the soil of perennial legume field. The SFW responded differently to the used cultivation practices, for example the highest number of fungi was found in the extensive orchard, and in the hedgerow. By repeating our measurements, we can add more data and complete our statements. Our study shows, that the use of qualitative SFW analysis is particularly important to evaluate soil management practices. The visual identification of the soil biota can effectively complete the usual qualitative measurements, because not only the activity of the microbes, but their different functional roles can be detected. Presence or absence of organisms, which are responsible for building a healthy soil can be followed in a more proper way.

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Impact of non-plough tillage in long-term trials – Results of the first crop rotation in organic farming

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Ploughing is usually the primary soil tillage in organic farming due to weed control and N mineralisation. Some farmers temporarily use reduced tillage without ploughing, but very few farmers permanently switch to reduced tillage or no-till systems with no ploughing in Germany. The aim of the study was to determine the impact of temporary and permanent non-plough tillage.

Two field trials were established in 1997 under conventional conditions at the experimental farms Neuhof (Pseudogley-Luvisol, silty loam, long-term average precipitation and temperature 677 mm and 8.7 °C, respectively) and Puch (Luvisol, loam, long-term average precipitation and temperature 882 mm and 8.8 °C, respectively). Standard farm machinery in large-scale plots was used. The three treatments were conventional ploughing (CP, ploughing after each crop), reduced ploughing (RP, ploughing every fourth year) and conservation tillage (CT, no ploughing). In 2012 and 2013, the management system was converted to organic farming by growing grass-clover leys. After conversion, the crop rotation consisted of grass-clover ley (one year, mulched), winter wheat, spring oat, field bean and winter rye. The three treatments remained the same: RP plots were ploughed after grass-clover and oat at Puch and after oat at Neuhof. A cultivator was used for soil tillage in the CT plots. Results from the first crop rotation (2014-2017) are presented in this abstract.

At Puch, yields in the CT plots were significantly lower for all four harvested crops (i.e. excluding the ley) compared to the other two treatments. Yields in the CT plots for these crops averaged only 72 % of the yields in the CP plots. In the RP plots, yields were significantly lower compared to the CP treatment only for oat (two years after the ley). Weed pressure was considerably higher in the CT plots in all crops following the ley year. The correlation between weed pressure and yield was significant and negative ($R = -0.70$). At Neuhof, wheat yields were significantly higher, but yields in the subsequent oat crop lower, in the CP plots compared to the CT plots. There were no significant differences in yield for the crops in the third and fourth years (field beans and rye). Over the whole crop rotation, the yields of the RP and CT treatments were 101 % and 97 %, respectively, of the yields for the CP treatment. Lower wheat yields were caused by higher weed pressure (particularly timothy) due to no ploughing after the grass-clover ley. In the other, subsequent crops, there were only small differences in weed pressure between all three management systems.

The differences between the experimental sites can be traced back to differences in precipitation. Precipitation is higher at Puch and therefore repeated cultivation was necessary, but often difficult or impossible after harvest. Under drier conditions, weed pressure is often lower and the probably higher water availability in tillage without ploughing is of more importance.

Extending shelf life of organic beans

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Nowadays, common beans (Phaseolus vulgaris (L.)) are regarded as functional foods that contribute to health benefits. A major problem in attempting to increase the supply of beans is high losses during storage caused by pests. The bean weevil, Acanthoscelides obtectus (Say) (Coleloptera: Bruchidae), is one of the most damaging insect pests of common bean. Pest damage by this species has been estimated to cause 20–40% loss of stored seeds per annum (Regnault-Roger & Hamraoui, 1994). Fumigating using methyl bromide (MB) to control any pest infestation used to be common practice in a number of countries (Riudavets et al. 2009), but it is not allowed according to the rules of certified organic agriculture. However, considering that even for conventional agriculture the Montreal Protocol decided to phase out the use of MB, there is a global interest in alternative strategies including development of chemical substitutes, exploitation of modified atmospheres, and integration of physical methods. The aim of this work was to investigate a new method of bean weevil control which is in accordance with the premises of organic agriculture and which will also be effective in the preservation of the bean quality characteristics. This method is based on the combination of modified atmospheres and plant essential oils.

Two different modified atmosphere conditions (A1: 10% CO2, 2% O2, 88% N2 and A2: 100% N2), 5 essential oils-monoterpenes (rosemary, lemon oil, cineol, linalool and limonene) in two different concentrations (2 and 18 μL/L air), as well as their combination were evaluated against the bean weevil. Exposure periods were 6, 8, 12, 20, 24, 48, and 72 hours. Furthermore, the effect of the above conditions on the quality characteristics of beans (moisture content, phenolic content, color, hydration rate, and cooking time) was evaluated.

The application of modified atmospheres was proved to be significantly effective. The 100% N2 atmosphere resulted in total control of bean weevil after 6 hours exposure. The mild modified atmosphere of 10% CO2, 2% O2 and 88% N2 resulted in total control at 48 hours. When this modified atmosphere was combined with essential oils, less time was required for total weevil control even at lowest concentrations of essential oils used. Thus, the essential oil could be used in a low concentration, presenting the same effectiveness as if a high concentration was applied. These results indicate that the combined application of a monoterpenoid and a mild modified atmosphere could be a natural alternative to insecticides.

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Intersectoral Cooperation of an Urban Food Garden in the Netherlands

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The Voedseltuin in Rotterdam is an urban food garden that supplies fresh fruit and vegetables to a local Food Bank for low-income households (www.voedseltuin.com). The Food Garden uses permaculture and it is designed in such a way that it is both ecologically sustainable and economically viable (Abma et al. 2013). It is a social, community supported, initiative where local active and vulnerable citizens with a distance from the labour market contribute as volunteers. In addition, it is an active player in the local area, with a participatory design. This food garden will be qualitatively evaluated by means of a focus group, to gain insights into factors that help ensure successful implementation of intersectoral initiatives, by looking into what elements were supportive or posed barriers for intersectoral cooperation. Possibilities for translation to other communities will be explored.

One focus group will be conducted, that includes at least one policy maker, one implementer and one target group member, with 5 to 8 participants. The focus group is inspired by Appreciative Inquiry (Cooperrider 2008), a strength-based approach for data gathering, focusing on what works well and how to do more of it. Beyond evaluation, this approach builds capacity and motivation for future cooperation among stakeholders, including the local community. In addition, the evaluation is guided by the INHERIT model (van der Vliet et al. 2018) which entails that specific elements of behaviour (capability, opportunity and motivation), but also the project's triple win (impacts on health, sustainability and equality) will be investigated.
The expected results of this focus group on intersectoral collaboration between the Food Garden and other local stakeholders, including citizens, will be related to supportive elements for intersectoral collaboration to establish a healthy, sustainable and inclusive community. These aspects may be related to motivation to cooperate, budget- and time restraints, but also speaking a different language due to different disciplines of stakeholders.

Urban food gardens that practice ecologic ways of farming such as permaculture can be an essential way to ensure small scale ecologic farming in urban environments, where there is less space for agriculture. In addition, these types of food gardens can help familiarize citizens with ecologic farming and ecologic food, as they are more approachable and accessible to citizens than ecologic farms that often lie further away from urban areas. In addition, urban food gardens can contribute to health, sustainability and equality. By gaining insight into how a local urban food garden collaborates with other social initiatives, valuable lessons can be drawn about how a local food garden can successfully organize intersectoral cooperation, in order to contribute to the development of a sustainable urban society with healthy, sustainable food for all.

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Efficacy of different mechanical impacts on weed growth

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Mechanical weeding is an important tool for organic crop production. Recently we observe many innovative technical improvements from different engineering companies. It is well known that harrowing and hoeing machines are mainly working by burying weeds but also pulling of the whole plants or parts of the plants are effective. However, there are no detailed and complete data available demonstrating the basic effect of different mechanical impacts. Therefore in 2018 we conducted glasshouse pot trials with the two weed species Alopecurus myosuroides (ALOMY) and Apera spica-venti (APESV). They were threatened by (a) complete pulling, (b) cutting at soil surface, (c) complete burying, and (d) Untreated. The plants were treated at three different growth stages: BBCH 11, BBCH 13-19, BBCH 29-30. In addition, the soil humidity was varied as followed: (a) 10, (b) 3, (c) 1, (d) 0 days after treatment of dryness. For each of the both weed species we had a three-factorial test with 48 variants each of it with 4 replicates. A similar test has been done with 16 other weed species in 2017. The results are expressed as fresh weight per plant and efficacy (%) calculated from the fresh weight in comparison to Untreated. Following a multi-factorial ANOVA all tested factors had significant effects ($p < 0.05$) and interactions between treatment and growth stage and between treatment and dry period were also highly significant. It could be demonstrated that pulling of ALOMY and APESV had the weakest effect and was reduced if the dry period was shorter than 3 days. Pulling of these weeds at BBCH > 13 resulted in efficacy rates of < 70 %. In contrast, the efficacy of cutting and burying of APESV was almost 100 % and was not affected by growth stage and dry period. APESV was much more sensitive to all mechanical impacts than ALOMY. ALOMY is able to regrow if the dry period after treatment is less than 10 days. The efficacy was only slightly influenced by the tested growth stages. As a consequence, new tools of hoeing machine should work more as cutting tools. Under field conditions control measures can be conducted rather late in order to use beneficial effects of weeds and to avoid subsequent weed flushes by soil moving. Furthermore, robots should be designed as weed cutting machines.

Susceptibility of winter wheat- and spelt wheat varieties to common bunt of wheat (Tilletia caries) and the need for ecological wheat breeding

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27 wheat and 6 spelt varieties suitable for ecological farming have been cultivated and tested for susceptibility to common bunt of wheat (T. caries). The 3-years randomized field trials have been carried out at 1 site, with 4 replicates and 10 m row length on naturally infested fields with T. caries. Sowing, weed control and harvesting was done by hand. The number of infested ears has been counted and the number of spores per kernel or spelt has been determined according ISTA. The infestation by wheat of the highest (Bernstein, Julius) and lowest (Pireneo, Graziaro) susceptible wheat varieties was higher than 30,000 and lower than 10 spores per kernel, respectively. The six spelt varieties had the lowest infestation significantly below 100 spores per spelt. None of the tested varieties was completely free of infestation. The most susceptible varieties come from conventional breeding programs therefore it is necessary to develop varieties with low susceptibility against common bunt of wheat in ecological breeding programs under ecological conditions.

Sustainability assessment of organic dairy farms in mountainous areas of Austria

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Dairy farming plays a major role in mountainous regions of Austria, mostly due to high proportion of grasslands. In general, Austria's dairy farming faces challenges regarding sustainability, e.g. environmental impacts, but specifically for alpine areas low productivity and dependency on direct payments are lowering sustainability. Organic farming is considered as a strategy to overcome these challenges. Considering this general background, we analysed the sustainability performance and its main drivers of organic dairy farms in mountainous regions of Austria.

In 2017-18 we assessed 173 organic dairy farms delivering milk to the organic brand Zurück zum Ursprung with the Sustainability Monitoring and Assessment Routine (SMART). SMART-Farm Tool is based on the SAFA Guidelines (FAO 2014) and models the performance of 58 SAFA sub-themes using 327 indicators. On a scale from 0% for poor to a 100% SMART analyses the degree of achievement of indicators and for the sub-themes (Schader et al. 2016). Stratified random sample (n=173) represents roughly 10% of all Zurück zum Ursprung-dairy farms. We applied descriptive statistics to analyse the sustainability performance of farms.

Average values of 58 sub-themes show an overall positive picture in the sustainability performance resulting in 26 sub-themes scoring 'very good', 25 'good', 6 'moderate' and 1 sub-theme scoring 'deficient'. Due to relatively high social standards in Austria, farms perform very well with respect to Social Well-Being, whereas in Ecological Integrity only 4 of 14 sub-themes do so. In many sub-themes regional comparisons show relatively homogenous scores, which indicates a levelling process through various standards applied by these farms, which focus on organic regulations, less concentrated feed and animal welfare. However, an intra-regional comparison shows higher variability.

