THÜNEN

From its roots, organic inspires science, and vice versa

Book of Abstracts of the Science Forum at the Organic World Congress 2021, September 8-10, 2021

Rennes, France

Gerold Rahmann, Frédéric Rey, Reza Ardakani, Khalid Azim, Véronique Chable, Felix Heckendorn, Paola Migliorini, Bram Moeskops, Daniel Neuhoff, Ewa Rembiałkowska, Jessica Shade, Marc Tchamitchian (eds.)

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Foreword

From its roots, organic inspires science, and vice versa

The scientific roots of organic systems are anchored in the four principles of IFOAM – Organics International: ecology, health, fairness, and care. Scientific skills are needed for the continuous improvement of organic food, systems, and culture.

The Forum invited researchers to share their work in the following five themes, with a special focus on interdisciplinary research (paper call text):

Ecological Approaches to Systems' Health

The development of healthy organic systems needs to be addressed with ecologically sound approaches and at various scales (plot/herd, farm, and landscape). Health management, in a broad sense, can be designed at each of these scales with specific methods, but also by taking advantage of ecosystem services. Managing health also means growing systems autonomy and resilience to increase constraints and uncertainties (climate change, resource scarcity, emerging diseases, market volatility).

Related topics:

- Approaches linking soil, plant, animal, human, and ecosystem health
- Animal or plant health management: new approaches and methods, their design and assessment
- Influence of organic food consumption on animal and human health
- Pathogen-host interactions and pathogen diffusion, prevention and control in organic systems in soil, plant and animal science
- Exploring genetic resources, new selection, and management strategies
- Enhancing biodiversity in organic agriculture
- Systems design: cropping and/or husbandry systems, farm arrangements, landscape patterns
- Questions related to coexistence with non-organic systems

Product and Process Quality in Organic Agriculture: Methods and Challenges

One of the key objectives of organic agriculture is to produce food with high nutritional quality in sufficient quantities without compromising biotic and abiotic resources. The expectation of higher quality is a core motive for consumers in purchasing organic products. This quality, however, is dependent on appropriate

management and can be compromised if best practices are not adopted.

Table 1: Submitted and accepted papers for the Organic World Congress 2021 by country

Country	Submitted	OWC ac
Argentina	1	1
Austria	6	5
Bangladesh	4	
Belgium	1	
Brazil	4	
Cameroon	2	1
Canada	8	4
China	3	
Czech Republic	1	
Denmark	10	3
France	76	21
Germany	44	17
Ghana	1	
Greece	1	1
Hong Kong	1	1
Hungary	5	2
India	7	2
Indonesia	1	1
Italy	21	5
Japan	3	
Kenya	2	1
Luxembourg	6	4
Mexico	1	
Netherlands	4	2
Nigeria	11	5
Norway	5	1
Peru	2	
Poland	8	2
Portugal	4	1
Romania	2	1
Serbia	3	1
Spain	10	2
Sweden	4	1
Switzerland	27	8
Taiwan	1	
Tunisia	3	1
Turkey	2	
Ukraine	2	
Great Britain	6	
USA	11	4
Not specified	1	
Total	315	98

Related topics:

- Food processing with care, high food quality, and consumer health.
- Consumer perception of organic products at different levels, and types of processing.
- Strategies to increase the level of nutrition in the organic crops
- Methods to ensure complete traceability of organic products and high quality in food chains.
- Approaches to reduce contaminations of organic products (e.g. pesticides, mycotoxins, pathogens, GMOs)
- Quality of non-food organic products: cosmetics and textiles

Transitioning Towards Organic and Sustainable Food Systems

The transition to more sustainable food and farming systems needs to be implemented by a broad and diverse range of people. It concerns stakeholders engaged in an ongoing evolutionary process of transforming land, agroecosystems, territories, and food systems based on "Sustainable Development Goals" across different scales.

Consumers also have an important role to play, as they have the power to support transitions by their food choices and diets. Citizens can be co-designers of new agroecological food and farming systems.

Related topics:

- Prospective studies and scenarios of future sustainable food and non-food models at different scales
- The redesign of food production systems based on ecological principles and natural processes
- Connections for producers and consumers to support a socio-ecological transformation of food systems
- Deeper and wider transformation of context and society through action learning approaches as well as knowledge co-creation and sharing
- Sustainability assessments with the following indicators: productivity, environmental, economic, social dimensions of agriculture and food systems

- Reducing the use of inputs by improving systems' efficiencies, replacing external inputs with more sustainable ones, and/or the redesign of production systems
- Organic from cradle to cradle: solutions for an organic circular economy

Innovation in Organic Farming: "Thinking Outside of the Box"

Table 2: Submitted and accepted papers for the Organic World Congress 2021 by topic

Thematic themes	Total	OWC accepte
• Ecological approaches to systems' health	82	29
• Product and process quality in Organic Agriculture: methods and challenges	40	11
• Transition towards organic and sustainable food systems	104	32
• Innovation in Organic farming: "thinking out of the box"	63	20
• Political and economic frameworks as drivers for a vibrant development of the organic sector	26	6
Total	315	98

Organic farming favours and needs innovation to push forward its goals while preserving its principles and identity. Innovations are not only technical or biological but also socio-economic. This triangle of innovation allowed the organic sector to find specific, original, and, until now, successful pathways from food production to consumption. Nevertheless, the future global challenges are severe. "Thinking outside of the box" of today's regulations, practices and markets is necessary to develop circular and stable organic food systems and to achieve the goals of organic farming: enough, high-quality and affordable food for everyone while maximizing environmental services and equitable social conditions throughout the value chains (cf. Organic 3.0). At the same time, with regard to the organic principles, the impact of new technology and innovation also needs to be assessed.

Related topics:

- Digital and non-digital strategies
- Robots in the fields to manage weeds and fertilizers
- New strategies for biodiversity management, soil fertility and/or water saving
- New production systems promoting mineral cycling and autonomy
- Alternative food sources and production techniques
- Innovation for reducing food and packaging waste
- Socio-economic experiments such as "free food" systems and community-supported agriculture
- Innovation and new technologies' impact assessment.

Political and Economic Frameworks as Drivers for a Vibrant Development of the Organic Sector

The organic sector relies on values and principles to guide its evolution and growth. Therefore, relevant regulations and processes are needed as socio-economic frameworks. Public and private policies influence these two pillars, principles, and regulations. They also influence the development of the organic sector through potential support and facilitation as well as through the organization and agreements

on trade. These policies, along with the economic choices made by private companies, can represent hindrances or foster opportunities for the sector's development.

Related topics:

- The analysis of public or private policies, economic choices, and their impact on the organic sector
- Mechanisms of price determination and added-value distribution along the organic value-chain, in relation to transparency, fairness, and equity
- Coexistence of the organic sector with the non-organic, whether conventional or other value-oriented, sectors like "fair-trade"
- Understanding the role of policy and market factors in conversion and reversion of organic farmers and consumers
- Contribution of organic farming to public goods.

Table 3: Submitted and accepted papers for the Organic World Congress 2021 by subject

Scientific subject	Total	OWC accepted
• Agropolicy, macroeconomy, sociology and research	45	10
• Animal health	4	2
• Animal husbandry non-ruminants	12	4
• Animal husbandry ruminants	17	4
• Arable crops	16	8
• Crop protection	17	7
• Cropping systems and soil tillage	28	14
• Food processing	8	
• Food quality and nutrition	20	5
• Horticulture, permanent crops and agroforestry	21	4
• Market, consumers and certification	27	6
• Nutrient management	32	11
• Plant breeding	26	8
• Resource conservation and sustainability	27	7
• Soil fertility	10	5
• Weed management	5	3
Total	315	98

The call for papers was released in spring 2019, resulting in 315 submissions from 40 countries (Table 1). About117 qualified scientists reviewed the submissions in the context of the 5 themes in order to assess their scientific quality and their ability to stimulate scientific discussion. 98 paper have been accepted (Table 2 and 3). Additional 107 papers with minor revisions are considered for the OWC21 as well.

Scientific discussions are critical for the development of research, not only in advancing knowledge and methodology but also in expanding innovation in approaches and visions. These discussions will provide the scaffolding for the 6th ISOFAR Conference of Organic Agricultural Science of the Organic World Congress in Rennes in 2021.

All authors agreed that all papers are uploaded to the public and free access online plattform Organic Eprints and to be published in this Book of Abstracts of the Thünen-Report 88 2021. 19 papers have been already published in a special edition of the peer reviewed Journal of Organic Agriculture in Volume 10, supplement issue 1, in December 2020 (https://www.springer.com/journal/13165).

The Science Board of the OWC 2021
Rennes, September 2021

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Parallel 1: Organic animal husbandry monogastric I

OWC2020-SCI-1401

PROTEIN FROM FRACTIONATED FORAGE LEGUMES AS FEED FOR MONOGASTRIC ANIMALS

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Abstract: Fractionation of forage legume crops can make a protein-rich feed available for monogastric animals. The aim of the current study was to assess the effect of fractionation method, leaf stripping or juice production, in lucerne (*Medicago sativa*) on protein yield in low-fibre fractions.

We established field trial with replications on two lucerne varieties in Menemen, Turkey, in 2018. At first cut in 2019 whole plant and six different fractions were processed and sampled. Across varieties, juice, leaves and leaf juice yields accounted for 45%, 53% and 24% of the whole plant dry matter yield, respectively.

Crude protein content was higher in leaf juice (26%) than whole plant juice (23%) and the content in leaves differed between the varieties (22% and 27%). Leaf stripping separated a higher proportion (on average 70%) of the total crude protein in the plant than juice production (on average 55%). The effects of variety, harvesting time and number of cut need further investigation.

Keywords: forage legumes, fractionation, lucerne, protein feed

OWC2020-SCI-551

THE POSITIONING OF ORGANIC PIG FARMS IN THE LANDSCAPE OF ALTERNATIVE PIG PRODUCTION IN FRANCE

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Abstract:A survey was made in organic and other pig farms alternative to indoor housing on fully slatted floor with the aim of describing the different housing systems and of identifying the pig health problems, the possible improvements in animal welfare and biosecurity levels.

The answers from 102 questionnaires were analysed with multiple correspondence analyses followed by hierarchical clusterings. Three main types of systems were identified: farms close to conventional farms as regard to the housing premises, farms mainly under the French 'Label Rouge Fermier' and with part of their pigs raised outdoors and farms mainly organic, characterized by runners allowing outdoor access (sows, gilts, fattening pigs) and litter bedding for indoor compartments (farrowing sows and weaners) and by more frequent reproduction disorders in sows and a lack of sanitary lock.

Our study confirmed a diversity in alternative housing systems but a relative homogeneity in organic systems in the study sample.

Keywords: Animal health, Animal welfare, biosecurity, free-range, organic farming, pig production

OWC2020-SCI-583

FULFIL THE EXPECTATION OF 100% ORGANIC FEED TO ORGANIC PIGS AND POULTRY

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Abstract: To contribute to the goal of 100 % use of organic and regional feed for monogastrics, this paper aims to describe and discuss:

- The protein requirement of monogastric animals (pigs and poultry), including different breeds, productions stages and rearing conditions
- Nutrient contents and potential feeding values of new protein feedstuffs
- Small-scale, on-farm equipment for feed processing
- Different feeding strategies

When feeding pigs and poultry 100 % organic and regionally produced feed, securing enough protein and essential amino acids is a challenge. There are two strategies to follow and they can be combined. One is to utilize by-products and explore new protein sources or refine already existing products. The other is to feed the animals less intensively and for this strategy slow-growing breeds will be useful due to a lower nutrient requirement. However, the possibilities for combinations of regionally grown feed, slow-growing breeds with different feeding strategies are many and they need to be explored.

Keywords: Feed processing, Feeding strategies, Monogastrics, Nutrient content, Protein requirements, Protein sources.

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NUTRIENT DIGESTIBILITY IN ORGANIC SLOW-GROWING BROILERS FED WITH GRASS AND CHICORY AS SUPPLEMENTS

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Abstract: At the end of an experiment with organic broilers reared under free-range conditions, a digestibility experiment was performed with a slow growing hybrid I657 including six treatments: diet C (control), C + grass, C +chicory; diet F1, F1 (reduced protein) + grass, F1+chicory. No difference was found in feed intake of the diets, however, the intake of C + chicory and F1 + chicory was significantly higher ($P<0.01$) than for groups with no access to forage material (C + F1).

The digestibility experiment showed a variation between diets as a higher nitrogen retention was recorded for all F1 diets given both supplements, chicory and grass compared to control diets ($P<0.05$). This indicate that the use of low protein diets in organic broiler production, with access to an attractive forage area, can reduce excess nitrogen excretion on outdoor areas, where diets with higher protein content result in higher N excretion.

Keywords: Digestibility of nutrients, Foraging material, Organic broilers

Parallel 1: Organic animal husbandry monogastric II

OWC2020-SCI-240

ORGANIC RABBIT FARMING AT PASTURE: GASTRO-INTESTINAL PARASITISM ACCORDING TO SEASON AND PASTURE ROTATION.

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Abstract: Gastro-intestinal parasitism in pasture raised rabbits was studied during three seasons: winter 2014, summer 2015, spring 2016. For every season, two groups of five movable cages (3 rabbits/cage) were disposed from weaning to 100 d. old, on a sainfoin or on a grass plot.

A high prevalence of *Trichostrongylus* sp. (93% of rabbits) and a 50% increase in the fecal excretion of oocysts was found in spring, particularly in sainfoin pasture (6.5 M. OPG) where the rotation times was shorter. No diarrhoea was observed during the trials, and at slaughter (100 d old) no intestinal macro-lesions were found, but 64% of the livers had whitish nodules (*E. stiedae)*. Infection by *Trichostrongylus* sp. was negatively correlated to the daily weight gain. Fecal excretion of *E. flavescens* may explain partly the lower daily weight gain (-5 g/d) in spring.

Our results suggested to increase the pasture rotation delay over the two months requested by organic rabbit farming regulation.

Keywords: rabbit farming, parasitism, pasture, season, coccidiosis

OWC2020-SCI-311

A NEW SIMPLIFIED PERFORMANCE REFERENCING SYSTEM ADAPTED TO ORGANIC RABBIT FARMING

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Abstract: A referencing system to collect and analyse performances of French organic rabbit farms was created using an Excel sheet. Performances of reproduction were compilated on 6 farms over 3 years of production (2015-2017). Does are housed in movable cage on pasture or in individual paddock, the livestock size averages 33 does. The productive time of a doe averaged 374 d. and was variable (75%).