We conclude that the individuality of farm backgrounds shows a relatively high variability of farms, though the standards mentioned. This is even true for core areas of these standards, e.g. the SAFA sub-theme livestock's Freedom from Stress showing a range of 30%, 34%, 23% and 32% for the regions Alpenostrand (Eastern Alps), Hochalpen (High Alps), Voralpen (Pre-Alps) and Wald- and Mühlviertel, or only moderate results for the SAFA sub-theme regional Value Creation, despite the fact that farms are part of a regional brand. Although farms show good to very good results, our analysis shows optimisation potentials and measures to improve sustainability not only on farm level, but also on a regional and national scale.

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Opportunities for farming in alpine countries – pathways to truly grassland-based beef and milk production in Austria and Switzerland

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Farming in the alpine countries of Austria and Switzerland fulfils important economic, socio-cultural and ecological functions for society. However, even though both Austria and Switzerland have increasingly focused their agricultural policy towards ecology, in both countries negative environmental impacts of agriculture still have to be reduced massively.

Our comprehensive analysis identifies nitrogen balance surpluses and related impacts as central factors for the negative environmental impacts of agriculture in Austria and Switzerland. The starting points for a more ecologically sustainable agriculture are therefore locally appropriate livestock numbers as part of an overall reduction in livestock densities, together with reduced reliance on concentrated feed and forage maize (Stolze et al., 2018).

To address these issues, we used the SOL mass-flow model (Muller et al. 2017, Schader et al. 2015) to analyse to what extent site-appropriate, grassland based regenerative beef and dairy systems (RDB) that minimise competition between food and feed production, could contribute to ecologically sustainable land use without exceeding the regional ecosystem boundaries.

Model results suggest that the implementation of 'regenerative beef and milk production systems' would result in lower ammonia emissions, a reduction of nitrogen balance surpluses and lower total greenhouse gas emissions from agriculture. From our analysis we can conclude for Austria and Switzerland that: a) A reduction in nitrogen intensity is urgently needed; b) Site-adapted production and closing material cycles are crucial; c) The improvements in environmental impacts achievable through regenerative beef and milk production exceed the effects of the previous agricultural policy since the 1990s; d) Arable land released by growing less concentrated feed and forage maize allows other options to be explored; and e) Reductions in the degree of self-sufficiency could be offset by sustainable trade and a significant change in dietary habits.

It has to be emphasized that creating the necessary framework and conditions for such a transformation from a production-led to an ecologically oriented land use and corresponding food systems cannot be achieved within a few years but that it signifies a long-term fundamental societal change.

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Yields of different crops in an organic agroforestry system

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The aim of this study was to compare yields of organic agricultural crops in an agroforestry system (AFS) (short rotation coppice – SRC) with standard cultivation on open fields. A positive effect on the yield of agricultural crops is expected, as reported in the literature for hedgerows and windbreaks (Bruckhaus & Buchner 1995, Pretzschel et al 1991).

Field trials were located at two experimental sites in Bavaria (Germany; Freising/Munich Gravel Plain, Neuhof/ Franconian Jura). The trees (poplar clones ‚Max 1' and ‚Max 3', seven-year rotation) were planted in strips five rows wide, perpendicular to the prevailing wind direction. Yields and quality were measured in a seven-year crop rotation consisting of oats, winter wheat and grass-clover leys in plots at different distances from the tree strips and at the same distances in plots on open fields.

Results are presented for the period 2009-2015. There were no significant differences between winter wheat yield in the AFS and in the open field control. Oat yields showed a similar pattern. The same also applied to grass-clover yields, with the exception of 2014 at the Neuhof site where yields were slightly higher between tree strips compared to the control. Yield spatial distribution, however, differed significantly. A significant yield reduction in plots in close proximity to the tree strips was offset by higher yields in plots further away from them. Results for crop quality showed that the SRC strips had no effect on grass-clover protein and energy content. Results were inconsistent between sites and years for wheat (baking quality) and oat quality parameters (hectolitre weight).

Our findings are in line with the results of Ochsenbauer et al. (2013), who also report lower biomass for winter wheat in close proximity to SRC strips and higher biomass at distances of greater than five metres from tree strips.
In conclusion, total yields in an organic AFS (SRC) did not differ from yields under open field conditions, whereas the spatial distribution of yields differed significantly. As tree strips provide important ecosystem services like erosion control, CO2 sequestration, biodiversity, cooling effects and low nitrate losses, they can be recommended for renewable energy production in organic farming. Adequate agro-environmental measures still have to be developed in Bavaria.

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Ochsenbauer M, Machl T, Maidl F-X, Schilcher M & Hülsbergen K-J (2013): Sensorgestützte Analyse der Ertrags¬variabilität von Winterweizen in einem Agroforstsystem mit schnellwachsenden Gehölzen zur Bioenergie¬er¬zeu¬gung. Mittg. Ges. f. Pflanzenbauwissenschaften, Göttingen, 25, 112-113

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How to improve collection on organic agriculture in the countries of Central and Eastern Europe

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Annually, the Research Institute of Organic Agriculture FiBL collects data on key indicators of organic agriculture in European Union such as area, production and trade data among national data sources (for trade data) and Eurostat (for area, production and operator data; Eurostat 2018). Data are compiled in a MySQL database, and quality checks are carried out following the ORMACODE of the EU-funded OrganicDataNetwork (OrganicDataNetwork et al 2014), much of which is based on Eurostat's Statistics Code of Practice (Eurostat 2011). Checks include the comparison against the previous year, the neighbouring countries, and the overall total. In case of inconsistencies, data providers are asked for clarification. FiBL publishes the data annually in collaboration with IFOAM – Organics International in a statistical yearbook (Willer & Lernoud 2018).

Survey results for 2016 show that almost 2.6 million hectares, or 21 % of the EU's organic farmland (12.1 million hectares), were located in the CCE countries of the EU. In 2016, the organic area increased by 4.7 % in the CEE countries and thus at a slower rate than in the EU as a whole (+8.2 %). Growth was, however, higher than in the three preceding years, for which stagnation was noted. Organic farmland in the CEE countries constitutes 5.1 % of the total agricultural land, which is less than the organic farmland share for the EU of 6.7 %. Retail sales data are scarce. According to the data available, the CEE organic market amounts to at least 524 million euros. However, for some CEE countries, no data or no updated data are available; and for many countries, data are based on estimates.

The data show that, currently, the organic sector in the CEE countries is developing at a slower pace than in the EU and that the development of the organic area and production is not matched by a similar development of the market or processing infrastructure. However, due to the many data gaps, it is not possible to draw a clear picture.

This brief analysis indicates that there are many challenges in the area of market data collection. Whereas the availability and accessibility of area and operator data is good, no country, except for the Czech Republic, has a permanent collection system for trade data. The extent of the domestic market is not known for many countries or CEE as a whole, and it is thus not possible to predict trends.
It would therefore be good if governments could support the collection and analysis of organic market data and if actors could follow existing examples of good data collection practices. It would be important to give a mandate to institutions already in charge with data collection to include data on organic agriculture, to help improve statistical processes, to support the harmonisation of classifications and definitions, and to make sure data are going though thorough quality checks (Zanoli 2014).

The work presented here is funded by the Swiss State secretariat for Economic Affairs and the International Trade Centre ITC and it received funding from the European Union in the framework of the OrganicDataNetwork project (No. 289376), which ran from 2012 to 2014.

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Organic or Local Food: Consumers' Attitudes and Preferences for Vouchers

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Organic food market has grown fast in several EU countries, but the market share remains quite small. Recent literature review (Aschemann-Witzel & Zielke 2017) concluded that price is the most important perceived barrier to the purchase of organic food. Consumers with limited budgets, such as low-income households, are less likely to buy organic food. Providing food vouchers have been shown to stimulate the consumption of the given foods among low-income households, but also to improve availability and variety of the foods (Hawkes et al. 2015).

The globalization and "conventionalization" of the organic food market has led to a "local" trend among consumers. In Germany for example, 92 % of respondents prefer local to organic food, while 77 % value organic locally grown produce. Apart from German consumers, little is known about consumer attitudes and preferences for interaction between organic label and origin in EU countries (Thøgersen et al. 2017).

This paper aims at shedding light on preferences and attitudes towards organic versus local food and demand stimuli in EU countries with very small organic food market shares (from 1.7 % to 0.2 %) (Willer & Lernoud, 2018).

Primary data analysis is based on a questionnaire survey conducted in five European countries (Spain, the UK, the Czech Republic, Latvia, and Portugal) between August and September 2018. We perform statistical analysis of about 10,000 survey responses to contingent behaviour experiment with three randomized treatments (vouchers for all fruits and vegetables, organic, and from country of the respondent). The financial participation of the respondent ranged from 20 % to 60 % of total value of vouchers. We used seven-point Likert scales to measure attitudes, perception of the term organic and local food, and trust in organic certification system.

Attitudes of consumers to organic and local food and differences in their willingness to pay for vouchers for organic and local fruits and vegetables are compared. We identify segments of the populations of the five countries that 1) prefer local food to organic food and that appreciate organic locally grown produce, 2) would apply for the vouchers. Consumer segmentation is based on sociodemographic and psychological variables.

Policy options for the promotion of organic food are proposed. The potential of vouchers for organic fruits and vegetables to serve as a novel policy instrument are discussed.

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Organic, local fruit and vegetables – strengthening links between consumers and producers across Europe

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Preferring organic fruit and vegetables, avoiding food that has been transported by air and reduction of consumption of meat and dairy products were identified as the most effective ways to limit the environmental impacts of food in developed countries (Reisch et al. 2013). To enable a 'triple win' by lowering environmental impacts, improving health and health equity, the EU funded "INHERIT" project (www.inherit.eu) seeks to identify new policies and promising practices.

To contribute to this aim, this session examines consumers' attitudes, preferences for organic and local food with focus on vegetables and fruits, and two pilot projects that connect consumers and local producers in a new way. The analysis in all three papers is guided by "INHERIT" model that explains behaviour by capability, opportunity, and motivation.

The main topic of this session is consumers' perspectives and expectations related to organic food. Except attitudes and preferences for organic label and country of origin, responses to vouchers for organic fruits and vegetables are analysed. Providing people with vouchers for organic fruits and vegetables could be a new policy instrument that will trigger the change to sustainable and healthy diet that can be affordable for low-income consumers who are less likely to buy organic food. The analysis is based on own consumer survey conducted in the Czech Republic, Latvia, Spain, the United Kingdom, and Portugal. In total, questionnaires from about 10,000 respondents were collected in 2018. The dataset is statistically analysed using regression analyses and latent class models.

The session further deals with topic development of local markets, as it presents one case study of a network that connects local small farmers, promoters and consumers and one case study of community supported agriculture. The first case study includes a survey of consumers (N=4,015) and producers (N=153) conducted in Portugal. Structural Equation Models are used to test the hypothesis that the network shapes opportunities, capabilities and individual motivation of consumers and farmers for more sustainable behaviours. The second case study is based on qualitative analysis of data from a focus group on collaboration between a food garden and local stakeholders in the Netherlands. The possibilities and limitations of the local markets are evaluated based on the case studies and the multinational survey that examines the "local" trend among consumers (Thøgersen et al. 2017). The session is also relevant to the conference theme of strengthening partnerships across Europe, as it brings together findings from several EU countries.

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Thøgersen, J. et al. How important is country-of-origin for organic food consumers? A review of the literature and suggestions for future research. British Food Journal 119, 542–557 (2017).

Rotational no-till vs. reduced soil tillage cultivation in organic soybean

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Cover crop based organic rotational no-till has important application possibilities in organic agriculture. The advantages of the roller crimper system are promotion of soil fertility, increased soil moisture, increased weed suppression, decreased soil erosion, and increased economic efficiency. Research shows that net profit of the roller crimper system is higher despite lower yields (Bernstein et al. 2011). The disadvantages of the roller crimper system may include problems with perennial weeds, decreased yield, and resprouting of mulch layer.

A field trial was performed in Absdorf Austria from 10/2016 to 09/2017 to compare differences between a roller crimper method and a reduced soil cultivation method in organic soybeans. In the roller crimper method (var. A), an overwintering cover crop (winter rye, Hungarian vetch) was sown in fall, roller crimped at the flowering stage and direct seeded in spring with soybean (cv. SY Livius, 133 kg ha-1). No soil cultivation nor mechanical weed control was performed between the sowing of the cover crop and the harvest of the soybean in var. A. In the reduced soil cultivation method (var. B), the overwintering cover crop was sown in fall followed by soil cultivation with a cultivator (5 cm depth) in spring. Soybean was then sown, as well as mechanical weeding during the main season. The field experiment was established as a strip trial with four replications, the statistical analysis was done with SPSS Vers. 24.

The results showed that the soybean yield per ha of var. A was similar with 1.7 to var. B with 2.2 t, the yield per plant was statistically different between the variants, with var. A having 4.3 compared to var. B with 8.9 g m-2. Despite var. A having a lower yield, var. A had 40 soybean plants/m^2, compared to var. B with 25 soybean plants/m^2. This was attributed to the decreased rowing spacing (25 cm rows in var. A, 50 cm rows in var. B), which resulted in lower intraspecific competition between the soybean plants and in higher biomass formation of the soybean with var. A having 3060 kg ha-1 dry matter compared with var. B at 2341 kg ha-1 dry matter. In addition, the soybean protein content was different with 36.1 % in var. A compared to 39.2 % in var. B.

In conclusion, var. A showed to have important benefits, such as higher water infiltration, having a rate of 6.6* 10–5 m/s, and var. B having a rate of 1*10–5 m/s a few days before roller-crimping and direct seeding, year-round soil cover, and increased above-ground biomass formation.

Bernstein, E.R., Posner, J.L., Stoltenberg, D.E., Hedtcke, J.L. (2011): Organically managed no-tillage rye-soybean systems: Agronomic, economic, and environmental assessment. Agron. J. 103: 1169–1179.

Effects of different farming systems on soil P in four regions of Germany

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Phosphorus is a limiting nutrient for the productivity of many agricultural systems. Therefore, it is important to study sustainable P management with reduced P losses and the use of renewable P resources. To achieve sustainable land use, it is important to understand the influences of agriculture on soil. A network of 40 pairs of organic and conventional farms across four regions of Germany was established with focus on research on climate impacts and sustainability indicators in agricultural production. In a part of the joint project "Climate Effects and Sustainability of Agricultural Systems – Analyses in a Network of Pilot Farms" soil chemical, biological and physical properties were investigated. The aims of the present study are to report the soil phosphorus in agricultural soils in four regions (East, South, West and North) of Germany.

Soil samples were taken between 2009 and 2011 on 80 farms (10 pairs in four regions) to analysis different effects on soil properties. Soil samples were collected from 323 arable fields with winter cereals and 78 grassland fields from the soil layer 0-30 cm. At each experimental site all data were collected in four sampling plots, each 10 m × 10 m in size. For each plot, the coordinates were determined with GPS. For each monitoring plot there is a database with detailed information comprising crops, cover-crops, amount and kind of mineral and organic fertilizers applied and tillage (management practice data). The soil phosphorus contents were measured using the Murphy and Riley (1962) colorimetric method.

Generally, P2O5 content in organic farming was lower than in conventional systems. In organic arable land, P2O5 content amounted 131 µg/g soil, in conventional arable land 170 µg/g soil, in organic grassland 77 µg/g soil and in conventional grassland 93 µg/g soil. In arable land and in grassland significant differences between regions were recorded. In grassland, the highest P2O5 content was recorded in the north of Germany; in arable land in the west of Germany. Cash crop farming amounted higher P2O5 content in the soil than dairy farming. P2O5 content differed significantly between the farm types only in organic farming. This suggested the important influence of farm type on soil parameters in organic farming. In the next steps, the soil texture, bulk density and other soil analysis (Corg- and Nt-content, K-concentrations, pH and microbial biomass) will be taken into account. In 2015-2016, the second soil sampling was carried out at the same sites. The results from both samplings will be compared and evaluated in context of management data.

There is a demand for further studies on the impact of agricultural practices on soil processes in relation to regional and farm scale parameters. Yet, the relation of farming systems, management practices and soil parameters is complex and influenced by regional differences.

Comparison of two specific treatments in the Hungarian on-farm research program for varroa control in organic beekeeping

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Varroatosis as the current bane of the beekeepers is causing the biggest economic damage in the apicultural sector. In conventional operations varroa mites are usually treated by synthetic products that over time lose efficiency and leave toxic residues in the hive products. In the technology of organic beekeeping only natural materials are allowed to be used such as essential oils and organic acids that actually also have interests because of the resistance to acaricides. Because of the high density of the hives in Hungary the reinfection is fast during the active season. The essential task of the program is to find an appropriate Varroa control method during brood presence. Concrete results are simply not available yet.

Since 2013 within the beekeeping on-farm research program, the Hungarian Research Institute of Organic Agriculture is collaborating with beekeepers throughout Hungary in comparative trials for testing the efficacy of different types of varroa control treatments and management. The trials are set up in market operations. In 2018, 93 beekeepers where creating „participatory" research team in the on-farm program. The current comparison is between the recently appeared application of "extended-release" method of the oxalic acid – glycerine in different carrier materials to the series of oxalic acids sublimation as a standard control method. The experiment was set up in June, July and August of 2018. Each treatment group was formed from four hives in each apiary. The treatment efficiency was calculated from the comparison of the caused mite falls to the naturel mite falls observed with sticky boards. The natural mite falls of one week were observed with sticky boards (e.g. 4 mites dropped in a week). The one-week natural mite falls were calculated for three-day time periods: number of fallen mites divided by the number of days elapsed by three (e.g. 4/7 * 3 = 1.7). The three-day mite falls following the treatment (e.g. 19) is compared to the three-day natural mite fall: 19 / 1.7 = 11.1x, thus, the treatment resulted eleven times more intensive mite fall compare to the natural fall.

The presentation is illustrating an interim observation period by examining the treatment types according to the following questions:

- Is there a difference between the effectiveness of different carrier materials?
- Does the size of the frame affect the effectiveness of treatment methods?
- Does population size of the colony is affected by the type of treatment?
- The bees would tolerate it?

Approaches to hop agrotechnics in organic farming in the Czech Republic

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The poster summarizes organic hop growing in the Czech Republic. It's focused on usage of organic manuring and mineral fertilizers, along with auxiliary plant preparations. Weed control, leaf analysis, irrigation, seedlings and growth improvement are described in connection with actual legislation.

The beginning of organic hop growing in the Czech Republic dates back to 2009. The first Czech certified organic hops was harvested in 2012 after 3 years long transition period. Due to the statistics of Ministry of Agriculture of the Czech Republic there were 10,55 ha of organic hop gardens on 30th May 2018. This area is divided among four hop growers in hop regions Saaz and Tirschitz with only two grown varieties – Saaz and Premiant.

Manure and compost are the most used substrates for hop nutrition, but they can't be produced in intensive livestock farming (due to Methodological Instruction of the Ministry of Agriculture No. 6/2016.Green manuring is recommended in order to ensure the circulation of nutrients between plants and the soil. If there is not organic seed on the market, an exemption for conventional seed with limited validity is required. Most of the hop gardens are sown with monocultures such as white mustard (Sinapis alba), lacy phacelia (Phacelia tanacetifolia), buckwheat (Fagopyrum spp.) and especially leguminous plants with the ability to fix air nitrogen like beans (Faba spp.), peas (Pisum spp.), peavines (Lathyrus spp.), lupine (Lupinus spp.), vetch (Vicia spp.), etc. or various mixtures of clover (Trifolium spp.) and ryegrass (Lolium spp.).

Mineral fertilizers of natural origin, like calcium carbonate, magnesium carbonate, magnesium sulfate etc., can be used. Since 2012, the Central Institute for Supervising and Testing in Agriculture in the Czech Republic administers the database „Fertilizer Register", which is supplemented by a clause on the use of fertilizers and auxiliary plant preparations in organic farming. A liquid nitrogenous fertilizer TopStim N13 (made out of rabbit skins) is available on the market and can be used for foliar feeding or applied with water to the soil.
The irrigation dose is calculated by a graphical-analytical method. Fertigation is allowed if authorised fertilizers are used.

Weeds are regulated mainly by mechanical cultivation. Herbicides and defoliants are forbidden. Thermal weeders are allowed.

Seedlings for planting a new hop garden or just replanting missing plants doesn't need to be organic, because of the exception in the Methodological Instruction of the Ministry of Agriculture No. 6/2016.

FARMER'S PRIDE: enhancing in situ conservation of plant genetic resources in Europe

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The Farmer's Pride project (www.farmerspride.eu) is establishing a European network of stakeholders and sites for the in-situ conservation of plant genetic resources (PGR) in the region to support agriculture, food and nutritional security. The project, running between 2017-2020, coordinated by University of Birmingham, involves more than 50 national and international organizations representing stakeholder groups with an interest in conservation of PGR, both from within and outside of Europe. With this project presentation we would like to draw your attention to the main objectives, however the first results are expected at the end of the second year, in 2019.

Although historically PGR conservation has almost exclusively been focused on seed collection and genebank ex situ storage, in recent years significant progress has been made in developing and testing in situ methodologies for both landrace (Veteläinen et al. 2009) and crop wild relative (Iriondo et al. 2008, Maxted et al. 2012) populations. Such a level of integration will need a novel holistic approach to PGR conservation and use, and involves the establishment of a network for in situ conservation (FAO 2011, ECPGR 2012). Farmer's Pride will help to establish multi-actor partnerships running a stakeholder survey (http://www.farmerspride.eu/survey), to gain a better understanding of the roles and aims of the people and organizations, involved or with an interest, in the in situ conservation of plant genetic resources in Europe and will also establish a stakeholder communication and collaboration platform to engender cross-sector partnerships.

A vital aspect of the project is to better understand existing systems of direct use of crop material involving local seed systems and how they interact with national gene banks and authorities, and private seed companies. By improving the management of community seed banks (CSBs) and by defining the roles of these different stakeholders—for example, in ensuring seed quality, good information management, and in developing national cooperation projects—the project is working to create stronger and long-lasting local, national and international networks. In-depth case studies in Denmark and Hungary are being conducted to investigate how to strengthen existing national networks—for example, by analyzing how local seed networks interact with seed companies and national authorities, and by reviewing the impact of national seed legislation. In order to analyze and at the same time facilitate networking between the formal and informal sector, during the project several meetings are organized in the above-mentioned countries.

CSB management guidelines are also being tested and evaluated and links between national and international networks are being investigated. The results will be used to demonstrate best practices in national seed networking and will be promoted with the publication of guidelines, including policy recommendations.

The project is funded by the Horizon 2020 Framework Programme of the European Union.

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Certification of green inputs for livestock production

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The increasing demand for livestock products is putting pressure on the livestock sector to produce more with limited resources (FAO, 2016). This increased demand brings challenges in terms of global resource usage and food security. Possibly one of the most important challenges facing animal agriculture is reducing the use of antibiotics in livestock production. The positive association between AMR and antimicrobial consumption (AMC) is confirmed for most of the AM-combinations investigated, in both humans and animals (EFSA, 2017), which emphasizes the fact that keeping antimicrobial medicine use low will lead to less risk for environmental, human and animal health, including the development of antimicrobial resistance.

In this current context, the development of alternative practices to feed and treat animals is a top priority within the sector. Therefore, the objective of this work is to present the development of a certification process for Green Inputs logo to be used on livestock production.

The CAAE Green Inputs® Logo has been developed by CAAE certification Service. The logo certifies that the products has i) Non-residual natural origin of compounds with proven efficacy, ii) no GMOs and iii) is in compliance with RE (CE) 834/07 Directive.

The actual work is being conducted through a collaborative framework between CAAE and CSIC and involve the following activities: i) analysis of the composition in metabolites of different plant extracts and essential oils by a combined analytical platform of LC-MS and GC-MS, ii) design of on-farm trials to test the efficacy of the treatments, iii) evaluation of trials results to elaborate the corresponding scientific report. Whilst CAAE has long experience in certification service as International Entity accredited for the EU for the European Organic Production Standard RE (CE) 834/07 and USDA for the National Organic Program (NOP); the department of physiology and biochemistry of animal nutrition at CSIC have expertise in the state-of-the-art research of animal feed additives.

During the course of the conference the authors will present the first results of both the analytical platform and the farm trials.