Female mortality averaged 17% over the period, while culling reached 10%. With 4.8 matings, 2.7 parturitions per female/year were obtained (60% fertility rate), for a total of 21.6 rabbits born alive and 16.7 weaned (26% mortality from birth to weaning). The yearly turnover of a full-time rabbit farmer (80 females) would potentially be around 26.3k€/year. The database is actually extending to a larger number of farms, thanks to the deployment of a smartphone application (GAELA), that enable a management assistance of the rabbit farm and data collection, synchronized to a national securised database.

Keywords: organic rabbit farming, performance referencing, database

OWC2020-SCI-371

PHOSPHORUS RETENTION MATERIALS IN OUTDOOR LAYING HEN PADDOCKS FOR REDUCED ENVIRONMENTAL IMPACT AND INCREASED NUTRIENT USE EFFICIENCY

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Abstract: This study investigated phosphorus (P) retention materials of sand and limestone outside houses in paddocks for organic laying hens, as a measure to retain P and reduce leaching.

When manure P, accumulated in the materials during 6 months, was exposed to rain simulations in a lysimeter study, P concentrations in drainage water were high from all treatments (58-136 and 130-197 mg L^{-1} of PO_4-P and total-P respectively). On average, 14% of the manure P, captured in the materials was leached after 100 mm of simulated rainfall.

The conclusion is that these materials may efficiently retain P during the outdoor season (May to October), but in order to reduce the risk of losses to waters during the following winter they need to be removed from the paddocks, preferably to arable fields. The materials can be regarded as potential P fertilizers and may thereby combine increased P use efficiency and environmental performance of organic outdoor poultry systems.

Keywords: egg production, lysimeter, P adsorption, P leaching

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PHOSPHORUS RETENTION MATERIALS IN OUTDOOR PADDOCKS AND DISTRIBUTION OF LAYING HENS DURING THE GRAZING PERIOD

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Abstract: This study compared the P retention materials sand and limestone with gravel in a randomized block design with three replicates to evaluate the effect on hens' distribution in the paddock between 1 May and 31 October. Each flock included 76 animals having access to a paddock (3.4 x 19.9 m), where material (3.4 x 3.0 x 0.2 m) was placed outside the pop-hole. The average amounts of hens' outdoors were documented at 9 am and 3 pm each day.

There was no significant difference between the materials concerning hens' distribution and they seemed to be equally comfortable. Instead weather conditions influenced hen distribution. The sub-area with material close to the house was more frequently used by hens during the hot and dry summer.

The hen's choice was promoted by a roof above the pop-hole giving shade. With lower temperatures and rain showers later the hens' distribution pattern changed significantly ($P<0.001$) and they were more evenly distributed over the paddock area during autumn.

Keywords: animal density, egg production, hens outdoors, weather conditions

Parallel 1: Animal husbandry ruminants

OWC2020-SCI-1108

SUCKLING DAIRY CALVES/NURSE COWS SYSTEM AND RISK OF GASTROINTESTINAL NEMATODES INFECTION DURING THE FIRST GRAZING SEASON IN ORGANIC FARMS

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Abstract: In dairy farms, new rearing practices of calves with nurse cows have been developed by farmers but still remain poorly documented.

The objective was to assess the impact of rearing suckling calves with nurse cows on the same pastures on the risk of gastrointestinal nematode (GIN) infection in calves. The grazing management has been recorded for each group.

Serum pepsinogen level and GIN egg excretion per gram of faeces (epg) were determined in 438 calves belonging to 38 groups from 30 farms in the western part of France at housing (October 2018 to January 2019). The maximum number of infective larval generations met by the animals (LG) in each pasture plot was modelled by Parasit'Sim expert system.

The data were analyzed using logistic regression (univariate and multivariate). Mean parasiticological parameters per group were low. On average, the serum pepsinogen level was 1.1 units of tyrosine (U Tyr) and the GIN egg output was 130 epg. Pasture infectivity was above LG4 for 2/3 of the groups. These results suggest that rearing suckling dairy calves with nurse cows decreases the level of GIN infection in calves at the end of the 1st grazing season compared with putting out to pasture weaned heifers alone. This can be explained by i) the fact that cows were immune and have a cleansing effect on the pastures when eating a lot of larvae while excreting few eggs and ii) Because not weaned calves had a slow larval intake when drinking milk from nurse cows.

Keywords: Dairy calves, Gastrointestinal nematodes, Nurses cows, Organic farms

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EFFECT OF ENVIRONMENTAL FACTORS ON STRESS INDICATING PARAMETERS IN CATTLE AT THE SLAUGHTERHOUSE

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Abstract: Farm animals experience various stressful situations, of which slaughter is a particularly sensitive event. Improvement of conditions during slaughter are essential to ensure good animal welfare.

We identified potential problem areas through guided interviews with slaughterhouse employees and a situation analysis at a Swiss cattle slaughterhouse. After implementation of improvement measures, data from 503 cattle slaughtered in August 2017 were evaluated with regard to the stress-indicating parameters cortisol content in exsanguination blood and proportion of vocalizing animals compared to data of a former study in 2012.

The mean cortisol content (3.50 ug/dl) was uncritical and significantly influenced by the driving person and the day. Whereas the high proportion of vocalizing animals of 19.1% was critical. The behaviour of the driving person was also decisive here.

We conclude that employee training is the key to further reducing stress-inducing situations during slaughter.

Keywords: beef calves, slaughter stress, animal welfare, slaughterhouse conditions

OWC2020-SCI-709

DUDDINGTONIA FLAGRANS: A PROMISING FUNGALBIOCONTROL AGENT FOR GASTROINTESTINAL NEMATODES IN SMALL RUMINANTS

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Abstract: Controlling gastrointestinal nematodes is a challenge for organic and conventional owners of small ruminants with access to pastures. A new biocontrol method using the nematophagous fungus *Duddingtonia flagrans* is expected to complement existing alternatives for controlling gastrointestinal nematodes in grazing animals in the future. Animals receive chlamydospores of *D. flagrans*, which pass through the gastrointestinal tract and germinate in the freshly deposited faeces. In parallel to the development of helminth larvae, the fungal mycelium grows and forms trapping structures with which it fixes, kills and "digests" the nematode larvae. This leads to reduced pasture contamination and infection of subsequently grazing animals.

In an experiment with organic dairy goats, a dose-dependent effect of *D. flagrans* administration was shown. Compared to horses, cattle and sheep, higher doses were required to obtain 70% reduction of helminth larval development in faecal cultures of goats.

Keywords: Biocontrol, Duddingtonia flagrans, Gastro-Intestinal Nematodes, goat

OWC2020-SCI-713

EFFECT OF THE EWES DENSITY PER HECTARE AND DAY ON THE CULTIVATED PASTURE IN ORGANIC FARM

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Abstract: In order to evaluate the effect of ewes density under a rational rotational grazing system on a cultivated pasture in an organic farm, 418 ewes were used in a very high livestock load. The experience consists of four different plots of 0.5 ha each one. Besides, there was a control area where the flock didn't get in. Despite the different plots were cultivated using the same techniques and the same amount of seed, the plant composition was not the same.

Although the ewes grazed, *Bromus diandrus* still growing because the animals were able to choose among the plant resources. The plant re-growth had higher protein levels than the initial situation (2,35±0,43) and lower fibre amounts (-3,70±0,73). The result was a better quality food in the re-growth than before the graze.

Keywords: Ewes, re-growth, consumption, grazing

OWC2020-SCI-953

COMBINATION OF TEMPORAL AND SPATIAL DIVERSIFICATION IN ORGANIC SYSTEMS IN EUROPE

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Abstract: There is a need to re-diversify current cropping systems in Europe to improve their sustainability and their resilience. A network of field experiments was built to study the benefits of crop diversification in time and space in organic systems in five countries in Europe. Different strategies of crop diversification are combined at the rotation scale.

The insertion of spatial diversification (cereal-grain legume intercropping, strip cropping both in arable and vegetable systems) in a cropping system should be encouraged owing to positive effects on yield and ecosystem services, based on the first results obtained in the network.

Keywords: Diversification, intercropping, Legumes, strip cropping

Parallel 2:Plant breeding and food quality

OWC2020-SCI-1263

A BETTER BALANCE IN QUANTITY AND QUALITY: OPPORTUNITIES FOR VEGETABLE VARIETIES BRED FOR QUALITY AND TASTE

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Abstract: Various trends shape organic agriculture. One trend is that organic consumers value product quality more and more. Another trend is that conventional breeding increasingly focuses on the use of molecular tools, F1 hybrid breeding and patents. For organic traders and farmers this means an alternative approach in breeding becomes more urgent: a breeding approach that meets economic, societal and nutritional values in a balanced way. One option is to develop varieties that have a good balance in storability, taste and nutritional value.

To better understand whether hand how such balance is possible, field trials were conducted for two years with three vegetable crops (pumpkin, red cabbage and carrots) with five varieties per crop, on two bio-dynamic farms with different soils (clay and sand), using two harvest moments. Measured traits were yield, storability, taste (at three moments after harvest), and nutrient quality (dry matter percentage, Brix and content of eight minerals).

A general conclusion is that it should be possible to breed for crop varieties with a good balance in yield (fresh), dry matter yield, taste, nutritional quality and storability. All these aspects should be taken into account at the start of the breeding process. The research showed clearly that in the context of bio-dynamic farming, open pollinated varieties can have similar yield and storability as F1-hybrids, although they are often lower in uniformity. How the balance in yield, taste, quality and storability should look like exactly for each of the crops should not only be discussed with farmers, but with the whole value chain including traders, processors and consumers.

Keywords: balnce, nutritional quality, organic plant breeding, storability, taste, yield

OWC2020-SCI-1297

CARROT IMPROVEMENT FOR ORGANIC AGRICULTURE WITH ADDED GROWER AND CONSUMER VALUE

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Abstract: Carrot Improvement for Organic Agriculture **(CIOA)** is a long-term breeding project started in 2011 to address the criticalneeds of organic carrot farmers by developing orange and novel colored carrots with improved disease and nematode resistance, improved weed competitiveness, and improved nutritional value and flavor.

Organic growers require vegetable varieties that are adapted to organic growing conditions and hold market qualities demanded by the organic consumer including superior nutrition and exceptional flavor. In carrots, work has been done to identify and breed for nutritionally superior varieties across multiple color classes including orange, red, purple and yellow.

These varieties are in high demand and in a high value crop, however much of this germplasm has not been improved for organic systems in general.

The project also evaluated the performance of varieties in organic versus conventional systems during the first five years to assess the potential for breeding for organic soil conditions. Organic producers need varieties that germinate rapidly with good seedling vigor, compete with weeds, resist pests, are efficient at nutrient uptake and are broadly adapted to organic growing conditions.

The CIOA project is ongoing, building off of research to date, with the goal of delivering improved carrot varieties; improved understanding of the farmingsystems influence (organic vs. conventional) on variety performance; and developing a breeding model adaptable to other crops for organic systems (Simon et. al, 2016). While significant progress has been made in carrot breeding to improve nutritional value, flavor, and disease resistance for conventional production systems, the majority of the conventional U.S. crop is threatened due to loss of chemical fumigants and sprays to control nematodes and Alternaria leaf blight, and organic production has no obvious means for economical carrot production when either of these pests threaten the crop.

Keywords: Carrot, Organic Plant Breeding, Seed

OWC2020-SCI-1350

THE TASTE-OF-THE-PAST FROM ANCIENT LANDRACES. HOW MODERN NON-ORGANIC BREEDING HAS AFFECTED AROMA QUALITY IN PEPPERS AND TOMATOES

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Abstract: Organic production in many areas of the world are mainly based in modern F1 varieties, particularly vegetables, which have been bred for more intensive, high input production systems, instead to more sustainable/organic systems.

In addition, these varieties have been mainly bred for yield, resistances and uniformity, to the detriment of quality and increasing genetic erosion due to the loss of agrobiodiversity. However, nowadays there is an opportunity for ancient landraces and for small and medium farmers in the frame of organic productions systems, as they are expected to show a better adaptation to low-input conditions like organic systems than modern varieties, but also as they may also provide the "taste-of-the-past" that modern varieties lack.

In this regard, some studies have revealed that sugars and acids have been lost in most modern varieties of vegetables, but there is not much knowledge about what happened with the volatile fraction, responsible of both aroma and whole flavour during mastication. In the present work we compared the volatile fraction of several varieties of ancient landraces and modern varieties from Oxheart tomatoes and Jalapeno and Numex peppers.

Our results indicate that within each varietal type modern breeding has provoked a remarkable loss of volatiles at both qualitative and quantitative levels, which indicates that the tastier flavour and more intense aroma of ancient landraces is mainly due to a richer volatile fraction.

Keywords: consumers preference, flavour, gas chromatography, mass spectrometry, vegetables, volatile compound

Parallel 2:Plant breeding for organic cereals

OWC2020-SCI-1116

HOW MAIZE EVOLVES WHEN IT IS BRED UNDER BIODYNAMIC/ORGANIC CONDITIONS AND SELECTED FOR IMPROVED NUTRITIONAL VALUE AND NITROGEN EFFICIENCY.

Walter Goldstein* [1] and a working group including Abdullah Jaradat, James White, Martin Bohn, Micheal Travis, Charles Hurburgh, and others.

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Abstract:A breeding program for maize for biodynamic/organic farmers has taken place in at the Mandaamin Institute. The program began in 1989 and entails summer nurseries in Wisconsin, USA and winter nurseries in Puerto Rico and Chile. Emphasis has been on improving adaptation, productivity, nutritional value, and nitrogen (N) efficiency/N_2 fixation.

Methods include pedigree breeding, development of synthetic populations, and selection under N limited conditions. A co-evolutionary approach is taken to optimize interactions between the maize populations, the breeder, and associated microbes, under N limited biodynamic/organic environments.

Results have been shifts in protein quality and better adaptation to N limited conditions. Emergent evolutionary processes a) increased the occurrence of mutants with soft grain possessing higher protein quality; b) improved chlorophyll content and N efficiency, and c) resulted in the appearance of densely branched rooting systems in the top layers of the soil for N efficient inbreds and hybrids.