Competition and productivity in organic oats-forage legumes cropping system

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Undersown of forage legumes in cereals is a technology intended to enhance biodiversity in organic agrosystems, increase and stabilize yields, and make better use of plant growth resources (Gaudin et al., 2013). The field experiment was carried out during 2018 at the Joniškėlis Experimental Station of Lithuanian Research Centre for Agriculture and Forestry on a clay loam Cambisol. The aim of study was to establish the effects of undersown forage legumes in oats on the competition and productivity of oats-forage legumes in organic cropping system. In spring, were sown sole crops: oats (Avena sativa L.), black medick (Medicago lupulina L.), white clover (Trifolium repens L.), Egyptian clover (Trifolium alexandrinum L.) and forage legumes were undersown into oats.

The oats were harvested at complete maturity stage. Indices of plant competition: competitive ratio (CR), forage legume relative yield (RYfl), oats relative yield (RYo) and relative yield total (RYT; RYT = RYfl+RYo), on the basis of total oats (grain+straw) and aboveground mass of forage legumes were calculated (Weigelt, Joliffe, 2003). Meteorological conditions (dry summer) influenced forage legumes growth.

The highest and stable oats CR was established in oats-white clover and oats-black medick, and the lowest – in oats-Egyptian clover cropping systems. It affected the grain yield of oats. In oats-Egyptian clover cropping system oats grain yield was 3556 kg ha-1 or by 200 kg ha-1 (6.0%) higher, compared with sole oats.

In the dry 2018 vegetation period, the emergence and establishment of forage legumes was weak. According to productivity of aboveground mass, forage legumes as sole crops were ranked in the following order: white clover > black medick > Egyptian clover. The growth of these forage legumes with oats resulted in yield decrease by 14-15 times compared to cultivation in a sole forage legume crop. The lower yield of the Egyptian clover is believed to be due to the weaker activity of the Rhizobium bacteria.

RYfl and RYo values defines the ratio between the yield of crops grown in oats-forage legumes cropping system and the yield of the same crops grown as a sole crops. When RYT >1 there is an undersown forage legumes advantage in terms of improved use of environmental resources for plant growth (Weigelt, Joliffe, 2003). In our research, the highest RYT value (1.1) was established in oats-Egyptian clover cropping system. The local and weather conditions can influence the degree of competition and crop productivity.

Gaudin A.C.M., Westra S., Loucks C.E.S, Janovicek K, Martin R.C, Deen W. 2013. Improving Resilience of Northern Field Crop Systems Using Inter-Seeded Red Clover:A Review. Journal of Agronomy 3, pp. 148-180

Weigelt A., Jolliffe P. 2003. Indices of competition. Journal of Ecology, vol. 91, pp. 707-720.

Bioaccumulation of essential and toxic elements in two species of alternative small grains in organic farming

Gršić, N.[1], Kovačević, D.[1], Dolijanović, Ž.[1], Oljača, S.[1], Popović–Đorđević, J.[1], Mutić, J.[2], Đurđić, S.[3]

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The chemical composition of soil has a very important role for the quality of cultivated plants as well as for the health and safety of products. Today, the chemical composition mostly depends on the type of agriculture production and there are several types of agriculture worldwide. Organic farming was created in response to the increasingly adverse impact that conventional agriculture has on the environment. It is a type of agriculture based on ecological principles and its ultimate goal is creating health-safe food. The aim of this study was to determine the content of essential elements – magnesium (Mg), potassium (K) and phosphorus (P) and toxic elements –vanadium (V), nickel (Ni) and strontium (Sr) in the soil and grain of two winter types of alternative small grains: Tritico secale (genotype Odisej) and Triticum spelta (Nirvana variety) which were organically cultivated. The transfer factor (TF) was also determined and it represents the ratio of the examined elements in both the soil and the grain. In the experiment, which was carried out on the experimental field "Radmilovac", on small plots, during the 2016/17 vegetative season, three variants of fertilizers were applied: foliar microbiological fertilizer (Slavol), two types of microbiological fertilizers (Uniker, which stands to be sertified for organic agriculture and was applied before sowing + Slavol, foliar application in the phase of stem elongation) and control treatment. Soil samples were collected in February before application of fertilizer. Inductively coupled plasma with optical emission spectrometry (ICP-OES) was used to determine the content of the elements. All samples had three measurements. In the soil, the highest concentration was observed for magnesium (3348 mg/kg in variant with Slavol), whereas the smallest concentration was detected for strontium (16.79 mg/kg in variant of Slavol+Uniker). The most favorable chemical composition had a variant with Slavol and Uniker combined, because it has the lowest concentration of toxic elements, and the highest concentration of phosphorus, which is of great significance to the wheat. In wheat grains, the highest concentration was found for phosphorus (4738 mg/kg – Nirvana – Control), while the lowest concentration was determined for nickel (0.19 mg/kg – Odisej – Slavol). Control variant had highest concentration of essential elements. Variant with Slavol had lowest concentration of essential elements and the highest concentration of toxic elements. When compared two types of wheat, Nirvana had higher concentration of essential elements in all samples, except for potassium in the variant with Slavol, but it also had higher concentration of examined toxic elements in combined application of Slavol and Uniker and higher concentration of vanadium and nickel in variant with Slavol. The transfer factor (TF) of the examined elements was in the order of P> K> Mg> Sr> V> Ni and it was the same for both types of alternative small grains.

Experiments of variety tests and seed-and soil treatment in organically cultivated soybean (glycine max (l.) Merril.)

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Soya production in the world has multiplied since the seventies (FAOSTAT 2018). The EU is increasingly importing 40 million tons of soybeans, mainly from Brazil and Argentina. On the world market, 8 to 15 million tonnes of GMO-free soybeans are available for the EU. This amount does not cover half the EU's total consumption. In recent years, the market demand for bio-qualified soybeans of European origin is further intensified. Soybean can be used to capture atmospheric nitrogen by the Bradyrhizobium japonicum bacterium in symbiosis with its roots. With this property, it plays an important role in organic farming too and as the world's most important protein plant in organic animal husbandry. Since 2013, ÖMKi has conducted soya experiments in ecologically cultivated areas, our aim to optimize variety selection and to develop efficient agrotechnics in organic soybean production.

In 2017, early maturing soybean varieties were tested (ES Mentor as standard, Sigalia, Sy Eliot, S 0880), and in combination with four different Bradyrhizobium inoculants soil (Biofil Soja) and seed treatment (RhisoNat as standard, Risoliq, EcoRhis) were tested on variety Sy Eliot. The experiment was carried out in the Soroksári Experimental and Research Farm of Szent István University with 4 repetitive randomized block layouts. Seed inoculation and soil treatments were made directly before sowing according to the recommendations of the manufacturer. Relative Differential Calculation was used to evaluate the yield results compared to the standard (RD %). The impact of four treatments on the number of the nodules was determined with nodules-counting on the root samples at flowering and via the calculation of the RD %. The effect of the number of nodules on the yield and yield quality traits was studied using Pearson-correlation.

Based on the data of the variety tests it can be stated that there were considerable differences between the average yields of the tested varieties. The yield of the other varieties exceeded the standard variety significantly. (The yield of Mentor as a standard was 3.66 t ha-1, while that of Sigalia was 6.05 t ha-1, (RD 65.2 %). For S 0880 and Sy Eliot the grain yields were 5.1 t ha-1, (RD 39.5 %) and 5.2 t ha-1, (RD 42.2 %), respectively. The differences in the protein content were lower with an average of 39.5 % (minimum value was 38.3 % for S 0880 while the maximum value was 40.7 % for Mentor). The highest protein yield was achieved by Sigalia (2.4 t ha-1).

Results on the effect of four treatments on the root nodule formation and its impact on the yield and yield quality showed that the number of nodules (26) was the highest for the Risoliq (RD 58.3 %), and lowest for the Eco-Rhis (7.2, RD 58.3 %) treatment. Highest grain and protein yields were obtained in the seed and soil treatment with Risoliq and Biofil Soja (6.8 t ha-1, 2.6 t ha-1, respectively). The number of nodules was found to have a positive correlation with the protein content (r = 0.5977) and the grain yield (r = 0.4575).

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Impact of roasting on the phenolic profiles, antioxidant and metabolic syndrome-related enzymes modulatory activities of Sorghum bicolor grain

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Consumption of whole cereal grains, such as Sorghum bicolor (S. bicolor), has been evidently associated with lower risks of metabolic syndrome (MS), due to the presence of some bioactive phytochemicals, including polyphenols. These phytochemicals and their bioactivities are affected by various processing methods. Hence, this study investigated the impact of roasting temperatures (150°C and 180°C for 20 min) on the phenolic profiles, antioxidant and MS-related enzymes modulatory activities of S. bicolor grains. Phenolic profiles of raw and roasted grains were quantified using HPLC-DAD. Antioxidant activities (2,2-azinobis 3-ethyl-benzothiazoline-6-sulfonic acid radical cation [ABTS*+] and 1,1-diphenyl-2-picrylhydrazyl radical [DPPH*] scavenging activities, reducing power and Fe2+ chelating capacity) and MS-related enzymes (pancreatic lipase [PL], α-amylase, α-glucosidase, xanthine oxidase [XO] and angiotensin 1-converting enzyme [ACE]) modulatory activities were assayed using spectrophotometric methods. Raw grains contained phenolic acids (gallic, chlorogenic, caffeic, ellagic and p-coumaric acids) and flavonoids (quercetin, luteolin and apigenin). The levels of these phenolics decreased significantly ($p < 0.05$) with increasing roasting temperature. Raw grains exhibited strong antioxidant and enzymes inhibitory activities. However, whereas the antioxidant activities increased, the enzymes inhibitory activities of the grains decreased significantly ($p < 0.05$) as the roasting temperature increased. Hence, through the inhibition of PL, α-amylase, α-glucosidase, XO and ACE, S. bicolor grain may be beneficial for retarding the rate of production of fatty acids, glucose, uric acid and angiotensin II, representing an important approach for managing the various components of MS, including obesity, type 2 diabetes, hyperuricemia and hypertension, respectively. However, roasting at high temperatures may not be recommended for the optimum retention of this health benefit.

Herbicidal Potentials of Three Botanicals in Cowpea Field in Oyo State, Nigeria

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Cowpea is one of the main food crops widely produced and consumed in Nigeria due to their high protein content. Their production is however, constrained by weed interference. Intensive use of synthetic herbicides in crop production enhances environmental and health hazards. Bio-herbicides have been reported to be effective and eco-friendly with no health risks. Therefore, herbicidal potential of three botanical extracts in cowpea Field was assessed in Oyo State, Nigeria.

Phytochemicals (mg/g) of Eucalyptus torelliana (ET), Eucalyptus camaldulensis (EU) and Leuceania leucocephala (LL)) were determined using standard procedures. Four concentrations (%) of the extracts from the botanicals: 100 (C1), 75 (C2), 50 (C3), 25 (C4), distilled water (C5) and Paraquat (P) severed as controls; these were used in assessing their phytotoxic effects on cowpea (Ife brown) seed germination (SGT) in petri dishes. Plumule (PL, cm) and Radicle (RL, cm) lengths of cowpea were measured. A 200 mL of the above treatments were applied in 10 kg soil before and five weeks after planting (WAP) to examine pre and post emergency potentials of the botanicals, respectively for 11 weeks. The treatments were arranged in CRD (r=3). Data were collected on Plant height (PH, cm), Number of leaves (NL) and Grain yield (GY, g/pot). Relative Important Values (RIV) of weed flora was computed at 3,5,7,9 and 11 WAP using standard procedures. Data were analyzed using descriptive statistics and ANOVA (α0.05).

Phytochemical contents (mg/g) in EU were higher in total phenols (32.0), tannins (27.4) and saponins (20.2). The SGT of cowpea ranged from 80.0±0.4 to 100.0±0.5 across the treatments. Cowpea had significantly higher PL (16.0±0.7) and RL (11.2±1.2) with LL under C4 than other extracts. In the pot experiment, phytotoxic effects on PH of cowpea (43.43±4.4) under ET under C4 at 9 WAP was significantly higher, while PH (7.8±0.8) was least under P at 3 WAP. Effect of EU under C1 on cowpea NL (42.33±4.5) at 9 WAP was significantly higher, while 6.0±0.9 at 3 WAP under P was the least. Significantly higher GY (4.2±0.5) of cowpea was obtained at LL under C3 followed by ET under C1 (3.04±0.2) with the least value (0.1±0.1) at P. The RIV of Mitra carpusvillosus (52.5) was higher at 3 WAP under C5, while the least was 7.34 at EU under C3 at 7 WAP.

Eucalyptus torelliana at 100 % and Leuceania leucocephala at 50 % concentrations enhanced the grain yield of cowpea. Herbicidal effect of Eucalyptus torelliana at 50 to 100 % concentrations reduced Relative Important Value of Mitra carpusvillosus. Therefore, awareness on use and more research on bio-herbicide should be encouraged.

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Implementing and fostering capacity building processes on sustainable agriculture in indigenous communities in the upper Baram (Sarawak, Malaysia)

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The Sustainable Agriculture and Resource Management (SARM project) was initiated in 2014 in the upper Baram region of Sarawak (Eastern Malaysia) in main cooperation between the Austrian Research Institute of Organic Agriculture, the Malaysian NGO Keruan and Eastern Penan communities, a former hunter-gatherer society. Fundamental changes in the livelihoods of the Penan have taken place, since the transition towards sedentism, which started shortly before the independence of Sarawak in 1963. The rainforest as main resource for food supply has been displaced by the cultivation of rice, which serves as staple food nowadays. Therefore, agricultural practices have become essential to guarantee food security. However, capacities regarding those agricultural practices are limited, due to e.g. restrictions in information-access alongside geographical remoteness. Further challenges, which lead to an increasing pressure on land and therefore food-guarantee, are population growth, deforestation through industrial logging and -plantations as well as declining rice yields.

Consequently, the SARM project aims to implement, strengthen and improve agricultural knowledge and techniques, so to support the development of capacities concerning present (and future) challenges. One core element of the project is to develop agricultural training booklets which 'translate' important aspects of sustainable (including organic) farming for literate and illiterate farmers, based on local knowledge, regional best practice and scientific research. Within a participatory approach, local community members determine the main development of those capacity building materials. Since the project started, the contents, texts, layout and graphics have been decided, tested and reviewed by roughly 25 local representatives, with a high extent of youth participation (e.g. via community meetings, workshops, topic rankings and interviews). Furthermore, decisions have been made on graphics being integrated into the booklet, which were then developed and illustrated by local artists and adapted to features of Penan culture. The booklets have been translated and are currently under revision, so to be available in indigenous language.

Concluding, the main purpose of SARM project is to foster capacity building processes and knowledge dissemination concerning sustainable agriculture in communities of upper Baram in Sarawak, Malaysia. Due to the development of information-booklets, agricultural knowledge is more easily available and accessible to members of the communities. Especially in case of young adults, who segregate from village-life during absence whilst schooling, the SARM project preserves that knowledge and might offer new perspectives and opportunities, concerning strengthening and improving independent and self-determined food-supply within the villages and communities of the Penan.

On the suitability of different grain legume species for organic fodder production in Luxembourg and Germany regarding to their nutritive and antinutritive ingredients

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About 63 % of European protein feedstuff are currently imported, the EC stated in 2018 (EC 2018). Most grain legumes contain antinutritional substances (AS) depending on cultivars and growth conditions (Ivarsson 2018). As livestock health is likely depending on the contents of antinutritional substances in this protein-rich fodder (Jeroch 2016), the aim of the study is to compare different grain legume species (GLS), i.e. winter and spring faba bean (Vicia faba) , winter and spring pea (Pisum sativum), blue lupin (Lupinus angustifolius) and soybean (Glycine max) in order to evaluate their fodder value considering their nutritive and antinutritive contents.

The field trials were conducted in 2012 and 2013 at Karelshaff (KH) in Luxembourg and in 2014 and 2015 on the "Hessische Staatsdomäne Frankenhausen" (FH) in Grebenstein (site description: Zimmer 2016 a & b). The field trial was done in a randomized block design with four repetitions. Besides nutrient ingredients, the GLS were analyzed for tannins and trypsin inhibitor as well as alkaloids (lupin, pea) and vicine/convicine (faba bean).

For the Luxemburgish trial, winter and spring faba beans showed the best suitability for producing protein-rich fodder on farm. However, it is important to note that in 2012 and 2013, weather conditions were very favorable for faba beans (Zimmer 2016a). For the German trial, no clear trend could be discerned in terms of best suitability for production. First results for AS show that the experimental site and yearly variations influence the content and that they are slightly different from literature values (Jeroch 2016). The AS showed yearly variations for all GLS except of alkaloids and of vicine/convicine in faba beans. Alkaloids were below limits of determination in FH (< 0.005 g/100 g) and CA (< 0.1 mg/100 g). Faba beans show vicine contents which are in the lower range of literature values for both sites, but concentrations in FH were the double of those in KH. Trypsin inhibitor for soybean showed lower concentrations and faba bean only 10 to 20 % of those values found in literature. Spring pea and winter pea in KH showed the same tannin concentrations for both years whereas concentrations at FH were the double in the second year. These first results show that data from these on farm trials will give necessary information on the suitability of local GLS as protein-rich fodder. Moreover, the antinutritive factors will be related to the nutritive factors in order to give advice to farmers for production regarding to livestock feeding.

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Effect of different mulching systems on the generative product and soil temperature of organically grown strawberry

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The most important part of the organic farming is the preservation of soil fertility. Among others the mulching material has a direct effect on soil temperature, weed growth and can have an indirect effect on crop yield as well. The organic mulching material also has nutritional properties for the crop and enhances soil life.

Our goal was to prove the effect of different mulching materials on soil temperature supported by measurements. We also wanted to find out if the different mulching has affected the yield of strawberry. The research was carried out in two consecutive years, in 2016 and 2017, at the show garden of the Faculty of Horticulture and Rural Development of John von Neumann University. The experimental field has sandy soil with very low hummus content and slightly alkaline pH. Ecological farming is used in the experimental plots therefore we only applied crop-enhancing substances that can be used in organic farming.

Three types of soil covering were used in addition to the uncovered control area: black geotextile, straw and hay. The straw and hay were continuously replenished during the vegetation, approximately every month, to maintain the thickness of at least 2-3 cm. During the maturation period the uncovered control plot was covered with straw in order to prevent soil particles contaminating the fruit. After the harvest the cover was removed.

Digital thermometers (BSIDE BTH04) were placed 10 cm deep in the soil of the experimental plots from April to end of June. Current soil temperature was recorded in 30 minute intervals.

Ranking of the mulching systems based on average soil temperature were the following in 2017: black geotextile (20,3 °C) > control (18,8 °C) > hay (18,6 °C). In 2018: black geotextile (22,1 °C) > hay (20,2 °C) > straw (19,1 °C) > control (18,7 °C). Looking at the maximum and minimum soil temperatures in both years the lowest were measured in the control plot (2017: 1,9 °C; 2018: 7,5 °C), the highest were in the black geotextile (2017: 38,4 °C; 2018: 32,7 °C). The temperature fluctuated the most under black geotextile, and in the control plots. This high soil temperature and the big temperature fluctuation is unfavorable for root growth. Based on our research we recommend mulching strawberry with hay or straw, instead of using black geotextile or no mulching.

Based on the data acquired in the two years of the experiment the effect of different mulching systems on the fruit quality and yield is not straightforward. Only the first year gave statistically significant results (Király et al., 2018).

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Király, I., Palkovics, A., Mihálka, V. 2018. Yield and fruit quality of strawberry cultivars under different mulching systems. Lucrari Stiintifice Management Agricol 20:(1) pp. 59-64.

Microbes and meat bone meal fertilization: effects on oat, barley, lettuce and ray grass yields

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Meat and bone meal (MBM) is a by-product of meat industry, a source for nutrient recycling and permitted to use in organic farming. Microbes as bio-fertilizer is a less used farming practice. However, the effects of plant growth promoting bacteria (PGPB) on a fruit yield and they can be used in organic farming (Esikten et al. 2010).

The aim of this study was to reveal the MBM and PGPB effects on yield amount of common crop plants. We are interested in yield effect of microbes (M), MBM used as such (MBM) and microbes and MBM) used together (MBM+M).

A field experiment was carried out in 2017 with M, MBM (Agra 8-4-2) and MBM+M on oat in Lantmännen research farm in Hauho. The N-amounts used were unfertilized control added with M, 40 kg/ha added with M and 80 kg/ha. M (BactoBoost) was used two times in growing period.

In 2018 a pot trial was carried out with microbes, MBM and MBM+M on barley, lettuce and ray grass in University of Helsinki research greenhouses. Conventional mineral fertilizers were compared with MBM (Agra 8-4-2) and microbe products. Treatments were unfertilized control and 100 and 200 kg N/ha in MBM and mineral fertilizer with and without M. Other main nutrients were balanced. BactoBoost was used three times for ray grass and BactoNP for lettuce and barley.

In both experiments only the yield was measured, because this was a pre-trial in Finland for using microbe products as an organic fertilizer. The field experiments, both M and MBM as well as MBM+M, have returned satisfactory yield results. MBM gave good yields in both experiments. With 80 kg N in Agra 8-4-2 fertilizer the yield in oat was about 5500 kg. BactoBoost microbe gave about 20 kg nitrogen effect per ha, which can be considered as a good result. Agra MBM-fertilizer gave also good yields in the pot trials and the results were in accordance to previous research of Kivelä et al 2015. Results of M in pot trials were not significant and only some trial members gave a significant difference. Microbe products used as bio-fertilizers show an effect according to one year field experiment, but further experiments of PGPB microbes need to be carried out. The research project and the field experiment are still going on. We will have final results by the end of 2018.

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Variety assessment with multicopter in on-farm winter wheat trials

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Drone-based multispectral remote sensing is mainly used in conventional agriculture for precise fertilization application, and for indicating crop stress and vigour. However, these methods can be easily applied also in organic agriculture systems to monitor heterogeneous field conditions and conduct yield prediction. The aim of this study was to test a low-cost multicopter-based intelligent flying camera system for variety assessment under everyday field conditions, with special focus on the tolerance to stress factors present in organic agriculture. A multicopter-based camera can assess 100% plot area, while traditional sampling can only provide point-wise data, which cannot reflect real field performance of varieties on large plots. Farm-scale single strip plots (cc. 0,12 ha/variety) were set-up with 15 winter wheat varieties in East Hungary. The multicopter with multispectral camera and software for data analysis were used according to Drexler et al. (2016) and were applied on the organic on-farm winter wheat variety trial. The Pix4DMapper software was used for the calibration and pixel-level matching of RGB and NIR images. When the two overlapping orthographic map layers were ready, we defined the areas of interest for each variety and calculated NDVI from the dual channel measurements for every pixel of the map. The overall ground resolution of imaging technique was around 0,5 cm. Ground data truthing was done by traditional data collecting methods during field visits of the on-farm site: At anthesis SPAD measurements of 15 randomly selected plants per selected region of interest was performed, and before harvest yield sampling (3 x 1 m^2 per plot) was done with the help of a high-precision RTK GPS system to provide georeferencing with cm-level-accuracy. Results from multispectral imaging were compared with reference data, and a high correlation was found. Moreover, it was found that field heterogeneity and genetic difference between varieties can affect crop performance on a similar scale. This fact affirms the importance of high resolution mapping techniques where these two effects (field heterogeneity and genetic variation) can be differentiated in contrast to random sampling, where the two causes of noise are not distinguished. Thus, there is a high potential in the future development of non-destructive, reliable and fast techniques in order to promote the farm level evaluation organic arable crop production.