Grain yields for the best hybrids have been competitive with conventionally bred hybrids, especially under N limited conditions. Grain quality of the resulting hybrids averaged 16 % more protein, 30 % more methionine, and 16 % more lysine than for conventional hybrids.

Under poultry feeding conditions where some synthetic methionine is fed, the monetary value of the grain was 14 % higher because it reduced the need for soymeal in feed.

Outcomes of the program are populations, inbreds, and hybrids which are now in wider spread strip plot testing on organic farms in Wisconsin, Illinois, Indiana, and have entered initial commercial production in conjunction with Foundation Organic Seed (Onalaska, WI). We will also report results from ongoing farm trials that assess relationships between rooting, N uptake, N mineralization of organic matter, N_2 fixation, and protein production in grain.

Keywords: endophytes, epigenetic, methionine, nitrogen fixation, protein, root density

OWC2020-SCI-1139

HETEROGENEOUS POPULATIONS VS. PURE LINE VARIETIES FOR ORGANIC WINTER WHEAT PRODUCTION IN GERMANY - PRODUCTION RISK

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Abstract: Heterogeneous composite cross populations (CCP) may enable winter wheat producers to cope with increasing biotic and abiotic pressure due to climate change. An economic farm model based on a cost benefit analysis was established to compare net return and production risk of organic winter wheat production with CCP and pure line varieties.

Two CCPs with both yield- and quality-oriented parent varieties (YQI and YQII) are compared with ten reference varieties (4 conventional cultivars, 4 from organic breeders, 1 hybrid, 1 feed wheat). The organic production system was modelled with a stochastic approach (Monte Carlo simulation) based on trial data, market prices and standard data.

Using iterative simulations (20,000 model calculations), possible results of the target variables were calculated according to the probability distributions of the individual input parameters. Yield distributions were estimated from trial data from the INSUSFAR project (2016 and 2017) using maximum likelihood statistics. Discrete distributions were defined for machinery and labor costs.

The individual results of this stochastic simulation can be presented cumulatively as a curve with the corresponding probabilities of occurrence, the risk profile. Risk profiles were used to compare the agronomic options. The evaluation of risk profiles was based on the concept of stochastic dominance. The populations showed a high stability with a moderate economic performance (net return; €/ha). The conventional cultivar 'Achat' dominates the CCP YQI (1st order stochastic dominance) and so do 'Hybery', 'Elixer' and 'Kerubino'. The varieties 'Genius' and 'Poesie' as well as 'Capo' showed a higher net return but also a higher variance and therefore lower stability. Without knowledge of the individual risk-benefit function of decision makers, no recommendation can be given here. The organic varieties 'Butaro' and 'Wiwa' are dominated by the CCP with 2nd order stochastic dominance. If risk neutrality or aversion is assumed, CCPs are preferable here.

Both CCPs showed a relatively low variance of results. CCP YQII dominated half of the reference varieties in the N-fertilization treatment. Especially in the scenario with N-fertilization a trade-off between stability and yield was observed. The hybrid variety 'Hybery' and the feed variety 'Elixer' had a high net return and therefore, despite higher variance, dominated the other varieties and the two CCPs.

Keywords: net return, organic agriculture, risk simulation, Triticum aestivum, yield stability

OWC2020-SCI-1470

EVALUATION OF POPULATION-VARIETIES DEVELOPED WITHIN A WHEAT PARTICIPATORY BREEDING PROGRAM IN FRANCE: PERFORMANCES, DIVERSITY, STABILITY AND ADAPTATION

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∗Speaker

Abstract: Modern agricultural systems rely on little crop genetic diversity, especially with the use of homogeneous varieties grown on large areas. However crop genetic diversity within fields is a lever for a more sustainable production, allowing for a greater stability through combined resistances to biotic and abiotic stress, and buffering environmental heterogeneity which characterizes organic systems.

In France, a Participatory Plant Breeding (PPB) project has been applied on bread wheat since 2006 involving farmers and facilitators of the farmers' seed network Réseau Semences Paysannes and INRA researchers for the development of populations based on a decentralized selection in farmers' fields.

This project leads to the development of heterogeneous populations whose intra-variety genetic diversity should allow them to adapt to farmers' practices and environments. We evaluated the agronomic behavior, genetic diversity, stability and local adaptation of ten populations developed within the PPB program compared to two commercial pure line varieties.

Some populations had very interesting responses when considering grain yield, biomass production and protein content, and six of them were not significantly less productive than the two commercial varieties when comparing overall grain yield per population.

While no clear evidence of local adaptation was detected, we found that populations' quality and in a lesser extent grain yield were more stable over years than that of commercial varieties. Protein content stability over time was positively correlated to genetic diversity with no significant drawback on protein production.

OWC2020-SCI-323

ORGANIC FARMERS' DESIRED QUALITIES FOR BARLEY

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Abstract: Barley is a versatile crop that can fit well in many organic farming systems. However, organic farmers in the United States have had limited adoption of barley as a regular crop in rotation. Researchers conducted a survey of organic barley producers to find out what they considered to be the main obstacles to growing barley.

The primary obstacles are limited markets and price. The breeding and development of better-quality barley suitable for specialty markets may be a way to expand markets and secure a better price. Yield was identified as the most important characteristic to the farmers responding, but other traits such as nutritional quality were also ranked high.

Naked or hull-less barley is one possible alternative that allows organic farmers to sell into multiple markets. Most respondents expressed interest in the development of such varieties suitable for organic farming conditions.

Keywords: Barley, Farmer Survey, Malting, Participatory Breeding

OWC2020-SCI-331

AGRONOMIC PERFORMANCE OF HETEROGENEOUS CEREAL POPULATIONS

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Abstract: Results from comparative field trials of heterogeneous winter wheat and maize populations marketed in Germany under the temporary experiment 2014/150 of the European Commission are presented. Winter wheat populations were tested across 16 environments (four locations x four years) and eight maize populations were tested in six environments (three locations x two years) under organic conditions. In terms of yield and quality parameters both the wheat and maize populations indicated good agronomic performance.

The wheat populations demonstrated yield levels and baking quality characteristics comparable to pure line varieties ranked in the highest German quality category (E). The maize populations yielded up to 85% of the hybrid reference varieties. An important future perspective will be the design of field trials for populations in order to test and quantify their special characteristics, e.g. adaptive capacity and suitability for low input conditions.

Keywords: diversity, heterogeneous material, maize, population, wheat, yield trial

OWC2020-SCI-774

HETEROGENEOUS POPULATIONS VS. PURE LINE VARIETIES FOR ORGANIC WINTER WHEAT PRODUCTION IN GERMANY - ECONOMIC PERFORMANCE

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Abstract: The economic performance of composite cross populations (CCP) of winter wheat were calculated and compared with pure line varieties using cost benefit accounting. An organic production system was modelled based on field trial data (yield, quality), market information (prices) and standard data (machinery and labor costs) to calculate the net return of the winter wheat production.

This paper compares two CCPs created from both yield- and quality-oriented parent varieties (YQI and YQII) with ten reference varieties. Yield distributions were estimated from experimental data from the INSUSFAR project (harvest years 2016-2019). Simulations for one fertilization scenario (100 kg N) are presented here.

At the field trial site, the CCPs were productively and economically similarly successful as or better than reference varieties from organic breeding, with the CCP YQII having the highest net return behind the hybrid and fodder varieties and two of the conventional E-varieties.

As expected, these results fit in with previous studies on yield stability by Weedon and Finckh (2019). Our results suggest that the CCPs can also compete (e.g. 'Capo') and outperform (e.g. 'Kerubino') individual varieties from conventional breeding.

However, these calculations are based on one trial location, so that further investigations are necessary in order to make general statements. An economic performance at the same level as or better than popular varieties from organic breeding indicates CCPs competitiveness under low-input conditions.

Keywords: net return, organic agriculture, production economics, *Triticum aestivum*, yield stability

OWC2020-SCI-948

ARE THE TRAITS OF WHEAT AND PEA CULTIVARS IN SOLE CROP PREDICTIVE OF THEIR BEHAVIOR IN MIXTURES? CONSEQUENCES FOR ADVISORS AND BREEDERS

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Abstract: In France, areas cultivated with cereals-legumes mixtures have been steadily increasing for 10 years, mainly in organic farming systems. For this management, little advice is available for varietal choice and there is almost no specific varietal selection. Farmers based their varietal choice on the traits of cultivars grown in sole crop, cultivars that have been selected for the dominant sole crop system. In these conditions, we can wonder if the traits observed in monoculture are predictive of those observed in mixture.

Our study focused on eleven varietal traits and performances of wheat and pea, in sole crop and in mixture.

Our results show that only half of the traits measured in sole crop are predictive of the traits in mixture and that the other traits such as yield cannot be predicted correctly by the values in sole crop.

Varietal advice for mixtures cannot therefore be based only on the known cultivars traits grown in sole crop. Specific assessments must then be carried out in mixture in order to 1) specify the varietal key traits necessary for the success of a mixture, according to the objectives targeted by the farmer, and 2) to develop, in the future, selection programs specific to mixtures.

Keywords: breeding, cereals, genotype x management interaction, interspecific mixtures, Legumes, varietal choice

Parallel 2: Organic plant breeding and participatory approaches

OWC2020-SCI-1254

SYSTEMS-BASED BREEDING APPROACH: HOW TO IMPLEMENT IT?

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Abstract: Organic breeders need to meet many demands in developing cultivars, e.g. with high yield, good quality, resource-efficiency, climate-robustness, and culturally and ethically acceptable and contributing to ecosystem services. Given the current and future climatic, agronomic, economic and societal environment working towards ecological and societal resilience can only be achieved by concerted action.

The concept of systems-based breeding tries to integrate the strengths of different breeding orientations and provides a perspective where breeders can be initiators of developments towards an ecologically and societally resilient crop production. In this paper we present the first steps for operationalising this concept.

Keywords: agrobiodiversity, breeding strategies, ecological resilience, new approaches, seed systems, societal resilience

OWC2020-SCI-222

IMPROVING THE QUALITY OF ORGANIC NATIONAL SEED DATABASES TO INCREASE THE USE OF ORGANIC SEED AND PROPAGATION MATERIALS IN EUROPE

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Abstract: The purpose of the national organic seed database is to list the seed varieties for which organically produced seeds and vegetative propagation materials are available in the market. The correct functioning of the organic seed database can facilitate the use and distribution of organic seed by improving transparency of the organic seed market. Each EU member state is free to establish its own database, resulting in varying different specific technical solutions among countries. In this study, quality of existing organic seed databases in place in all 28 EU member states and Switzerland was evaluated using different usability criteria.

Our analysis revealed that fully computerised databases are to be preferred as they can influence the user's perceived completeness. Moreover, suitable support and training should be provided by the database managers to improve users' comprehension of database and to increase ease of use.

Keywords: database quality, database usability, organic farming, organic seed use, seed database

OWC2020-SCI-554

WHAT SHOULD ORGANIC FARMERS GROW: HERITAGE OR MODERN SPRING WHEAT VARIETIES? REPORT FROM A STUDY COMPARING YIELDS, GRAIN AND BREAD QUALITY.

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Abstract: For a 100% organic value chain, we need more varieties suitable for organic cultivation. Varieties bred for organic growing is a challenge in small markets. Many breeding goals are equal for organic and conventional cereals.

Hence, accessions failing qualification as commercial varieties may perform well in organic growing. A field experiment over two years was performed at two growing sites to compare 25 accessions of spring wheat, ranging from old heritage varieties to modern breeding lines.

We assessed yield and agronomic characteristics, artisan bread baking quality and sensory characteristics. Modern accessions gave best yields. Old varieties had smaller kernels, less grain filling, lower falling numbers and SDS-sedimentation volumes, but higher concentrations of minerals, although the growing site has a strong effect. Bread from modern accessions performed best in a baking test. Several sensory characteristics such as juiciness, chew resistance, firmness, acid taste and vinegar odor varied between varieties.

Heritage varieties have an important cultural value, and many consumers are willing to pay a significant premium price for such products. A premium price is required, since yield levels are often considerably lower.

Keywords: breeding, cereals, grains, Norway

OWC2020-SCI-597

BOOSTING THE USE OF ORGANIC SEED AND CULTIVARS – HOW TO ASSESS PUBLIC AND PRIVATE SECTOR INTERVENTIONS

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Abstract: Organic seed and cultivars markets are highly distorted. Political or private sector interventions to overcome market failures need to be found to comply with the demands of organic agriculture. Simulation models are useful tools to assess such interventions in ex-ante assessments. This study outlines a conceptual framework to simulate the seed value chain of EU organic agriculture: We deem a positive recursive-dynamic model with decision-making through a combination of mathematical programming and heuristics of a multi-agent system as the most suited approach.

Potential modelling scenarios comprise a number of regulatory measures, as well as public and private investments in training and research along the seed value chain.

Keywords: ex ante assessment, organic seed, sector intervention, value chain analysis

OWC2020-SCI-652

ORGANIC SEEDS OF THE FUTURE: SIMPLE MATERIAL?

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Abstract: The day where seeds were considered as "material" in legal text was a decisive moment. Using the word "material" (translated by materiel in French) to define a seed sounds as an oxymoron! It's surprising that the organic sector tolerates the word *material* in its legislation to name living beings! Semantic drifts and technical drifts are close. Which type of organic seeds do we prepare for the future?

Patented seeds, edited seeds, certified seeds, farm seeds, peasant seeds, participatory seeds? It's time to decide! A simple word may change the way of envisioning plant breeding and it is finally the relationship to the living that is questioned.

OWC2020-SCI-656

COMPARING YIELD AND YIELD STABILITY OF ORGANIC BRED AND CONVENTIONAL BRED WINTER WHEAT VARIETIES ON ORGANIC VARIETY TRIALS IN LUXEMBOURG

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Abstract: Weather conditions in Luxembourg became more instable, therefore varieties with more stable yields were need in organic farming in Luxembourg.

Data of 4 winter wheat varieties (2 organic and 2 conventional), pooled data of all organic and all conventional varieties and total varieties through 2015-2019 were used for analyses. Results show no significant differences in grain yield between organic and conventional bred varieties.

One organic and one conventional variety could be selected based on their yield stability. Therefor yield stability could be a useful tool for analysing variety trials.

Keywords: Organic bred varieties, conventional bred varieties, winter wheat, yield, yield stability, organic farming

Parallel 2: Organic plant breeding and systems approaches

OWC2020-SCI-1090

RESCUING NON-GM ORGANIC COTTON SEED THROUGH PARTICIPATORY BREEDING APPROACH

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Abstract: Introduction of Bt-cotton and its fast adoption in India posed a major threat to availability of non-GM cotton seed for organic production. With the continuous growth of the organic market it is important to maintain non-GM germplasm, to enlarge the offer of organic cultivars with a better performance that meet the demand of the market, and to rebuild the seed sovereignty of organic smallholder cotton farmers.

This study aims to examine relative yield performance and fibre length of commercially cultivated American *Gossypium hirsutum* (HV) and Desi cotton *G. arboreum* (AV) varieties in comparison with the advance (F6-F8) HV and AV lines developed under Seeding the Green Future (SGF) program at different sites. Analysis revealed wide range in seed cotton yield across different locations in both, heavy and light soils resulting from the unpredictable weather conditions, an extended period of drought during sowing followed by flash flooding during the 2018-19 cotton-growing season.

However, both advance (F6-F8) HV and AV lines gave promising results and were at par with the performance of commercial HV and AV cultivars. Analysis of data on fibre quality revealed encouraging results with mean fibre length of >28 mm observed in Bandapari and Akola, especially with advance (F6-F8) AV lines, which is minimum industrial standard. While desi cotton *G. arboretum* has inherent ability to adapt under adverse climatic condition and is well known for tolerance to sucking pests and drought if coupled with such important quality parameter can help in securing the availability of non-GM seed.

This is of special importance as desi cotton does not cross-pollinate with Bt-cotton and shows clearly distinguished leaf morphology. In the current scenario, where the integrity of Indian organic cotton under the spotlight due to GM contamination, there is a need to reorient research efforts to ensure that the existing wealth of genetic diversity of traditional Desi cotton can be capitalized in organic production and industrial processing.

Keywords: Organic cotton, participatory breeding, seed

OWC2020-SCI-1130

IMPROVING TOMATO FLAVOUR WITH THE BREEDERS' SENSORY TEST

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Abstract: Tomatoes are the most important vegetable in Europe and worldwide. However, often the quality of fresh tomatoes does not meet the consumer expectations. Assessing the organoleptic quality of fresh tomatoes in early generations is a challenging task in tomato breeding programs, even though good flavour is an important goal in organic plant breeding.

Therefore, we introduced and evaluated the so-called breeders' sensory test. This breeders' sensory test is designed to assess a high number of samples, which are common in early breeding generations, with a small team. Results indicate that selection for flavour is feasible in early generations and that the breeders' sensory test is an appropriate tool to assess the flavour of tomatoes.

Keywords: tomato, flavour, sensory test, instrumental analysis, early breeding generations

OWC2020-SCI-1285

PARTICIPATORY PLANT BREEDING AND TRIALING TO INCREASE FARMER CHOICE IN VEGETABLE VARIETIES THROUGH THE NOVIC PROJECT

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Abstract: The demand for organic food in the United States continues to increase at two to three times the rate of demand for non-organic food and a substantial portion of this is organic fruits and vegetables. A comprehensive breeding and seeds system targeted to organic production systems is required to provide the cultivars needed to support increasing demand for fruits and vegetables. Farmers still lack access to a wide array of certified-organic seed and vegetable varieties adapted to organic production. Cultivars that are best adapted to organic production will be those bred under organic conditions.

The Northern Organic Vegetable Improvement Collaborative (NOVIC) was implemented to increase the diversity and choice of vegetable cultivars available to organic farmers. It has been funded in three four-year cycles with the project currently in its second year of the third cycle. It is a collaboration of six institutions and over 30 organic farms in six states. The overall goal of NOVIC is to increase the proportion of U.S. agriculture that is managed organically. NOVIC uses participatory plant breeding and participatory variety trialing to understand farmers' needs and conduct breeding efforts. The project has three major initiatives: 1) to conduct vegetable variety trials to identify those adapted to organic systems; 2) to breed vegetable crops where needs are identified; and 3) to provide farmers with the knowledge to produce their own seed and to breed their own varieties.

NOVIC has been instrumental in 10 releases of four crops, with another 12 varieties of seven crops in the pipeline. In addition, there are numerous private sector varieties that have undergone evaluation in NOVIC trials.

Essentially all of farmers who have participated in NOVIC have indicated that they have changed varieties based on regional trial results. Outreach activities have occurred in about a dozen states through plant breeding workshops and videos and publications are available online.

Keywords: organic plant breeding, Participatory Breeding

OWC2020-SCI-1404

LIVESEED - IMPROVING THE PERFORMANCE OF ORGANIC AGRICULTURE BY BOOSTING ORGANIC SEED AND PLANT BREEDING EFFORTS ACROSS EUROPE

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Abstract: LIVESEED is a Horizon 2020 project applying interdisciplinary and multi-actor approaches aiming to transform the organic seed and plant breeding sector. The main goal is to reach 100% organic seed of cultivars suited for organic agriculture in order to improve competitiveness and integrity of organic production.

LIVESEED covers the five main crop categories: legumes, vegetables, fruit trees, cereals and fodder crops, considering diverse cropping systems across Europe including mixed cropping and agroforestry.

LIVESEED explored legal, technical, scientific, and socio-economic aspects that impact the use of organic seed from breeding to seed availability. LIVESEED developed policy recommendations on the implementation of the rules for organic seed in the EU organic regulation and an EU wide router database for organic seed. Innovative concepts for seed health and systems-based breeding have been developed as well as several breeding and selection tools for improved resilience. Innovative governance models for assessing suitability of homogeneous and heterogeneous cultivars for organic agriculture are designed and recommendations made to ease the official release of organic bred varieties.

Economic business models for the whole seed supply chain including financing of organic breeding allowing simulation of interventions are under development. Science based policy recommendation of LIVESEED can have an immediate impact on the delegated and implementing act of the new organic EU regulation promoting organic seed and plant breeding.

Keywords: organic breeding, organic seed, policy recommendation, seed health, seed supply chain, selection tools

OWC2020-SCI-417

SELECTING FOR LANDRACE-LIKE POPULATIONS: INSIGHTS FROM A COLLABORATIVE PROJECT ON FORAGE CROPS

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Abstract: Between 45 to 81% of the total phosphorus (P) fertilizer applied to soils in sub-Saharan Africa is absorbed in the soil, which among other factors reduce crop yield and contributes to high poverty in the region. The objective of the study was to assess the effect of different phosphorus rock (PR) management on carrot yields, P recovery and use efficiency.

Different volumes (100, 200, 300, 400, and 500 mLs) of organic (lemon and pineapple) juices and water were used to dissolve 100 g of PR. The available P concentration in the solution was determined using a standard protocol.

The solution with the high P concentration as well as powdered PR was each composted with manure and crop residues. Thereafter, a field experiment was set up on Humic andosols and Orthic acrisols to compare the effect of the dissolved PR applied directly with compost, to dissolved PR composted, powder PR composted, powdered PR applied directly with compost, Triple supper phosphate applied directly with compost, compost and the soil alone (as a control).

Our findings showed that lemon juice could release over 65% of the available P from PR and the combined application of the dissolved PR and compost at planting increased P recovery and use efficiency, and carrot yields on both soils as compared to the other treatments.

Keywords: Compost, Organic juices, Phosphate rock dissolution, Phosphorus recovery

OWC2020-SCI-804

FARMER INVOLVEMENT IN AGRO-ECOLOGICAL RESEARCH – THE ORGANIC ON-FARM WHEAT VARIETY TRIALS IN HUNGARY

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Abstract: The acreage of organic farming is constantly increasing in Hungary. The cultivation of cereals – and within it – the production of winter wheat is of main importance in organic field crop production. However, it encounters various difficulties.

As official post-registration variety trials only exist under conventional farming conditions, ÖMKi started participatory organic on-farm variety tests in 2012, with the involvement of volunteer farmers all over Hungary.

In the past seven years, nearly 50 varieties and more than 20 farms have been included in the tests which were conducted with the aim to find the most suitable varieties for high quality organic wheat production and to exclude the inappropriate ones for respective production regions.

Our results demonstrate that there is great potential in choosing the varieties best suited, and that it is possible to achieve both high yield and excellent quality also in organic farming, when applying the suitable cultivars.

Keywords: organic farming, on-farm research, variety test, winter wheat

OWC2020-SCI-811

A PARTICIPATORY WHEAT VARIETY TESTING PROGRAMME WITH BRITISH ORGANIC FARMERS

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Abstract: In organic farming, crop adaptation to the growing environment and resilience towards changing climate are key in ensuring a sustainable and profitable agriculture in the absence of external inputs. Varietal choice is the major crop specific management decision organic farmers can make on a short-term basis to manage crop performance.

Here, we present the results of two years of field-scale variety testing of winter wheat inEngland, which is the arable crop with the largest acreage, yet with a very small and shrinking organic acreage.
In the framework of the H2020 LIVESEED project, we started a collective experiment in which varieties were tested by organic farmers at a commercial field scale. This programme is currently in its third year and expanding, it involves 14 farmers and has tested 15 varieties.
In the first two years, this work has paved the way to better understand winter wheat production and thereby build decision support frameworks and feedback to breeders on useful traits. It has also been a powerful tool for co-learning between researchers, farmers and supply chain stakeholders. Collective experiments can empower the organic sector to independently produce the evidence needed for on-farm decision making.

Keywords: organic seed, organic variety trials, Participatory research, wheat

Parallel 3: Diets, Food quality and health

OWC2020-SCI-381

LONG-TERM EXPERIMENTS AS A TOOL FOR GOVERNING THE TRANSITION TOWARDS NEW FOOD SYSTEMS: AN ITALIAN TRAJECTORY

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Abstract: In order to face the challenges of Agenda 2030 and sustainability goals, there is an urgent need to promote transformative changes in food production, from field to market.

Agricultural research should encompass all the dimensions of agriculture, at farm, landscape and food system scale, by multidisciplinary and participatory approaches. To accomplish this need, the activation of long-term processes of food system co-design can be a valuable strategy to achieve the ambitious goal of producing in a sustainable way.

The Long-Term Experiments can be considered as the training ground to apply this approach for information and co-production and sharing. In this study, we present an on-going process activated in Italy, based on the connection of different local farmer-to-farmer/researcher networks through common objectives and methodology sharing.

Keywords: co-design, food system re-design, organic farming and agroecology, Participatory research, stakeholders

OWC2020-SCI-426

SUSTAINABLE VALUES OF THE FRENCH FOOD-BASED DIETARY GUIDELINES: FINDINGS FROM THE BIONUTRINET PROJECT

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Abstract: Several countries have integrated the sustainability concept into official nutritional recommendations. In 2017, the new French recommendations promote the consumption of organic food and plan-based foods. Our objective is to compare the level of sustainability of the previous and new recommendations through several indicators. This study was conducted in the NutriNet-Santé cohort and uses two validated scores reflecting the level of compliance with the recommendations.

This population includes 76% women and the average age is 50 years. Overall, the new recommendations are more effective than the old ones in terms of greenhouse gas emissions, energy demand and land use. However, a diet complying with the new recommendations is more expensive.

By construction, participants adhering to the new recommendations also have a higher consumption of organic food. Their energy intake is lower. If adopted by a large part of the population, the compliance with these new recommendations would reduce the environmental impacts related to food systems but economic concerns remain.

Keywords: cohort study, dietary recommandations, dietary sustainability, green house gaz emissions, health

OWC2020-SCI-484

DESIGN OF AN AGRI-FOOD SYSTEM ON THE MIRECOURT TERRITORY: ARTICULATION BETWEEN TECHNICAL AND FOOD LOGICS

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Abstract: The desire to reconnect agriculture and food to develop more sustainable food systems is emerging in many territories. On the INRA Experimental Facility in Mirecourt, we have been implementing a system experiment since 2016 to place an agricultural system in transition to an agri-food system.

This transition is rooted in the local territory and involves mutual influences between technical systems and food systems. Through two examples, we develop the interdependencies between the agro-technical logics and the food logics expressed at territorial scales.

Keywords: Agri-food system, Diversification, Local scene, Science-society interaction

OWC2020-SCI-610

DIETARY PESTICIDE EXPOSURE AND CANCER RISK IN THE NUTRINET-SANTÉ COHORT

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Abstract: Pesticides are used in large quantities in current agricultural practices all over Europe. Some of them are suspected of having negative effects on human health, in particular on neurological, respiratory, dermatological, digestive, reproductive and reproductive systems as well as carcinogenic potential (collective expertise INSERM, 2013).Some associations between occupational exposure and several types of cancer have been already evidenced. However, evidence on pesticide dietary exposure of the general population associated with cancer risk are not sufficient.In this work, we aimed to study the association between dietary exposure to pesticides and cancer risk among participants of the web-based NutriNet-Santé cohort.Participants completed a self-administered semi-quantitative Food FrequencyQuestionnaire (FFQ) including 264 items with a distinction between conventional and organic foods. Exposure to 25 pesticides commonly used in agriculture were calculated using a pesticide residue table taking into account the farming practices, from *Chemisches und Veterinäruntersuchungsamt* (CVUA) Stuttgart.

Non-Negative Matrix Factorization (NMF), a specially adapted method for data with excess zerros, was used to establish exposure profiles to pesticides. The NMF components obtained were then introduced in quintiles into cause-specific Cox models estimating hazard ratio (HR) and 95% confidence interval, adjusted for known confounding factors, in particular food quality and other anthropometric and lifestyle factors.A total of 31,229 participants were included in the analysis, of whom 931 developed cancer, including 145 breast cancers.