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Agronomic performance of winter wheat in organic on-farm variety trials in Hungary

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Arable crop cultivation is the most important sector of Hungarian organic production. Regarding cereals, wheat is the most frequently cultivated species, which is produced mainly for export to West-European markets. Selection of best adapted varieties to local pedo-climatic conditions and the organic farming system is a crucial step for successful production. The Hungarian organic sector is relatively small and thus, little attention has been given previously to the evaluation of wheat varieties cultivated under organic conditions. Therefore, ÖMKi started organic participatory on-farm variety trials in 2012 with a simple trial design (strip-plots, 0,12 ha/plot) in order to provide practical information to organic farmers on the performance of different winter wheat varieties under organic conditions. Assessment of varieties is done at the flowering time for phytopathological bonitation and at the harvest, wheat samples (3 x 1 m^2 per plot) are analysed for most important standard quality parameters (protein, gluten and falling number) and yield. Since 2012 near twenty organic farms from different parts of Hungary were involved in the experiments and more than forty varieties have been compared. From the 5 year experiment we could get an overview on the performance of varieties, taking into account different climatic and soil conditions in Hungary. Results indicated that limited Nitrogen availability often reduces produce quality, varieties with high N-use efficiency are needed. Conventional bred new varieties often do not meet quality and/or yield demands of organic farming. Old varieties (such as Bánkúti 1201) are still often preferred by organic farmers, as high quality, extensive cultivars. According to geographic region, different varieties could be identified as more suitable. Organically bred Austrian varieties e.g. overperformed conventionally bred varieties in West-Hungary, however, could not compete in dryer East-Hungarian climate. In order to have more information about the performance of different wheat varieties (conventional and organically bred from Hungary and abroad), from 2017/2018 onwards, the ÖMKis on-farm variety tests are complemented by organic small-plot trials, conducted at the Agricultural Research Centre of the Hungarian Academy of Sciences, Martonvásár. Moreover, ÖMKi aims to advance the setup of the on-farm trials implementing Bayesian Modelling for flexible experiments (Rivière and Dawson, 2015).

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Sustainable control of oriental fruit moth, Cydia molesta Busck and peach twig borer Anarsia lineatella Zell. by using Cidetrak® OFM/PTB MESO™ pheromone dispensers

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The trials were carried out in the years 2017-2018 in an isolated peach experimental orchard of one ha in the Fruit Growing Institute, Plovdiv – Central South Bulgaria. Mating disruption (MD) was tested as an alternative method controlling oriental fruit moth (OFM), Cydia molesta Busck and peach twig (PTB) borer Anarsia lineatella Zell from post-bloom till harvest. CIDETRAK® OFM/PTB MESO™ pheromone dispensers were installed once during the season, before the start of OFM and PTB flights. For monitoring of the pests one type of pheromone traps was used in this experiment – PHEROCON® VI Delta traps with a sticky changeable bottom. The pheromone baits were OFM COMBO dual lures developed for the orchards with MD for the correct estimation of the population density of the pests. The pheromone dispensers, traps and baits are a product of Trécé, Inc.USA. In the reference, conventionally treated orchard, 5-7 insecticide treatments were applied to control oriental fruit moth, peach twig borer, aphids and other pests. The fruit damage by OFM and PTB were below the economical threshold in the successive years. Percentage of damage in the experimental orchard treated with Cidetrak® OFM/PTB was 0.1 %, by OFM and 0.1 % by PTB i.e. rather below the economical threshold; no outbreak of the OFM and PTB appearance was noted. So, the MD method, with use of the Cidetrak® OFM/PTB MESO™ dispensers, proved to be an effective means of control even in an orchard below 2 ha. The results obtained may open the possibilities of practical use of the method of mating disruption in Bulgaria.

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CIDETRAK® OFM/PTB MESO™ dispensers for the trials were provided by Trécé Inc., USA.

Improving soils in vegetable crops with a mechanized permanent raised bed system

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Based on the principles of Controlled Traffic Farming applied to vegetable crops, a system developed in France, with tractor wheel tracks permanent and not tilled deeply, was adapted in Canada. The growing space under the tractor is tilled using adapted tools and bed-making implements. In the first phase of the project, six pieces of equipment for the permanent raised-bed system were developed by the CETAB+: a disk hiller, a deep working cultivator, a flex-tine bedmaker, an adapted green manure seeder, an adapted manure spreader, an adapted harvest platform. Those implements were used in the second phase where the objective was to evaluate the impact of the permanent bed system on crop yield, weed control, and soil properties over time. A five-year study was conducted at the Organic Agriculture Innovation Platform (IRDA) on a St-Urbain heavy clay and a Du Jour clay loam. The study included two experimental sites, one for each type of soil. The experimental design was arranged in a randomized complete block with two treatments, conventionally tilled using plowing and a rotary bedmaker compared to permanent raised beds, and 4 replications. Results show an improvement in soil structure and crop root development. Soil bulk density decreased significantly in the permanent bed system indicating higher porosity and improved soil structure. Crop productivity was improved gradually and after 3 years, crop yields were 30 and 40 % higher in the permanent bed treatment compared to the conventionally tilled in the heavy clay and clay loam, respectively. No important difference in annual or perennial weeds was observed during the trials. After 5 years, weight and number of worms were 3 and 1,5 times higher in permanent beds compared to the conventional rotary system in the heavy clay and clay loam, respectively. An economic analysis indicated that the permanent raised bed technique might increase vegetable farm profitability due to reduced operational costs by eliminating ploughing and rotary tillage. This system has been adopted by a sizeable portion of Quebec organic market farmers because improved soil conditions offered by the permanent raised bed system are positive for crops and for economic performance.

Phenolic acids composition of organically grown einkorn, emmer and spelt

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Cereals are a good source of plant phenolics, the most common type of phenolic compounds in cereals are phenolic acids. Little information is available on phenolic acids composition and concentration in different Triticum species, as well as on possible environmental effects (Brandolini et al., 2013). The aim of this study was to explore differences in the phenolic acids content of different Triticum species with focus on their free and bound fractions, and their changes caused by different cropping years climate conditions. Material and Methods Winter spelt, emmer and einkorn varieties were cultivated under organic farming conditions at the Experimental base of the Slovak University of Agriculture in Nitra (48°19´N, 18°07´E) as randomised – block experiment, in four replicates. Free and bound phenolic acid extractions were carried out according to methodology described by Wang et al. (2013) with some modifications. Individual phenolic acids in the wholemeal flour extracts were analysed by an Agilent 1260 HPLC system, equipped with a DAD detector and an Agilent Triple Quadrupol 6410 MS/MS system with a Symmetry C-18 column (Waters, USA). Results and Discussion Free phenolic acids make the smallest contribution to the total phenolic acids content in cereals. Free phenolic acids (FPA) concentration determined within three years of experiments ranged from 35.2 μgg-1 dm for emmer to 45.8 μgg-1 dm for einkorn (significant). No significant differences were observed between emmer and spelt. Average free phenolic acids contribution to total PA of Tr. species was 5.9%. Most of phenolic acids in wheat occur in bound form (Adom and Liu, 2002), the average bound phenolic acids (BPA) content of Tr. species reached 571.9 μgg-1 dm, contributing 94.1 % of total PA. Differences in bound and total phenolic acids content of emmer and spelt were not significant, the most important source of PA was einkorn, with 682.4 μgg-1 dm of bound PA and 728.2 μgg-1 dm of total PA.The concentrations of individual phenolic acids were measured for free and bound fractions. As expected, the dominant compound was ferulic acid, which accounted for 72.5% of free PA and 94.9% of bound ones. Significant differences in the content of all determined phenolic acids were noted in free and bound (except caffeic acid) forms among Triticum species. In the free PA, significantly highest concentrations of ferulic acid (34.0 μgg-1 dm), p-coumaric acid (2.01 μgg-1 dm), sinapic acid (2.45 μgg-1 dm) were determined for einkorn, spelt and emmer were equal in ferulic acid content and significantly differ in p-hydroxybenzoic, caffeic, p-coumaric, salicylic, sinapic, syringic acids. P- coumaric acid was the second most abundant in Tr.species. In the case of spelt, the highest content of bound p-hydroxybenzoic, salicylic and syringic acids was found. Emmer was the poorest source of phenolic acids.

LeguTec – Mechanical weed control in soybean cultivation in Luxembourg

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Soybean (Glycine max (L.) Merr.), a member of the family Leguminosae, has a protein content of about 40 % and a very high biological value due to an optimal amino acid composition, making it one of the most important feed protein sources in animal nutrition (Bernet et al. 2016). Being one of the EU-states that signed the European Soya Declaration (2017), Luxembourg aims to promote the regional cultivation of soybeans and other protein crops. The decisive factor is the current dependency on imports from mainly North and South America. Far more than 60 % of the required amount of soybean is imported (Bernet et al. 2016), which causes various environmental and social problems (Beste et al. 2011). Thanks to breeding of new varieties with very early maturity, soybean cultivation is nowadays possible under low temperature conditions – an opportunity to introduce soybean production in Luxembourg and thus increase its protein autarky. However, the organic cultivation of soybean is demanding and in addition to the currently not yet guaranteed further processing in Luxembourg (e.g. toasting as one heat treatment possibility) there are above all knowledge gaps in efficient and sustainable mechanical weed control techniques.

From spring 2018 onwards, five mechanical weed control methods in soybean cultivation (variety Merlin) are tested and compared under real conditions on three organic farms spread over Luxembourg: 1) harrow, 2) interrow cultivator with duck foot shares, 3) interrow cultivator with duck foot shares and finger weeder, 4) a flexible system, a combination of treatment 1 and 3, while the decision is made according to the actual site and weather conditions and 5) mixed cropping of soybean and camelina in combination with harrow. A negative control, where no weed control is administered, and a positive control, where all weed is taken out of the plots by hand, are considered as well. The trials are implemented each as a one-factorial-exact-trial with 4 replicates. Additionally, an on-farm trial is conducted at the experimental site of the Lycée Technique Agricole in Bettendorf. Weed and soybean biomass and cover, weed species and number of plants/species as well as number of soybean plants were taken before and after each weed treatment as well as at flowering and at harvest to assess the efficiency of the used technique and potential plant damages. Statistical analysis is performed with ANOVA and linear mixed models testing whether treatments significantly differ from each other in terms of yield and biomass. The company Geocoptix GmbH complements the assessments with the help of drone-supported aerial photographs using different true colour and multispectral images of the treatments. First results in yield, yield formation, biomass and interactions within the analysed plant and weed parameter of the first year are presented on a poster within ICOAS.

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Does the length of value chains matter? Assessing the regional benefit of different beetroot value chains in Lower Austria

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Regional food products are still gaining interest in the western world's food markets as they are often associated with sustainable agricultural production and food processing by consumers. To evaluate the effects induced by regionally labelled food products we developed an assessment tool focusing on socio-economic issues comprising product properties, regional added value as well as regional and corporate resilience (Gusenbauer et al. 2018). An indicator-set of 28 indicators was applied to each relevant stage along the whole value chain and is applicable to different product groups or length of value chains.

The aim of our study was to measure if and to what extent the length of a value chain (resp. number of value chain stages) affects the regional benefit. Therefor we analysed six value chains of beetroot, presenting organic and conventional agriculture as well as different degrees of processing and length of value chains respectively. The main ingredient beetroot is labelled with the region "Weinviertel" in Lower Austria within all of the organic value chains examined.
The unprocessed beetroot value chain (agriculture, one processor and nationwide retailer) and the beetroot juice value chain (agriculture, 3 processors and retailer) reach similar results of regional benefit values regarding the organic value chains (Figure 1). The sour beetroot salad contains 74 % beetroot, sugar and vinegar and is the longest value chain (3 agricultural ingredients, 4 processors and retailer) and reaches values of 29 % of maximal possible points within the organic value chain.
The aggregated results of the conventional counterparts are lower than the organic ones mainly because of product features (like traceability or information on ingredients' place of origin) and performance of the agricultural production system (like price premium paid to agricultural producers). The most influencing impacts are the performance of the different value chain stages and methodical implications (like deductions in the case of wide geographical distances).

The detailed results show that the length of the value chain affects the regional benefit – but unlike expected not due to the number of value chain stages. In fact, the poorer performance of single stages as well as larger geographical distance between the value chain stages result in lower scores for longer chains. The value chains are consistently and coherently assessed with the assessment tool. Further enhancement of the model, making regional benefit transparent, could potentially also be used for the communication to consumers.