The 3rd and 4th quintiles of NMF component 2 (high exposure to Boscalid, Cyprodinil, Iprodione, Tebuconazole and λ-cyhalothrin) were significantly associated with an increased overall cancer risk compared to the 1st quintile of this same component with HR_{Q3} =1.28 (IC97%=1.03 ;1.60) and HR_{Q4}=1.27 (IC97%=1.02 ; 1.58). In postmenopausal women, quintiles 3, 4, 5 of component 3 (low overall exposure to synthetic pesticides) were significantly associated with a decrease in breast cancer risk compared to the 1st quintile of the same component: HRQ3=0.50 (IC97%=0.30; 0.84), HRQ4=0.46 (IC97%=0.27 ;0.79), HRQ5=0.57 (IC97%=0.34 ; 0.97). A stratified analysis on the sPNNS-GS2 score (measurement of adherence to national dietary guidelines without the organic component) was performed. Thus, significant associations between NMF component 2 and overall cancer risk were confirmed in the 1st tertile of sPNNS-GS2 (low adherence). In postmenopausal women, associations between breast cancer risk and component 3 were found in the 1st and 2nd tertiles of sPNNS-GS2.The associations observed in this study support a potential role of dietary exposure to pesticides on cancer risk.

Keywords: cancer, DIET, EPIDEMIOLOGY, Organic foods, pesticide residues, Sustainability

ENVIRONMENTAL IMPACTS ASSOCIATED WITH OMNIVOROUS, PESCO-VEGETARIAN, VEGETARIAN, AND VEGAN DIETS ACCOUNTING FOR FARMING PRACTICES

OWC2020-SCI-672

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Abstract: In the context of climate urgency, food systems are an essential lever for action as food production leads to environmental issues. Some studies, mainly based on simulation, have shown that reducing meat consumption can limit the environmental footprint. However, vegan or vegetarian consumers consume many organic foods and this parameter is often omitted in impact assessments.

We compared the environmental impacts from life cycle analysis at the food production phase for different types of diets from individual observational data taking into account the production system (organic or traditional). Data from 29,210 participants in the NutriNet-Santé cohort who completed a food frequency questionnaire distinguishing production methods have been used.

Diets excluding meat are less impacting in particular on greenhouse gas emissions with a 78% reduction between omnivores and vegans. As regards land occupation, a reduction of 67% was observed. Previous studies may have overestimated difference in land occupation between the types of diets as organic food system requires more land.

Keywords: diet-related environmental impacts, animal-based food, farming system, greenhouse gas emissions, cumulative energy demand, land occupation.

OWC2020-SCI-806

ASSOCIATION BETWEEN ORGANIC FOOD CONSUMPTION AND THE RISK OF DIABETES: RESULTS FROM THE NUTRINET-SANTÉ PROSPECTIVE COHORT

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Abstract: well-conducted prospective study to characterize the potential association between OF consumption and T2D risk, accounting for confounders is lacking. We aim to study the associations prospective between organic food consumption and of type 2 diabetes (T2D) risk in a French population-based prospective cohort.

A total of 33,256 participants included in the NutriNet-Santé cohort and completing the Organic food frequency questionnaire were included (2014). Share of organic food in the diet (as weight without water) was computed. The associations between organic food consumption (5% increment and as quintiles) and the risk of T2D were estimated using multivariable Cox Hazard-proportional model provided Hazard Ratio (HR) and 95% confidence interval (95%CI) adjusted for various risk factors, in particular lifestyles including diet. Organic food consumption was associated with a lower risk of T2D (HR for a 5% increment of organic food in the diet = 0.97 (95%CI= 0.95-0.99), HR Q5 vs. Q1= 0.65 (95%CI= 0.43-0.97). The findings were robust in the sensitive analysis.

In this large observational prospective study, a higher part of organic food in the diet was negatively associated with the risk of T2D. Several hypotheses may explain these findings but further experimental and prospective studies set in other context should be conducted to confirm these observations.

Keywords: cohort study, diabetes, epidemiology, Organic foods

Parallel 3: Organic food processing-methods, quality and nutrition

OWC2020-SCI-1226

QUALITY PARAMETERS VARIATION OF ORGANIC STRAWBERRY REGINA CV. DURING FREEZING AND STORAGE

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Abstract: Organic strawberries represent a good source of vitamins, polyphenols and mineral elements. The postharvest storage of organic fresh strawberry is relatively short and the injuries, rapid spoilage, nutritional (vitamins, polyphenols, anthocyanins) and moisture loss lead to dramatically reduces of their commercial value.

Therefore, limited production period and short postharvest storage remain the most important problems for food industries and consumers. Due to these, aim of the study is to investigate the effect of frozen storage temperatures and period on quality parameters of organic strawberry Regina cv, during 12 months.

Keywords: ascorbic acid content, freezing, organic strawberry, storage

OWC2020-SCI-1272

THE DIVERSITY OF FOOD PROCESSES IN ORGANIC SHORT CHAINS THE CASE OF ARTISANAL PASTA

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Abstract: To provide local and healthy food, an increasing number of French farmers make the choice to not only produce cereals but also process them into flour or semolina, then pasta and sell them on farm or through local food networks. Less or no gluten sensitivity have been reported by some consumers of these handmade products.

A current participatory project proposes to inventory such initiatives in Occitanie region, to describe their farming systems and to evaluate the quality of pasta. The first results showed that on-farm processing and marketing are mostly the fact of small-scale organic farms growing landraces durum wheat varieties and other orphan Triticum species.

Stone-milling is mainly used instead of roller-milling and the pasta process is soft, simpler but longer than the industrial one. The raw materials and the final products were analyzed in order to understand how the process influences the final quality of pasta, particularly the gluten and organoleptic quality.

OWC2020-SCI-376

PRODUCTION-RELATED CONTAMINANTS (PESTICIDES, ANTIBIOTICS AND HORMONES) IN ORGANIC AND CONVENTIONALLY PRODUCED MILK SAMPLES SOLD IN THE USA

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Abstract: We sought to determine if contaminant levels differ by the production method used. Half-gallon containers of organic and conventional milk were collected in each of nine US regions and shipped on ice for analysis.

Pesticide, antibiotic and hormone (bovine growth hormone (bGH), bGH-associated insulin-like growth factor 1 (IGF-1)) residues were measured using liquid or gas chromatography coupled to mass or tandem mass spectrometry.

Levels were compared against established federal limits and by production method. Current-use pesticides and antibiotics were detected in several conventional (26–60 %; *n* 35) but not in organic (*n* 34) samples. Among the conventional samples, residue levels exceeded federal limits for amoxicillin in one sample (3 %) and in multiple samples for sulfamethazine (37 %) and sulfathiazole (26 %). Median bGH and IGF-1 concentrations in conventional milk were 9·8 and 3·5 ng/ml, respectively, twenty and three times that in organic samples ($P < 0·0001$).

Keywords: antibiotic residues, dairy, growth hormones, milk, pesticide residues

OWC2020-SCI-377

DIFFERENCES AND SIMILARITIES IN THE PROCESSING OF ORGANICALLY AND NON-ORGANICALLY PRODUCED (SEMI)-HARD CHEESE- ANALYSIS BASED ON EXPERT INTERVIEWS WITH ARTISANAL CHEESE DAIRY STAFF IN THE MÜNSTERLAND REGION IN GERMANY

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Abstract: The study compares the production of organic and non-organic artisanal (semi-)hard cheese and examines the producers' understanding of the term "gentle processing". Guided interviews were conducted with four experts from two organic and two non-organic artisanal on-farm-dairies in the Münsterland region. The interviews were evaluated on the basis of the structured content analysis according to Mayring.

Both expert groups described similar steps in their cheese production. As differences in cheese processing, the experts stated the use of additives, the storage time of the milk and the cheese care. Moreover, differences in the technological pre-treatment of the milk could be identified. This study is the first to investigate differences and similarities in the processing of (semi-)hard cheese in organic and non-organic dairies.

Keywords: artisan cheese, dairy cow, Dairy goats, processing method

OWC2020-SCI-392

DEVELOPMENT OF SUSTAINABLE DRYING STRATEGIES FOR BEEF DRYING

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Abstract: Organic food is regarded as more sustainable compared to other processing forms, however, usually only the production on farm is considered and not the postharvest processing steps. Often, food processing steps do not differ in organic processing compared to conventional food processing which could impact the quality and the sustainability of the product. Innovative approaches that focus on individualized processes by non-invasive measurements during processing, could enable improvements for both product quality and sustainability.

In this study the usability of hyperspectral imaging in terms of drying of salted beef samples was investigated. Beef slices were dipped in salt solution and dried at 50, 60 and 70 °C. The question was if it is possible to build prediction models for moisture content (MC) and colour parameters, although the drying behaviour is different. The results indicate the possibility for implementing non-invasive product monitoring during processing to enable individual and therefore sustainable processes.

Keywords: beef drying, hyperspectral imaging, PLSR, product monitoring

OWC2020-SCI-696

A MULTI-TECHNICAL INITIATIVE TO AUTHENTICATE ANALYTICALLY ORGANIC FOOD PRODUCTS: THE TRUE ORGANIC FOOD (TOFOO) PROJECT

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Abstract: The organic sector is facing vulnerabilities to fraudulent activities. New analytical tools are needed for authenticating the production system. Non-targeted analyses, based on a multi-techniques approach, have the potential to overcome these hurdles. A large-scale initiative called True Organic Food (TOFoo), led by Eurofins, has been launched to develop and validate such methods. New tools may be available for use in the whole organic sector.

Together with other traceability tools, they may better guarantee that only authorised practices have been used along the supply chain. It will also increase the protection of virtuous players and support the sustainable growth and dynamism of the organic sector.

Disclosure of Interest: E. Jamin is employee of: Eurofins, received grant/research support from: Bpifrance, J.-F. Morin is employee of: Eurofins, received grant/research support from: Bpifrance

Keywords: analytics, authentication, dairy product, multi-techniques, plant-based food, statistics

OWC2020-SCI-808

EFFECT OF WEATHER CONDITIONS ON THE FATTY ACID PROFILE OF MEDIUM-GROWTH CHICKEN MEAT REARED IN ORGANIC PRODUCTION SYSTEMS. NIR SYSTEM EVALUATION.

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Abstract:A total of 160 medium-sized one-day-old male chickens were raised for 120 days in a certified organic farm farming system. The chicks were classified according to the weather period (P1 and P2). A total of 80 chickens were used for each breeding period (8 repetitions with a total of 10 chickens/group). The characteristics of the weather period were defined based on the information provided by the SiAR; P1 were colder than P2. All birds were provided with the same diets. After 120 days, the animals were taken to a certified slaughterhouse for organic meat where they were slaughtered.

A total of 24 chicks per period were randomly selected, then the breasts (*Pectoralis major*) were extracted to the analysis. Individual fatty acids were measured by gas chromatography and expressed in grams per 100g / fat. From the values obtained, the total lipid fractions were calculated.

NIR spectra were measured on the surface of the breast without preparing or manipulating. Warmer period (P2) significantly decreased ($P < 0.01$) the content of saturated fatty acids (SFA) and ratio between SFA /polyunsaturated fatty acids (PUFA), and increased ($P < 0.05$) content in PUFA and n-6 in the breast. However, no significant differences were observed on the individual composition of fatty acids. The NIR system was not able to correctly classify the samples according to the aging period.

Keywords: poultry meat, physicochemical aspects

OWC2020-SCI-814

SOLVING PHOSPHITES EMERGENCY IN ORGANIC FRUIT AND VEGETABLES: THE PARTICIPATORY BIOFOSF PROJECT

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Abstract: Quality and safe food is an imperative in organic production. Recently, in EU market some organic fruits and vegetables were positive (>0.01 mg/kg) to phosphonic acid (i.e., phosphite), despite fosetyl-Al or phosphite are not allowed as plant protection products in Reg.

EC n.889/2009. In 2016, the Italian Ministry of Agricolture funded the BIOFOSF project to the Council for Agricultural Research and Economics, which promoted a partecipatory approach among researchers, farmers and control bodies for solving this issue.

The endogenous production of phophonic acid was not observed, while it was evidenced that its origin is due only to external inputs. A contamination of some plant protection products (PPP) and organic fertilizers allowed in organic farming was found, thus suggesting a deep revision of their official control system.

Keywords: fosetyl residues, MRL, Organic vegetable production, Pear, phosphonic acid, potato

OWC2020-SCI-961

INFLUENCE OF ENCAPSULATION ON THE TECHNOLOGICAL FUNCTIONALITY AND STABILITY OF ORGANIC NATURAL PLANT EXTRACTS.

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Abstract: In this study new organic ingredients consisting of encapsulated organic nettle (*Urtica dioica* L.) and tomato "Pera d'Abruzzo" extracts to be used for the production of organic foods with high added value were developed.

Extracts encapsulation was performed by freeze-drying using enzymatically hydrolyzed maltodextrins. Encapsulated extracts were evaluated for the chemical, physical and thermal properties, and antioxidant activity. Quality parameters and stability during storage at room temperature were also assessed. Freeze-dried extracts were used as reference samples.

This study shows that encapsulation in maltodextrins affects the technological functionality and the antioxidant activity of tomato and nettle extracts during freeze-drying, and also their stability during storage. These ingredients can be applied in organic productions for the production of innovative and fortified products.

Keywords: plant extracts, organic, encapsulation, thermal properties, stability, antioxidant activity

OWC2020-SCI-974

AN UPDATE ON IMAGE FORMING METHODS: STRUCTURE ANALYSIS AND GESTALT EVALUATION

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Abstract: Rocket lettuce from a field trial with biodynamic, organic and mineral fertilization with or without horn silica application was investigated with the image forming methods copper chloride crystallization, capillary dynamolysis and round filter chromatography with two approaches.

Firstly, image evaluation by two individual evaluators was based mainly on analysing structural features in capillary dynamolysis, secondly, a panel of eight evaluators analysed both structural and Gestalt criteria of copper chloride crystals. With the first approach, the two manure fertilizers were differentiated from the minerally fertilized sample, while with the second approach, biodynamic fertilization was differentiated from organic and mineral fertilization, and samples with horn silica application were successfully identified.

Apparently, biodynamic preparations affected Gestalt criteria more than structural aspects. Gestalt recognition may be a method to capture properties of the farm organism that emerge from the integration of different components.

Parallel 3: Market, Consumers & certification I

OWC2020-SCI-1061

INFORMATION ON ORGANIC MILK PACKAGING IN COUNTRIES WITH DIFFERENT LEVEL OF ORGANIC MARKET MATURITY – A COMPARISON BETWEEN GERMANY, THE NETHERLANDS, ITALY AND POLAND

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Abstract: The packaging of a food product is an important communication tool between producers and consumers. Consumers have special requirements for organic products. However, organic food markets within the EU are on a different maturity level. Are there differences in the product quality information on the packages of organic milk in countries in a different stage of development?