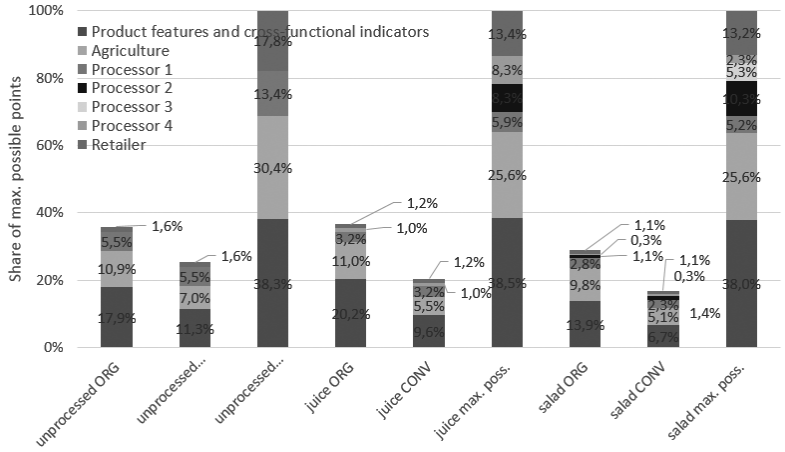

Figure 1 Regional benefit of organic and conventional beetroot products (relative to maximum possible)

Gusenbauer et al. (2018): How a region benefits from regionally labelled cheese products in Austria: a model-based empirical assessment along different value chains. Organic Agriculture https://doi.org/10.1007/s13165-018-0209-y

Effects of foliar spraying with a Scenedesmus obtusiusculus-based microbial product on growth, yield and stress tolerance of organically grown strawberry

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Microalgae might have a potential in organic farming as sustainable alternatives of chemicals for improving plant performance, yield and stress tolerance. In the present study the effect of a Scenedesmus obtusiusculus-based product is tested in organic farming on strawberry. Results of two successive seasons are summarized below.

Fragaria × ananassa cv. Joly frigo transplants were planted in March, on sandy soil. Biostimulant, containing living cells of S. obtusiusculus was sprayed on leaves in 2 l/ha quantity in flowering phase, and after harvesting, when new leaves developed (2 treatments/year).

Marketable fruits from 20 treated and 20 untreated (control) plants were harvested, average size and weight of the fruits, number of fruits per plant were measured and total yield per plant was calculated. At the end of the 2nd harvesting season (July 2017) 6-6 plants (treated and control) were excavated. Underground parts (root+rhizome) and foliage were weighted separately, and fresh and dry weights were determined.

In the first season of the 3-year experiment, we found that the sizes of fruits of treated plants are larger, causing a somewhat higher production. In the second growing season (2017), significant increase both in number (+28.5 %) and in size of fruits was found.

We found that treatment with S. obtusiusculus-based biostimulant resulted in higher fruit setting. Total yield/plant increased by an average of 35 % and the difference was statistically significant (P=0,049). Average fresh and dry weights of treated plants (175.5 g and 55.8 g respectively) were higher, than the control's (168.7 g and 50.0 g).

In 2017, some days of morning frost in the flowering period lead to losses in strawberry production in Hungary. Flowers affected by frost damage either aborted or developed deformed fruits. These fruits could be selected visually. 14 % of fruits of treated plants showed deformity related to frost damage of flowers, while only 4.2 % of control fruits. ANOVA test (SPSS Statistics 23.0.) indicated strong, (p=0.0015) significant difference.

In the present study, we demonstrated that application of a S. obtusiusculus-based biostimulant caused the increase in yield of strawberry. Furthermore, in agreement with Bogunovic and co-workers (2015), we found that the application of the biostimulant enhances frost tolerance. We conclude that in our experiment the difference in yield was partially caused by the frost damage. Fruit setting of control plants was more affected by frost, compared to treated plants and resulted therefore in decreased yield of non-treated plants.

This research is supported by EFOP-3.6.1-16-2016-00006 project.

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Determining white clover leaf mass yield and ratio of a range of cultivars and successive cuttings

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The leaf mass of small grain legumes contains a large part of whole plant protein and has a more preferable amino acid profile than the whole plant (Sommer & Sundrum 2014). The leaf fraction as a fodder provides an alternative for protein supply in organic poultry and swine nutrition. In order to enable leaf mass use in animal feeding, precise information on expected leaf mass yield and how it can be increased by management measures are required.

In the growing season of 2017, on the experimental field in Freising, Germany, eleven white clover cultivars were grown, and herbage sampled. Herbage was harvested four times at full bloom stage with a combine grass harvester and the herbage yield being determined. Herbage samples were dried gentle at 40 °C and separated by a wind separator into leaf and stem fractions. Subsequent the leaf mass yield was determined.

The results showed high significant variation in leaf mass yield and leaf ratio between subsequent cuts ($p < 0.001$); the highest average leaf mass yield was achieved at the first cut (15.1 dt ha-1), followed by third (10.9 dt ha-1), second (8.3 dt ha-1) and fourth cut (6.7 dt ha-1). The highest leaf/stem ratio (average of all genotypes) was achieved at the fourth cut (63 %) and followed by the third (53 %), first (46 %) and second cut (35 %). Between cultivars no significant variation in leaf mass yield and leaf ratio was found.

The correlation of leaf ratio and leaf mass yield was positive ($p < 0.001$). Nonetheless, the leaf mass yield strongly depends on crop condition. Therefore, even a cut with lower leaf ratio can provide a satisfying leaf mass yield.

Sommer, H. & Sundrum, A. (2014): Determining the feeding value and digestibility of the leaf mass of alfalfa (Medicago sativa) and various types of clover. Conference paper: 11th European IFSA Symposium, Farming Systems Facing Global Challenges: Capacities and Strategies, Proceedings, Berlin, Germany, 1-4 April 2014 pp.1698-1704 ref.13

Five years of the BioRegio Farm Network in Bavaria – an assessment

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The Bavarian BioRegio farm network (BioRegio Betriebsnetz Bayern) is part of the state program „BioRegio Bayern 2020“, initiated by the Bavarian State Ministry of Food, Agriculture and Forestry in 2013 to double organic production in Bavaria and increase sales of regional organic food by 2020. Information on organic farming practices has been communicated by the new network since September 2013. The network was developed by the Bavarian State Research Center for Agriculture (LfL) in cooperation with the Bavarian Association for Organic Agriculture (LVÖ). At present, 90 long-standing, very well-run organic farms are part of the Bavaria-wide network. The network provides a deeper insight into organic farming practices and promotes knowledge transfer between farmers. These diversified farm businesses are typical for their region. They serve as a point of contact for agriculture schools, farmers who want to convert to organic farming and managers of organic farms. The BioRegio farm network concept is an original Bavarian innovation in the field of agricultural education and has become a central component of the initiative „BioRegio Bayern 2020“.

Using cluster analysis to determine key drivers of sustainability of Austrian organic dairy farms

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In order to meet the claims of sustainability in agriculture, many tools were established for assessing sustainability in the food sector. SMART (Sustainability Monitoring and Assessment RouTine; Schader et al. 2016) is one of these tools and is based on the SAFA-Guidelines which were developed by the FAO (FAO 2014). Organic „hay milk" is widely perceived as being sustainable. Using SMART, we assessed the sustainability performance of a representative sample (n=94) of the supplying "hay milk" dairy farms associated with the organic label „Zurück zum Ursprung" in six mountainous regions of Austria. Furthermore, we analysed the key drivers of the farms' sustainability performance using cluster analysis.

Thereby the 94 farms were clustered into four groups, according to their ratings in eight especially important SMART-sub-themes, for which farms also showed a relatively large variance. The cluster analysis resulted in the farms being divided into better and worse performing farms, with all the ratings still being „good".

The analyses of those clusters indicate that farm individual management practices exist. A pattern of „bigger, more modern" farms being more „sustainable" is found at second glance. Comparisons with findings from other studies lead to the question whether the inaccuracy of SMART may be the reason for potentially existing differences in sustainability performance of different groups of farms within the production system "organic hay milk" not being able to be detected more distinctly.

Despite these potential shortcomings, SMART still constitutes a good basis for discussing sustainability of farms. Opportunities in the application of SMART and corresponding cluster analyses may lie in the comparison of production systems with bigger differences and/or on different geographical locations. Moreover, other statistical tools, like e.g. discriminant analysis, should be taken into account when trying to determine key drivers of sustainable farming.

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Organic consumers' knowledge and attitudes towards wild plant foods in Vienna, Austria

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Wild plant foods are gathered and processed into a wide range of products all over Europe and commercialized through local, national and international mass markets and specialized niche markets. They were estimated to be consumed by 100 million European citizens. Wild plant foods, including fungi, can be produced and commercialized as organic products following EC regulations 834/2007 and 889/2008, but insights into organic market potential are rare. We thus aim to inquire 1) which wild plant food species do organic consumers know, gather and purchase? 2) Which attitudes do organic consumers have towards wild plant foods? Research was conducted in Vienna, Austria, in April and May 2018. We selected a purposive sample of 10 food markets where organic foods were sold and interviewed 207 organic consumers with a structured questionnaire. Data was analysed with descriptive statistics. The 207 organic consumers listed altogether 1630 items which could be attributed to 104 different plant genera and 15 different genera of fungi. The consumers knew a median value of seven items, gathered three items and purchased one. Organic consumers recognize the importance of wild plant foods being gathered without reducing their natural availability (94 % of consumers approve as important or very important) and apart from conventional agriculture (84 %) – both key criteria for organic certification of wild plants. And while comparably few believe that it is important that wild foods are controlled and certified following organic regulations (69 %), more think that it is important that wild foods are labelled as 'wild' (79 %). Wild foods are perceived as having better taste than cultivated ones (80 %) and as being important supplements for healthy lifestyles (93 %). However at the same time a minority thinks that wild plant foods are indispensable for their nutrition (44 %), and most agree that wild plant foods are available on specialized markets only (85 %) and have little economic relevance (76 %). This research supports earlier findings that urban consumers know, gather and purchase wild plant foods, appreciate their high quality and value environmental friendliness of production. Enhancing consumers awareness about the criteria for organic certification of wild plants might be an important working point to ensure that consumers get what they appreciate. Organic consumers also call for labelling of wild plant products as 'wild' and seem to perceive pronounced differences compared to cultivated plant products. The labelling of wild plant foods as 'wild' would also help to raise awareness among consumers that wild plant foods are not only ingredients of niche products in specialized markets but also frequently part of products in organic mass markets.

Ease of handling of sows on organic farms: assessment options and genetic selection

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Piglets have to undergo several routine husbandry procedures in the first days after birth. This clashes, however, with the sow's behavioural need to be left undisturbed with her piglets during this period. Consequently, some sows tend to defend their piglets. As many organic farms have farrowing crates with no fixation, sow defensive behaviour can be quite dangerous for the farmer. The aim of this study was to develop a behavioural scoring system for the ease of handling (EOH) of lactating sows and to determine the impact of EOH on reproductive performance. The experiment took place at the Training and Research Centre for Organic Farming Kringell from Aug 2015 to Dec 2017. The sows (n=68) were purebred German Landrace of different parity (1 to 11 litters). The litters (n=134) originated from mating with boars of the breeds Pietrain (37.3 %), Danish Duroc (28.4 %) und German Landrace (34.3 %). All sows were kept in loose farrowing systems without fixation (FAT 2 system). During the first postnatal week, sow defensive behaviour was observed five times while piglets were removed from the pen for husbandry procedures. The following qualitative behavioural scores were used: no defensive behaviour: sow doesn't make any threatening gestures or sounds; low defensive behaviour: sow makes threatening gestures or sounds when the stockperson enters the pen, sow moves away from the stockperson and does not attack; high defensive behaviour: sow makes threatening gestures or sounds before the stockperson enters the pen, sow does not move away from the stockperson and is aggressive. The five individual observations were summarized in one grade for EOH (grade 1: not defensive, grade 2: somewhat defensive, grade 3: highly defensive). The numbers of piglets born alive, stillborn piglets, weaned piglets, piglet losses, weight at birth as well as at day 35 were recorded to evaluate reproductive performance. Statistical analyses were performed using SAS 5.1. Effects of parity, litter size and season on EOH were analyzed using a generalized linear model (GENMOD). For analyzing the effect of EOH on sow productivity traits a general linear model (GLM) was used, including fixed effects of sire breed, litter size, parity, season and EOH grade. 64.9 % of the examined litters had EOH grade 1, 23.1 % had grade 2 and 11.9 % had grade 3. Litter size and parity did not have a significant influence on EOH. The results show that EOH had no influence on sow productivity traits. In practice, mainly sows with grade 3 for EOH are challenging, as these sows repeatedly show highly defensive behaviour. These animals decrease operational safety and adversely affect time management. A qualitative behavioural scoring system for EOH of lactating sows was developed using the results of this study. As litter size and parity did not impact EOH, genetic selection for this trait is appropriate. In addition, EOH had no influence on sow productivity traits. Removing aggressive sows from the herd will not reduce output.

Postharvest and minimal processing technologies applicable to organic fruits

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In last years the demand of fruits obtained in organic conditions has rapidly increased among consumers due to their acceptance that are nutritional, high quality, sustainably produced and friendly with the enviroment. Compared to conventional system, in the organic agriculture occur additional challenges in processing and preserving of fruits, because many preservatives and additives are not allowed (EC 2008). Different postharvest technologies are designed to extend shelf life of fruit, fresh or processed, as a component that adds value to organic production and reduces losses in its peak periods. Furthermore, information on the impact of storage and processing technologies on the main quality parameters that specifically characterize organic food is limited (Crichton 2017; Kahl 2014). In this way the present paper have as main objective to debate the actual knowledge on some postharvest technologies such as modified atmosphere packaging (MAP), storage under controlled atmosphere conditions (CA) and some minimal processing technologies like drying and freezing, technologies that can be applicable to organic fruits. Because these technologies are simple to be approached and managed, have became increasingly applied in fruits storage, providing increased shelf life for low costs. Otherwise, drying prevents both food spoilage and decay, allowing foods to be stored at room temperature for long periods with minimal deterioration and simplify the handling of the products through their reduction of weight and packaging volume (Moscetti et al. 2018). Considering all these advantages, they might prove to be one of the most dominant preservation techniques in the twenty-first century (Kirtil and Oztop 2016).

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Impact of winter cover crops on soil quality and weeds in organic cropping systems

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Winter cover crops and their combination with composted cattle manure have shown significant influence on soil quality and weeds in five-field crop rotation (barley undersown with red clover – red clover – winter wheat – pea – potato) of three organic cropping systems. The control system just followed rotation. In the second and third organic systems the winter cover crops were used: after winter wheat mixture of winter oilseed-rape and winter rye; after pea – winter oilseed rape and after potato – winter rye. In third system additionally, composted cattle manure was given (for cereals 10 t ha-1 and for potato 20 t ha-1). Organic carbon content increased significantly in systems with winter cover crops (1.57 %) in comparison with control system (1.51 %). That enhanced the biological activity of soil – increased number of collembols and soil microbial hydrolytic activity. Soil life activation was correlated with better formation of plant nutritional elements. For example, especially increased Ca and Mg content, according to systems 1397; 1432; 1474 and 160; 172; 195 mg kg-1. Soil pH KCl increased from 5.95 in control system to 6.03 in systems with cover crops, soil structure also improved. After the second rotation, the best soil quality with good structure and the highest content of nutritional elements was reached in system where winter cover crops in combination with composted cattle manure were used.

Winter cover crops depressed also weeds. In systems with winter cover crops the biomass of weeds was lower in spring before cover crop incorporation to soil as well as before main crop harvest in summer. Weed suppression was depending on cover crop species. In all years the winter rye was the best suppressor of weeds compared to other winter cover crops.

During two rotations, in years 2012-2017, this study was carried out and supported by ERA-Net Core Organic projects TILMAN-ORG and FertilCrop.

Effects of two seeding dates on the performance of grass-clover leys

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Grass-clover leys can either be undersown in winter cereals or established after harvest of the preceding crop in August. Undersowing is more cost-effective and the cash crop is not affected by seeding an undersown ley in spring (Urbatzka et al. 2013, 2011). Nevertheless, sowing after harvest allows weed control via soil cultivation, which is often necessary. The aim of this research was to compare the two seeding dates in terms of the performance of grass-clover leys.

A long-term field trial was established in 1998 at the experimental station Viehhausen (Upper Bavaria, silty loam, soil quality (Bodenzahl) 62, long-term average precipitation and temperature 786 mm and 7.8 °C, respectively) in a block design with three repetitions. Different crop rotations with and without grass-clover leys and the subsequent crops cereals and potatoes were compared. Details are shown in Castell et al. (2016). Results from the period 2005 to 2013 from two crop rotations with undersown leys and two crop rotations with leys sown after harvest are used in this analysis. Undersown leys were seeded between mid-April and mid-May and incorporated into the soil slightly with a tined weeder. Seeding after harvest of the previous cereal was done in August. Leys were grown for one main production year.

Yields were 25 % higher for undersown leys than for leys sown in August. This is due to the additional cut in autumn following sowing and higher yields in the first two cuts in the spring of the following year. In undersown leys, the proportion of clover was higher, and the proportion of grass and weeds lower, in the first cut in spring. Clover in undersown leys probably benefited from the very low amount of nitrogen in the soil. In contrast, soil cultivation stimulated weed seeds to germinate in leys sown after harvest. The subsequent nitrogen mineralization benefited grass and weeds. Hence, establishment conditions for clover are better in undersown leys. Another consequence of the differing proportions of clover and grass was that the quality of the first cut was higher for undersown leys. The proportion of weeds was also negligible in the following cuts in leys sown after harvesting due to the competitiveness of grass-clover leys.

Therefore, undersowing grass-clover leys is recommended, unless weed control is necessary after the cereal harvest due to perennial weeds such as dock or couch grass.

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Characterizationand participatory evaluation of Greek tomato heritage varieties for organic farming

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Greek heritage tomato (Solanum lycopersicum) varieties were used for the purpose of characterization, participatory evaluation under organic farming conditionsandidentification of promising genotypes with good agronomical and quality traits.

The growing period 2017-2018, 21 heritage varieties, like Milo, Dramas, Lagada, Olympou, Feta and Hamoti, originating mainly from central and north regions of the Greece, with the commercial tomato hybrid Formula, as control, where characterized in a non-heated greenhouse, in Thermi Thessaloniki. UPOV descriptors for tomato were used during growing period and after harvest, to record the descriptive characteristics of the varieties. Table-ripe fruit yield was measured on each plant over all harvests in the experiment. Earliness was estimated on the basis of the produce, which was harvested during the first third of the harvest period. The experimental design was a randomized complete block with three replicates, each consisting of five plants. All the observations and measurements were obtained on individual plant basis. Data were subjected to analysis of variance by the SPSS 21 statistical program and means were compared by Duncan's multiple range test, at the 0.05 significance levels.

In 2016-2017 a participatory on farm evaluation field day took place in Volos for performance and taste of 25 Greek heritage varieties, under organic farming conditions. A 1 to 9 scale questionnaire was used to visually record performance of the plant growth (robustness), yield promising, fruit appearance and taste. Measurements were also taken place for date of maturity, fruit characteristics (shape, colour, weight) and finally sugar content (% Brix).

The results of 2016-2017 experiment indicated that at least 6 varieties among 25 combined all the traits according to the interviewees (robustness of plant, yield promising, fruit appearance and taste) and were proposed as best for cultivation and market purposes: Best varieties chosen for consumption had quite high sugar content and bright red colour.

In 2017-2018 experiment, the descriptive characteristics showed high diversification between the varieties. The evaluation of early and total yield classified them in two groups, the one with high productive characteristics and the other that yielded behind.

Description and characterization of heritage varieties are essential for conservation, registration and breeding. Also, participatory evaluation processes are a useful tool for distinguishing promising tomato varieties on the field valorising agrobiodiversity in a sustainable way. Both research elements can contribute to the valorisation of tomato agrobiodiversity in organic market and seed production.

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Impact of legume crops on a subsequent pea crop in soils affected by legume yield depression syndrome

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Legumes are an important part of crop rotations in organic farming. However, they are susceptible to specific soil-borne diseases. These pathogens are, in addition to nutrient deficiencies, assumed to be the main reason for legume yield depression syndrome (Schmidt et al. 2014). Little is known about the compatibility of different legumes when grown in the same crop rotation. Therefore, the aim of this study is to investigate interactions between different grain and fodder legumes with a particular focus on soil-borne pathogens. In several greenhouse experiments, the effects of various preceding crops (legumes and one non-legume) on a subsequent pea crop were examined.

From 2016 to 2018 three greenhouse experiments were carried out. The treatments consisted of six different legume crops (field bean, field pea, blue lupin, Egyptian/red clover, common vetch), and rape as the control. In all treatments field pea was subsequently grown as the main crop. The potting substrate consisted of soil taken from two plots with different crop rotations at a site in Hohenkammer (Upper Bavaria) with legume yield depression syndrome, mixed with a substrate low in nutrients in a ratio of 1:1. When harvesting the initial crops, the aboveground biomass was cut into small pieces and mixed with the corresponding soil. After sowing the main crop, the trial was divided in two blocks with four repetitions each. One block was irrigated normally, in the second block several waterlogged treatments were carried out. Foot and root diseases were rated according to Pflughöft (2008). After pea harvest the aboveground dry matter was analysed.

Fusarium ssp. infected the peas in all experiments and, due to the different crop rotations, in one trial they were also infected with Sclerotinia sclerotiorum, Phoma medicaginis and Pythium ultimum. Symptoms were more severe, and biomass yields lower with waterlogging. An analysis of stem-based diseases showed that, in peas after peas and after Egyptian clover, disease incidence was significantly higher than in peas after blue lupin, common vetch or rape. Infection rates were also significantly higher after red clover than after Egyptian clover. The aboveground biomass of pea grown after pea was significantly lower than for peas grown after blue lupin or rape. In accordance with Schmidt et al. (2014), a negative response of peas to peas or peas to red clover was confirmed in these experiments. Yields and susceptibility to foot diseases were similar for peas after blue lupin and peas after the non-legume crop rape. Blue lupin could therefore be appropriate for crop rotations with field peas. These experiments are being continued to confirm these results.

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Interactions of weeds and cover crops and their relations to management

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There is a strong link between agriculture and biodiversity. Agriculture is one of the primary drivers impacting biodiversity. However, farmers could benefit from ecosystem services linked to biodiversity. Therefore, indicators of functional biodiversity related to core agronomic practices need to be developed. One of the issues relevant to farmers in this context are plants like cover crops or especially weeds that are not harvested. While weeds are mostly seen as problematic because of adverse effects to crops, cover crops can be of importance for retention of nutrients, protection from erosion or even for suppressing of weeds. In this study vegetation, especially weeds and cover crops, on farms was assessed to explore their interactions and relations to soil and management parameters. Additionally, a rapid semi-automatic indicator approach using standard camera pictures was tested.

The vegetation was assessed on nine farms in southern Bavaria (Germany). Four farms were under conventional, and five farms were under organic management. 65 plots mostly planted with winter cereals were sampled in autumn 2014 and spring 2015. A general vegetation survey was conducted within a 10 x 10 m square for each plot. Also, on each plot, three one square meter quadrats were marked with a gauge to take a photo of the area. The pictures were later used to determine vegetation cover and proportion of green leaves with a semiautomatic procedure. Additionally, data on management practices and abiotic soil properties (Ct, Nt, P, K, soil texture) was collected.

In general, the plots were managed according to best practice, and only a few weed species were found. Soils were mostly loamy sands but showed a broad variation in the measured parameters. Cover crops provided a good cover for the soil and suppressed most weeds, at least at the time of recording. The same was found for plots with clover-grass mixtures. Although this was not measured it can be concluded, that the cover crops retrieved a considerable amount of nitrogen. In the conventional plots, harder to control weeds with highly competitive power were found, while organic plots hosted several rare arable weed species. Plots under organic management also showed a higher diversity of cover crops species possibly indicating a higher provision of different ecosystem functions. The rapid camera method provided a reasonable estimate of cover and greenness in relation to the detailed vegetation surveys.

Cover crops and grass-legume mixtures can provide essential ecosystem services both in conventionally and organically managed farms. Weed communities differed under both management systems, and organic farming seemed to promote species less harmful and more worth protection. In this context, images provided a cheap and easy to assess indicator for the provision of ecosystem services by cover crops. New image recognition techniques could be easily used to improve this approach and e.g. identify weeds.

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