The research was conducted in Germany, the Netherlands, Italy and Poland in the summer of 2019. The number of milk packages analysed was 37 in Germany, 27 in the Netherlands, 16 in Italy and 13 in Poland. Information on animal welfare, place of origin and on sensory aspects was frequently present on packages in all four countries.

Detailed information about the processing of milk was only seldomly found. Differences were found in the amount of national and international labels. Consumers can be overwhelmed by information on product packaging. Therefore, the selection of information should be conducted with care.

Keywords: food labels, food packaging, food quality, organic milk, packaging information, processing method

OWC2020-SCI-1064

IMPORTANCE-PERFORMANCE ANALYSIS OF ORGANIC SHEEP AND GOAT FARMERS: A STUDY IN SIX EUROPEAN COUNTRIES

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Abstract: The aim of this paper is to analyse the performance of organic sheep and goat farms through a set of indicators of multi-dimensional sustainability (MDS) classified in four categories: Financial, Innovation, Market and Resources. Data refer to 42 organic farms across six European countries and consider meat, dairy and dual purpose farms.

Farm performance and the respective importance paid for each MDS indicator are analyzed through Importance-Performance Analysis (IPA). Results show a differentiated situation both in terms of farm types and of MDS indicators: Financial aspects show the worst performance, while Market aspects the best ones. Resources are scored positively for Goats and Dairy farms, while Innovation is generally considered as not relevant for most of farm types.

Keywords: organic aquaculture, systematic review, economic performance, consumer attitude

OWC2020-SCI-213

ESTIMATING THE JAPANESE ORGANIC FOOD MARKET IN 2018 USING CONSUMER PANEL DATA:A TENTATIVE RESULT

Yoko Taniguchi and Research Project Team "Current Status and Trend of Agricultural Policy and Global Market for Organic Food: Study on European, North American Countries and Japan"

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Abstract: As part of an ongoing research project in which we attempt to identify what are needed to produce reliable, and internationally comparable organic market data, we conducted a pilot data collection and made an estimate on the size of the organic food market in Japan using household panel data. In the household panel data, we identified 9180 items as organic food products.

Using the list of the organic food items, the total purchase value in the year 2018 was estimated to be about 44.3 billion yen (369 million Euros or 403 USD), by far the smaller amount compared to preceding estimates. By extrapolating the purchase to the entire population and adding the estimate on the retail sales of organic products that do not carry JAN code, we estimated the total retail values of organic products in 2018 was 108.9 billion yen.

There is a big gap between our estimate and preceding estimates, and it is important to note the difference in the definitions of organic food market and the methodology of data collection employed.

Keywords: consumer panel data, Japanese market, market data, market estimate

OWC2020-SCI-368

DETERMINANTS OF ORGANIC FOOD CHOICE IN GERMANY: THE CASE OF YOUNG ADULTS

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Abstract: The purpose of this paper is to explore the values that underlie young adults purchase motivation of organic food. Online chat-based laddering interviews were conducted with 30 organic and non-organic consumers. The results revealed several values of young adults that are relevant for organic food purchase.Values that were frequently revealed in relation to organic food purchase were well-being, universalism, hedonism and benevolence.

Values that were explored in relation to non-purchase of organic food were security, hedonism and self-direction. The findings show that egoistic values were more relevant for young adults organic food purchase intention than altruistic values. The findings of this study can be used by producers and marketers by increasingly considering the values in their marketing strategies.

Keywords: laddering, means-end chain, organic food, purchase behaviour, values, young adults

OWC2020-SCI-445

RESULTS OF A EUROPEAN MARKET AND STAKEHOLDER SURVEY ABOUT ORGANIC PROCESSING TECHNOLOGIES

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Abstract: Today there is a lack of mandatory standards and indications for suitable methods regarding the organic food processing within Europe. Hence, the main objective of the EU funded Core Organic - ProOrg project is to develop a set of strategies and tools (Code of Practice) that would serve to food processors in the selection of appropriate technologies. It will give guidance to make a better choice for careful, minimal and mild processing methods.

Before drafting a Code of Practise for processors, a market and stakeholder survey is conducted to reveal opinions regarding the (potential) usage of certain (new) technologies in organic food processing.

For that purpose, an online questionnaire is targeted at experts in organic food processing as well as at other organic stakeholder across Europe. The survey process will run between November 2019 and january 2020. The results will be analysed through descriptive statistic methods and compared between different stakeholder groups. More Information about the project and the market and stakeholder survey can be viewed under https://www.proorgproject.com.

Keywords: new technologies, organic processing, processing technologies, stakeholder survey

OWC2020-SCI-683

CONSUMERS' PERCEPTIONS OF ORGANIC FOOD PROCESSING – FIRST INSIGHTS INTO MILK AND JUICE PROCESSING

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Abstract: The project "ProOrg" aims at developing a code of practice (CoP) for organic processors because they lack a guide for selecting appropriate technologies for organic processing. When developing processing technologies for organic products, consumers' expectations and preferences on quality and transparency should be taken into account.

Thus, this part of the project aims at exploring consumers' knowledge, expectations and opinions of selected processing technologies in organic foods. Consumers knew very little about processing technologies and rather focused on organic production of raw material.

Asking participants for their preferences for specific processing technologies often overstrained their judgement, even though some basic information was provided. We argue that organic food processors have to undertake responsibility by anticipating consumer expectations and by processing in line with overall organic principles.

Keywords: Consumer preferences, Organic foods, processing technologies, ProOrg Code of Practice

OWC2020-SCI-772

STUDY OF THE POTENTIAL OF COMMUNITY-SUPPORTED AGRICULTURE (CSA) FOR THE DYNAMIC ON-FARM MANAGEMENT OF AGROBIODIVERSITY

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Jocelyn Parot URGENCI (international network of Community-Supported Agriculture initiatives fostering peer-based solidarity among CSA actors to actively contribute to the food sovereignty movement worldwide)

Charline Ducottet INRA (National Institute for Agronomic Research in France)

Abstract: As part of the European project H2020 DYNAVERSITY (1) (Dynamic seed networks for managing European Diversity), a study on the potential of Community Supported Agriculture (CSA) for on farm management of cultivated biodiversity was conducted by INRAE and URGENCI.

CSA can be defined as a direct partnership based on the human relationship between people and one or more producers who share risks, responsibilities and benefits of agriculture through a binding long-term agreement.

This study led to the publication of a report about the issue of raising consumer awareness about agrobiodiversity challenges in the context of the CSA partnerships (2), which draws recommendations to foster more involvement from the CSA movement into the issue of on farm management of cultivated biodiversity.

We will be presenting our results, thoughts and recommendations in the framework of the theme 4 "Innovation Organic Farming", in order to promote CSAs as a social innovation for on farm management of cultivated biodiversity.

Keywords: agrobiodiversity, Community Supported Agriculture, DYNAVERSITY

OWC2020-SCI-473

ORGANIC CONSUMERS' ATTITUDES, KNOWLEDGE AND PRACTICES WITH RESPECT TO WILD PLANTFOODS

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Abstract: Wild plant collection is performed on significant 30 % of the world's organically-certified land but it is still hardly addressed in scientific or public discourses on organic food. The aim of this study was to understand organic consumers' attitudes with respect to wild plant foods along with their knowledge, purchasing and gathering practices. The study was conducted on 22 food markets in urban and provincial areas in Austria; 497 organic consumers were interviewed with questionnaires and data were analysed with exploratory factor analysis and multiple linear regression. We found that 1) wild food plants are known and gathered by the majority of organic consumers; 2) organic consumers have positive attitudes with respect to wild food plants, highlighting in particular their good food quality and concern with gathering responsibly; 3) although wild food plants are widely appreciated, known and gathered, they are rarely reported as being purchased by organic consumers.

Keywords: Europe, Foraging, Non-timber forest products, Organic farmers, Perception, Wild plant gathering

Parallel 3: Public policy, strategies and support

OWC2020-SCI-1364

THE INCOMPATIBILITY OF LARGE-SCALE BIOENERGY WITH LARGE-SCALE ORGANIC AGRICULTURE

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Abstract: Large-scale bioenergy (i.e. bioenergy providing significant shares of global energy supply) is promoted as one approach to meet the 1.5-degree climate change mitigation goal. It may not be compatible with large-scale conversion to organic agriculture, though, (i.e. significant shares of global agricultural areas as well as livestock numbers being cropped and produced organically), due to increased competition for land and nutrients.

We employ a mass-flow model to analyse scenarios that combine conversions to large-scale bioenergy and large-scale organic agriculture. This results in situations with very high land use and nutrient deficits, due to the non-recycled nutrient losses when processing biomass to energy.

Complementary strategies on food-systems level, such as a reduction in animal source food consumption or a reduction in food waste and loss reduce but do not resolve these challenges. Thus, large-scale bioenergy seems to be incompatible with large-scale organic agriculture.

Keywords: bioenergy, greenhouse gas emissions, land use, nitrogen surplus

OWC2020-SCI-625

BENEFITS OF THERAPEUTIC HORTICULTURE IN INSTITUTIONALIZED PATIENTS WITH MENTAL HEALTH CONDITIONS WITHIN AN ORGANIC ENVIRONMENT

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Abstract: Therapeutic horticulture (TH) is a non-pharmacological approach to assist other psychiatric treatments and should be carried out according to organic principles for health reasons. The benefits of TH in individuals with mental health conditions can be found in the literature.

However, it is scarce the information to understand if TH activities have advantages when compared to more conventional occupational therapies (OT), and this is the main objective of the present study. It was led in a psychiatric hospital in Portugal with 25 patients attending TH amongst other OT and 15 patients attending only OT.

The instruments used were two questionnaires of sociodemographic and clinical data and patients' preferences, and two evaluation instruments, the 'Subjective Happiness Scale' (SHS) and the short form of the 'Social and Emotional Loneliness Scale for Adults' (SELSA-S).The scores of the SHS and SELSA-S were generally similar for TH and OT groups, except the 'optimism about life' with a lower optimistic perception of life for the TH patients. It was found that the activities of TH were preferred to other OT by 48% of the patients in the TH group.

The changes perceived by some of these TH patients included the perception of feeling more relaxed and happier. In this group, a greater number of days per week with activities provided lower loneliness and a greater happiness perspective compared to peers. For all patients, visits by family or friends also had a positive effect as revealed by the lower level of family emotional loneliness, compared to patients without visits.

The findings and the benefits reported in the literature suggest that TH is an integrative treatment option, which merits further study and can be better tailored to maximize TH effectiveness.

Keywords: Therapeutic horticulture, Mental health conditions, Subjective happiness, Social and emotional loneliness

OWC2020-SCI-744

MASS CATERING AS A DRIVER FOR AUSTRIAN ORGANIC AGRICULTURE

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Abstract: In Austria, around 1.8 million meals are consumed daily in public and private mass catering facilities. The aims of this study was (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.

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.

Keywords: austria, organic agriculture, public procurement

OWC2020-SCI-786

WHAT ARE THE POLICIES NEEDED TO UPSCALE ORGANIC FOOD CHAINS? FINDINGS FROM THE TYFA SCENARIO EXERCISE

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Abstract: Upscaling organic farming (OF) and agroecology (AE) in Europe will have major implications across the whole food-chain. As both the intensity and the geography of food production would undergo significant changes, it will affect the current rationale of the entire food chain, namely collectors, processors, traders, retailers and at the end, consumers.

The challenge is to identify how the business models should evolve at each link of the chain to accompany the large scale transition towards OF/AE, thus delivering the specific food attributes associated with OF/AE.

Based on the Ten Years For Agroecology scenario (TYFA), the paper first identifies the structural changes implied in food chains organization by a full transition to OF/AE across Europe. It then explores the policy changes needed at the EU level in order to accompany such a transition. The range of policies concerned is wide. The proposed analysis may inspire an EU policy agenda towards sustainable agriculture and food.

Keywords: Food system, Political Agroecology, transition to organic

Parallel 3: Market, Consumers & certification II

OWC2020-SCI-1135

PARTICIPATORY GUARANTEE SYSTEMS vs OFFICIAL CERTIFICATION SYSTEM. WHEN PEOPLE WANT TO TAKE PART OF IT...

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Abstract: There are many initiatives of short food supply chains in Spain that have been implementing participatory guarantee systems, with great involvement of producers and, in some cases, consumers.

In this context, aresearch has been developed to systematize the procedures under which 8 Spanish and 1 French PGS have developed, to assess conformity under a participatory approach involving local communities.

Through the review of the documentation provided by the initiatives, we have analyzed the procedures and tools that are shared among the experiences, that allow them to be identified as PGS. We highlight the way these initiatives understand confidence building as a matter of collective implication and involvement at local scale.

To identify the differences between a guarantee system as a participatory and collective, and that impose by the official regulation of the third party certification, we have generated a comparative table to highlight the main differences between both systems.

Keywords: alternative food networks, Certification, guarantee systems, confidence building procedures

OWC2020-SCI-1274

MODELLING THE GREENHOUSE GAS IMPLICATIONS OF CONVERTING FOOD PRODUCTION IN ENGLAND AND WALES TO ORGANIC METHODS

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Abstract: Although organic farming can provide numerous benefits from a sustainability perspective, the greenhouse gas impacts of a widespread conversion are still uncertain. An assessment of a 100% shift to organic management within England and Wales was therefore applied, using linear programming and Life Cycle Assessment. The study built on earlier work by including estimates of the emissions associated with additional land requirements, and the offset that could be achieved through soil carbon sequestration in organic systems.

The results from the modelling revealed major reductions in productivity under an organic scenario, in particular for wheat, barley, oilseed rape, pork, eggs and poultry meat whereas the production of potatoes, oats, minor cereals and ruminant meat increased. Results from the environmental assessment revealed reduced greenhouse gas emissions under organic management, despite increased emissions per tonne for some products such as carrots, potatoes, poultry meat and eggs. When land use change impacts were included, the greenhouse gas savings that could be achieved through the widespread adoption of organic practices were offset, leading to worse performance overall.

Enhanced soil carbon sequestration could offset only a small part of the overseas emissions under the 100% organic scenario.

Keywords: conventional farming, food security, modeling, organic farming, organic livestock

OWC2020-SCI-1321

FARMERS' PERCEPTION OF THE ORGANIC CONTROL AND CERTIFICATION PROCESS IN TYROL, AUSTRIA

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Abstract: The introduction of regulations, controls and certification in organic farming were meant to protect consumers from fraud and producers from unfair competition. The willingness of farmers to participate in the organic scheme is prerequisite and depends on the farmers' attitudes towards the certification process.

This study tries to identify with three focus groups Tyrolean farmers' perception of the organic certification, as well as influential factors, and aims to show strengths and weaknesses of the certification system. The focus groups took place on the 12th, 15th and 16th of April in 2019 in Kematen in the district Innsbruck-Land. Generally, farmers perceive a great diversity of standards and struggle especially with regulations regarding animal husbandry, the procurement of seeds and labelling.

Farmers feel forced by retailers to comply with additional requirements and perceive insufficient support through their control body or organic farming association. Farmers state that inspector's intentions often are decisive for the outcome of the control and prefer inspectors with in-depth knowledge about farming.

Regulations or inspectors get rather rejected, if they don't correspond with farmers' values and beliefs. Therefore, there should be more space for a cultural adaption and an equal level of information among all stakeholders within organic certification.

Keywords: Certification, Control, Inspection, Perception, regulations

OWC2020-SCI-338

PARTICIPATORY GUARANTEE SYSTEMS IN SPAIN: BUILDING A SYSTEM TO ASSESS AND FOSTER AGROECOLOGICAL TRANSITION

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Abstract: There are many initiatives of short food supply chains in Spain that have been implementing participatory guarantee systems, with great involvement of producers and, in some cases, consumers.

In this context, a research has been developed to systematize the criteria that ten Spanish PGS have developed, to assess conformity. Through the review of the documentation provided by the initiatives, we have analyzed the criteria that are shared among the experiences and how they are evaluated.

We highlight the way these initiatives foster the agroecological transition by establishing criteria at different levels of obligation and periods for the different criteria to be adopted.

To identify the differences between the agroecological framework these initiatives entail, and the definition of organic food that the European official regulation imposes, we have generated a comparative table to highlight the main differences between both definitions.

Keywords: Alternative Food Networks, Certification, Participatory Guarantee Systems, Spain

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ASSESSING STAKEHOLDER PARTICIPATION IN PARTICIPATORY GUARANTEE SYSTEMS (PGS)

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Abstract:PGS can serve as important tool for promoting more sustainable food systems. For doing so sustainably, participation is key. This paper analyzes how participation in PGS has been addressed in scientific literature. An analytical framework based on Cohen and Uphoff [1] is used.

Results show that data on participation in PGS is still strongly fragmented in scientific literature. Quantitative empiric evidence is very scarce. The paper argues that more research on participation in PGS is needed for it to be better understood and concludes suggesting a more holistic methodology for further research.

Keywords: organic certification, Participation, Participatory Guarantee Systems, PGS

Parallel 3: Drivers & tools for organic development

OWC2020-SCI-1043

HOW ARE ECOLOGICAL APPROACHES JUSTIFIED IN EU AGRICULTURAL POLICY? A TEXTUAL ANALYSIS OF CAP AND RURAL DEVELOPMENT DISCOURSES ACROSS SIX EU MEMBER STATES

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Abstract: This paper explores what types of policy discourses are used by national policy makers to communicate the rationales of ecological farming practices in policy documents of the Rural Development Programmes (RDP) of the Common Agricultural Policy (CAP).

A hybrid form of discourse analysis and content analysis is used to analyze both CAP and rural development discourses between six EU member states (MS) and across three different CAP periods. Findings indicate that over the whole period 2000-2020 ecological approaches are related with the multifunctionality discourse with two dominant sub-discourses: i) nature conservation in all considered EU MS (except in Sweden); ii) agri-ruralism (including Sweden). The neomercantilist discourse becomes more and more prominent over time, appearing in third position in the two last CAP periods of 2007-2013 and 2014-2020. Agroecology and organic farming are among the most frequently mentioned types of farming system cluster.

Keywords: Common Agricultural Policy, Content analysis, Discourse analysis, Ecological approaches, Rural development

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ORGANIC CONSUMERS' VIEWPOINTS TOWARDS NEW BREEDING TECHNIQUES IN ITALY

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Abstract: Despite the recent decision of the European Court of Justice to consider plant obtained by New Breeding Techniques (NBTs) as GMOs, there is still an intensive debate in Europe on the use of these new techniques in the organic farming. For this reason, understanding organic consumers' viewpoint towards NBTs is essential for the future of the sector.

Following the Q method approach (Brown, 1980), a pilot study was conducted in Italy with 36 organic consumers. The balanced Q-sample, which accounted 48 statements regarding NBTs, was defined according to a 4 x 2 factorial design with six replications. Results demonstrated the presence of two relevant viewpoints towards the adoption of the NBTs in the organic seed and plant breeding sector.

Keywords: consumers, NBT's, organic sector, Q methodology

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THE CONSUMER OR THE CITIZEN: WHO SHOULD PAY FOR THE BENEFITS OF ORGANIC FARMING?

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Abstract: Organic farming delivers a range of benefits for individual consumers and society at large, which is often referred to as the dual role of organic farming.

In recognition of societal benefits - often referred to as public goods - that correspond to policy goals organic farming receives public support in many countries.

The growing interest of consumers in organic products is illustrated by the market. In this paper, we present an economic framework, distinguishing between public and private goods and explore where public support is justified and for what consumers can be expected to pay a premium price.

Keywords: Consumer preferences, economics, Policy, Public good

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FUTURE OPTIONS FOR ORGANIC FARMING POLICY SUPPORT IN EUROPE

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Abstract: Policy support has been very important for the development of organic farming in Europe since the 1990s. Measures include regulations defining organic in the marketplace, support payments for organic conversion and maintenance, and action plans aimed at integrating market and rural development support.

Such support has been justified in terms of the environmental and other societal benefits delivered, as well as the economic benefits of the market for organic food. While the evidence for public benefits from organic farming is clear and increasing, the mechanisms for rewarding these benefits have been focused, as other agri-environment measures, on income foregone and costs incurred. With the introduction of a new CAP, involving Member State Strategic Plans and Ecoschemes, the focus of policy is shifting to results. This paper explores the implications of the for future organic farming support, including how public benefits from complex, multi-functional systems can be identified, quantified and valued at an affordable cost.

Keywords: Agri-environment, Common Agricultural Policy, Eco-schemes, Policy, Public goods

OWC2020-SCI-1306

MEASURING IMPACT OF ORGANIC AGRICULTURE RESEARCH: CANADA'S ORGANIC SCIENCE CLUSTER AS A CASE STUDY

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Abstract: Organic research is tailored to advancing the organic sector, by increasing yield and quality, reducing environmental and health impacts, and improving animal welfare. The practices from organic research can also be applied on non-organic operations. Recently, however, there have been critiques of organic research in particular: that results are not applicable for producers.

Canada's Organic Science Cluster (OSC) has produced a substantial number of results that are intended to be of use to Canadian producers.

A total of 386 new knowledge items were reported from 2009 to March 2019 in OSC. Going forward, assessment of impact of these results will be undertaken. Organic research can also have other types of impact. We present results about the number of highly qualified people (HQP) trained over the past ten years in OSC, as another measure of the impact of organic research.

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ORGANIC SYSTEMS PLANS AND FARMER OBSERVATION OF BIODIVERSITY ON US ORGANIC FARMS

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Abstract: The key element linking the organic regulation with farm practices is the Organic Systems Plan (OSP), which each farmer develops with guidance from their accredited certifier as part of the certification process. The OSP specifies farming practices, production inputs, monitoring practices, recordkeeping system, and plan for preventing contamination and commingling with conventional crops or prohibited substances.

Yet, in the US, conservation and monitoring of biodiversity on organic farms has been poorly enforced, leading to the suggestion of explicitly addressing biodiversity through the Organic System Plan. We use primary data to examine the efficacy of this approach. Preliminary results find that farmers are more likely to observe changes in soil and pollinator, but not wild animal, biodiversity on their farm if the Organic Systems Plan template used included explicit language about biodiversity.

Keywords: biodiversity, organic systems plans, farmer observation

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DRIVERS OF ORGANIC AGRICULTURE'S INSTITUTIONALIZATION. A COMPARISON BETWEEN UGANDA AND BENIN.

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Abstract: Since its first appearance in the late 1980s, organic agriculture on the African continent has become a dynamic sector. How did organic agriculture developed? Literature about organic institutionalization in Africa often emphases the important role played by development aid actors. In this paper, we compare Benin and Uganda and we use a conceptual framework inspired by the French school of public policy theory to explain organic agriculture pathways. We argue that a variety of drivers explain those trajectories.

Three main explaining dimensions are studied: configuration of the national agricultural sector, aid development programs, and social movement mobilization. In Benin, the socialist regime that ensured widespread use of pesticides across the agriculture sector, scattered organic initiatives, compounded by the low level of development aid all contributed to a lesser institutionalization of organic agriculture than that seen in Uganda.

Parallel 3: Innovative designs for transitions and research

OWC2020-SCI-1040

OPPORTUNITIES AND BARRIERS TO THE DEVELOPMENT OF ORGANIC AQUACULTURE

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Abstract: This study considers the context of organic aquaculture worldwide from an economic perspective. We present an analysis of the current situation of aquaculture production and the main results from a systematic review of the literature concerning economic issues in organic aquaculture.

Results show that profitability in organic aquaculture is not assured for all aquaculture species, and the feed and fixed costs should be balanced by adequate price premiums. Socio-economic aspects of organic aquaculture are mostly relevant in developing countries. Even if consumers show a positive attitude towards organic seafood, consumers knowledge of organic aquaculture standards is still limited.

Dedicated research, competitiveness of organic fish farming and marketing activities (in order to develop consumer knowledge) need to be improved to ensure the future development of organic aquaculture, and efforts should be made to simplify the regulatory framework.

Keywords: consumer attitude, economic performance, organic aquaculture, systematic review

OWC2020-SCI-1264

ICT4AGROECOLOGY - A FARMER PARTICIPATORY RESEARCH PROJECT IN TANZANIA

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Abstract: The role of technologies to support a transition to agroecological production systems is becoming increasingly important(e.g. digital or biotechnological technologies).

Technologies are oftenassigned the role of a key driver of change wherethe proposed, mostly proprietary technologies shape the change process and require adaptation of the farmer and theproduction system to the technology in order to allow the technology to realize its maximum potential.

We place the focuson the farmer and the agroecological production systems and retool digital technologies tosupport the farmers inrealizing the maximum potential of their agroecological production systems.

Here, we present the current outcomes of theResearch and Advocacy on Agroecology program, coordinated by Swissaid Tanzania, and implemented by national andinternational partners, including Sustainable Agriculture Tanzania (SAT), Sokoine University of Agriculture (SUA) and theSwiss Federal Institute of Technology (ETH).

Keywords: agroecology, ICT support tools, maize

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LOCAL ISSUES AND MARKET AS DRIVERS FOR INNOVATION IN ORGANIC FARMING

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Abstract: This paper analyses innovation processes in the French organic sector. On the basis of an inventory of multi-stakeholders innovative groups at national level and detailed case studies, we identify and characterise different types of innovation dynamics. While most groups implement simple innovations, a few carry out more complex and multiple innovations. Some are coupled innovations, to achieve consistency between local environmental stakes, farming systems and practices, agricultural products and market opportunities. They involved various actors working collectively. Others innovations are the outcome of a co-evolution process, taking place at production and processing levels rather independently.

Keywords: coupled innovations, environment, globalisation of market, local initiatives

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RUMMAGING AT THE BOTTOM OF THE BOX: REVISITING THE USE OF REEDS ON ORGANIC FARMS IN THE ATLANTIC MARSHES

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Abstract: This study focuses on a practice and know-how that was once commonly used in marshes of Charente-Maritime, namely the use of the common reed (*Phragmites australis*) a tall grass that naturally grows in wetlands.

Livestock farms formerly used it as bedding for cows and as fodder in the summer. A comparative test of straw and of reed bedding was carried out at the experimental farm of INRAE (French National Research Institute for Agriculture, Food and Environment) of Saint Laurent de la Prée, in an organic farming context.

We demonstrate that reeds make good bedding material for cows at a lower cost than purchasing straw. Moreover, a test of summer grazing on a reed bed by a herd of cows demonstrates the appeal of this type of fodder and its beneficial nutritional qualities compared to natural prairie hay.

This study shows the advantages of this natural resource for the successful operation of marsh livestock agriculture, provided that the reeds are cultivated sustainably.

Keywords: experimental farm, litter, marshes, mixed crop-livestock farming, reed beds

OWC2020-SCI-527

A SYNTHESIS OF THE 2ND, 3RD, 4TH AND 5TH ISOFAR SCIENTIFIC CONFERENCES: POINTERS TO FUTURE FRONTIERS OF KNOWLEDGE

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Abstract: Globally, basic and applied organic agriculture research projects are not adequately funded thereby hindering the development of innovations that can properly tackle multifarious challenges in the food and agriculture sector. A review of 1,118 scientific papers presented at the last four editions (2nd, 3rd, 4th and 5th) of ISOFAR Scientific Conferences held in 2008, 2011, 2014 and 2017, respectively revealed that 45.8 – 66.6% of papers presented were on agronomy (crop and soil) followed by socio-economics. Very few scientific papers (0.0-4.0%) were based on organic aquaculture, policy issues, health and safety of organic products, and standards and certification. It is recommended that in the nearest future, inter- and transdisciplinary research projects be commissioned to explore the potential of these identified neglected research areas in solving global challenges in the food and agriculture sector.

Keywords: conference, ISOFAR, organic, research areas, science track

Parallel 4: Autonomy and resilience of organic production systems

OWC2020-SCI-1111

USING LIFE CYCLE ASSESSMENT TO ASSESS AND IMPROVE THE ENVIRONMENTAL PERFORMANCE OF ORGANIC PRODUCTION SYSTEMS

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Abstract: Life cycle assessment (LCA) is an international method that allows an estimation of a set of environmental impacts of products. A growing number of studies have used LCA to assess environmental impacts of agricultural products, but available LCA data mainly concern conventional agriculture. The ACV-Bio project has created LCA data for arable crops, grassland, forages, grapes, cattle, sheep, pigs and poultry in France.

For most products, contrasting production systems were assessed to explore a diversity of organic systems. The web-based MEANS-InOut software was used to facilitate and streamline the generation of LCA data, and their external review by independent experts. Impact values were calculated for nine indicators.

The InOut software was enhanced to allow assessment of intercrops and cropping systems, which are important elements of organic systems and of agro-ecological systems in general. Eco-design scenarios of pig and grape production systems allowed impact reductions of 0 - 22%, depending on the impact considered.

Keywords: Eco-design, environmental impacts, Life Cycle Assessment, Life cycle inventory, organic farming

OWC2020-SCI-1195

FAO'S TOOL FOR AGROECOLOGY PERFORMANCE EVALUATION (TAPE): A MULTI-DIMENSIONAL ASSESSMENT TOOL FOR THE PERFORMANCE OF AGROECOLOGY FOR BETTER DECISION MAKING IN THE TRANSITION TO SUSTAINABLE FOOD SYSTEMS

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Abstract: Agroecology is fast gaining interest worldwide among a wide range of actors as a holistic response to the multiple and interrelated challenges facing food systems – not least of which include continued poverty and hunger in the context of degrading natural resources and climate change. While there is increasing evidence on the positive impacts of agroecology, results remain fragmented because of heterogeneous methods and data as well as differing scales, locations and timeframes.

In 2018, FAO was requested by its governing bodies to develop metrics, tools and protocols to evaluate the contribution of agroecology to the transformation of sustainable agriculture and food systems. To respond to this request, FAO, with the help of multiple partners, has developed a global analytical framework for the multidimensional assessment of the performance of agroecology: the Tool for Agroecology Performance Evaluation (TAPE) (FAO 2019), which aims to:

- Inform policy makers, development institutions, and other stakeholders by creating references to the multidimensional performance of agroecology and its potential to contribute to multiple SDGs;

- Build knowledge and empower producers through the collective process of producing and sharing data and evidence based on their own practices;

- Support agroecological transition processes

This session will explore the TAPE tool and its utilization with an aim to link the assessment of agroecology to better decision making in order to foster the transition to sustainable food systems.

Keywords: agroecology, assessment, multi-stakeholder approach, sustainable agriculture, Toolkits

OWC2020-SCI-1230

DIVERSITY AS A KEY TO ANALYZE FRENCH ORGANIC FARMS: METHODOLOGICAL ELEMENTS

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Abstract: Many typologies of organic farms exist but they fail to take into account diversity, *i.e.* the combination of productions, which is a core principle in agroecology.

Our aims were multifold: i) increase the knowledge of the organic farms (OF) ii) better characterize organic systems in terms of diversity, iii) analyze the territorial distribution of diversity types, and iv) compare diversity between conventional farms (CF) and OF.

The French Observatory of Organic Agriculture (ONAB) database from Agence Bio was used. It collects data from all French organic farms and provides detail on surfaces and livestock (about 200 species).

We explored complementary methods to build a classification able to reflect the type and level of diversity within the farms' systems, and to take into account their localization. Nevertheless it was challenging and further work is needed to improve methods to better characterize organic systems with this focus on diversity.

Keywords: diversified production, diversity, ecological farming, Farm characterization, typology

OWC2020-SCI-591

TENSIONS BETWEEN LOCAL AND ORGANIC FOODS AND HOW TO OVERCOME THEM

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Abstract: Originally organic production was closely related to locally oriented food systems. However, after its institutionalisation and growth since the 1990's, the organic sector has evolved in different directions. The main part of organic foods consumed in Europe today is processed and retailed through mainstream, industrialised and largely conventional supply chains. In this process, the local links have been lost and, in the Swedish context, organic is sometimes seen in opposition to local food systems. This paper discusses four tensions between local and organic food systems: 1) the fact that there is no unifying definition of local food systems, 2) the mixing up of modes of production and place of production, 3) the many aspects of sustainability making priorities difficult, and 4) local nutrient flows between society and agriculture. We conclude that while some of these tensions are real, some of them can be overcome only by bringing more clarity into the discussion.

Keywords: local foods, sustainable development, Sweden

OWC2020-SCI-649

ORGANIC FARMING AND BIODIVERSITY: STATUS QUO AND ACCEPTANCE FOR IMPROVING OPTIONS

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Abstract: Intensive discussions are ongoing with regard to the negative impacts of intensive farming practices on wild flora and fauna and their habitats. Our systematic literature review compiled from 75 sources from 1990 to 2017 showed that organic farming has clear positive effects on the species richness and abundance of selected flora and fauna groups.

The results underline the high potential of organic farming for the preservation and promotion of biodiversity in agricultural landscapes. At the same time, however, there is a need to develop and improve organic management systems to better meet biodiversity goals for certain species.

A survey of organic farmers in north-eastern Germany showed that besides the costs, other factors, such as overcoming bureaucratic constraints, are very important for the acceptance of conservation measures.

Keywords: abundance, management systems, species richness, survey of farmers

OWC2020-SCI-928

WHAT IS THE CONTRIBUTION OF ORGANIC AGRICULTURE TO SUSTAINABLE DEVELOPMENT? RESULTS OF 10 YEARS FARMING SYSTEMS COMPARISON IN THE TROPICS (SYSCOM)

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Abstract: Tropic will be the epicentre for food production as population will sore from 7 billion to 10 billion by the end of century. It is imperative to explore the potential of different food production system in tropics. In 2006-07 FiBL started the 'Long-term Farming Systems Comparison in the Tropics (SysCom) Program' in collaboration with local partners in three tropical countries to produce scientifically sound data on the agronomic, ecological and socio-economic performance of organic and conventional production systems over a long-term.

The program comprises of a network of four long-term experiments (LTEs) in Kenya, India and Bolivia, in concert with participatory on-farm research (POR) aimed at developing locally adapted sustainable technologies.

Our research in the tropics shows that organic agriculture and agroforestry systems have large potential to contribute to sustainable development especially in the field of soil fertility and biodiversity conservation while productivity and profitability are usually equal.

Yet, for full exploitation of the benefits of organic agriculture major efforts are needed to tackle agronomic/ technological challenges (lack of input, pest management), capacity development for farmers (technical know how) and institutional/governance challenges (markets, agri-business).

Keywords: agroforestry systems, long term experiment, profitability and productivity, sustainable development, systems research, tropical agriculture

OWC2020-SCI-197

UNDERSTANDING THE AGROECOLOGICAL PERFORMANCE OF SMALLHOLDER HOUSEHOLDS IN THE PERUVIAN ANDES

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Abstract: An interdisciplinary consortium of academic and development aid organizations was established to study the performance of agroecological smallholder households in the Northern and Southern Andes of Peru, between 2,000 and 3,700 meters above sea level.

In order to collect information about environmental, economic and social dimensions, a household survey was conducted on a total of 305 households, including agroecological as well as conventional households.

According to farmers' perceptions and based on several indicators, an improved performance could be stated in agroecological households. However, statistical strength of the aforesaid indicators is limited due to a non-probabilistic sampling method.

The present study questions the belief that organic agriculture represents an intermediate state in the transition process from conventional agriculture to agroecology and show that the opposite might also be true.

Keywords: Agroecology, Andean agriculture, Household survey, Multi-criteria evaluation

Parallel 4: Systems health, biodiversity & autonomy

OWC2020-SCI-1092

INSPIRING FARMERS FOR HEALTHY FARMING

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Abstract: The health and nutritional value of agricultural food products is strongly linked to, and inherently dependent on the production process and farm system. However, there are currently only limited options for transferring and measuring farm-health principles at farm level (Vieweger and Döring, 2015).

In our previous work we have shown how organic farmers have developed their own strategies and philosophies for running healthy farming systems and increase the health of soils, plants, animals and humans. Such tacit farmer knowledge and awareness of a holistic systems-approach to health in food production can contribute crucial information and practical understanding for food system sustainability.

The current project builds on these earlier findings, using participatory multi-actor approaches to collaborate with the established international network.

The farmer groups in Germany, Austria and the UK aimed to 1) conceptualize health criteria on farms, such as 'Is a nutrient or humus balance calculated?', 'How much time is spent for observation and reflection?', 'Are regionally adapted breeds and varieties used?'; and 2) develop a concept for farmer-to-farmer learning, defining most appropriate conditions and methodologies for the multiplication of this knowledge. With a co-learning approach, we aim to allow a flexible integration of farmer knowledge and experience, thereby inspiring farmers to reflect on the potential ways they can improve health in their system, and further develop their individual methods over time; this approach also aims to help research identify general drivers of farm health.

Keywords: farm health, farmer-to-farmer learning, intuition, principles of health, soft skills

OWC2020-SCI-1317

DOES ORGANIC MANAGEMENT LEAD TO HIGHER LANDSCAPE HETEROGENEITY IN LARGE SCALE FIELD CROP PRODUCTION?

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Abstract: Organic agriculture is expected to maintain or enhance biodiversity in the landscape. Over the past few decades, studies have confirmed that organic management can provide a higher level of biodiversity than conventional management.

Landscape heterogeneity, i.e. the diversity of features on a landscape, is positively associated with biodiversity. Large scale field crop production increasingly utilizes large equipment to capture efficiencies of scale.

Farmers are known to remove landscape features such as wetlands, woodland patches, and fence lines that interfere with field operations. Here we hypothesize that land under organic field crop management has higher landscape heterogeneity than that under conventional management. To study this, we will identify 120 paired, organic and conventional fields in Saskatchewan, Canada, where landscape heterogeneity will be assessed.

For each field, a manual digitization of major landscape structures is carried out and landscape ecological metrics are applied to characterized landscape heterogeneity. Results will help us identify the relationship between landscape heterogeneity and farming systems and specific landscape structures that contribute to the greatest differences between the management systems.

These results will help farmers and policymakers better understand the importance of landscape heterogeneity on agricultural systems.

Keywords: biodiversity, landscape heterogeneity, organic agriculture

OWC2020-SCI-363

AGROFORESTRY MARKET GARDENING: A STRATEGIC CHOICE TO IMPROVE SUSTAINABILITY IN AGROECOLOGICAL TRANSITION?

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Abstract: Agroforestry mixing fruit trees and organic diversified vegetable is currently experiencing strong growth in France. The SMART project aimed to (i) explore the sustainability of these systems, (ii) assess the effects of synergies and competitions generated by agroforestry, as perceived by the farmers.

Surveys and observations carried out among farmers showed that these systems were implemented by farms involved in short food supply chains. Diversification of products was therefore a central justification for the intercropping of fruit trees and shrubs with vegetables.

The majority of farmers considered that intercropping fruit trees and vegetables did not create a problem for workload organisation or competition. Their certainty in this respect was rather limited, given the generally short duration of their experience.

A global assessment of their satisfaction integrating technical, agronomic, environmental or socio-economical dimensions (see results) led most of them to consider that the choice of agroforestry was fully justified and could be recommended to other market gardeners.

These results showed the need, when evaluating such systems, to adopt dynamic and holistic viewpoint on the different performance levels, allowing to consider the evolution of the trade-offs between pros/cons of such systems on the long-term basis.

Keywords: agroecology, agroforestry, market gardening, performance, resilience

OWC2020-SCI-389

DOES ORGANIC MANAGEMENT HELP PRESERVE LOCAL FUNCTIONAL DIVERSITY? A CASE STUDY IN THE PAMPA OF SOUTH AMERICA

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Abstract: Organic agriculture is a production management system that promotes and improves the health of agroecosystems. We studied the association between changes in taxonomic diversity and changes in ecosystem functions in highly modified landscapes.

We sampled birds across the land use intensification gradient from relict and organically farmed land to conventionally farmed land in the Pampa ecoregion of Argentina. Using bird traits as indicators of species' response to environmental change or the effect of ecosystem functions, we calculate functional diversity (FD) metrics.

We show a consistent change in the taxonomic and functional diversity from undisturbed habitats to agroecosystems with organic and conventional production systems. Organic farm management retains a significant amount –but not all - of birds' functional diversity. Organic management linked with the maintenance of natural habitats could be a key to conserving ecosystem functioning.

Keywords: Birds, Dos Hermanas, Functional diversity, Organic management, South America

OWC2020-SCI-846

CO-DESIGN OF AGROECOLOGICAL TEMPERATE FRUIT TREE SYSTEMS: APPROACH, TRADEOFFS AND OUTPUTS

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Abstract: Crop diversification and ecological intensificationare a way to foster ecosystem services and produce in very low input systems.

We analyzed the design process of three experimental sites that shared the same objective of ecological intensification and diversification in fruit tree production. Agronomic, ecological and organizational aspects were involved in the approach.

Pest suppressive plant diversification, resource sharing among cultivated and associated plants, and feasibility were key elements. Identifying the expected functions of each plant species or assemblage (e.g. barrier, trap, production) was also crucial.

Co-design brought experiences and expertises and was a powerful way to obtain trade-offs between targeted services in the design of innovative fruit production systems being now experimented. Further research and evaluation of the experimented prototypes are still required but the present analysis opens avenues for agroecological design in perennial crops.

Keywords: agroecology, co-design, ecosystem service, fruit, orchard

OWC2020-SCI-851

SHEEP GRAZING ORGANIC VINEYARDS AND ORCHARDS: WHAT ABOUT COPPER POISONING?

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ABSTRACT: Sheep have long been allowed to graze in orchards and vineyards during winter, generating benefits for both breeders and wine or fruit growers. This practice, which had become scarce because of agricultural specialization, is recently regaining popularity.

However, concerns have raised about the potential risk of Chronic Copper Poisoning (CCP) of sheep – particularly in the context of organic agriculture, which widely uses Cu as a fungicide. CCP is driven by the long-term, symptomless Cu accumulation in the liver, potentially leading to a hemolytic crisis that generally triggers animal death within 48h.

Our study aimed at evaluating both the quantity and dynamics of Cu in the cover vegetation of vineyards and orchards, and the potential harmful effects of Cu on the health of sheep that graze therein. Our results show that i/ Cu content and assimilability is high in the studied plots, and may lead to CCP; ii/ surprisingly, sheep show only slight signs of ongoing CCP.

Keywords: None Declared

OWC2020-SCI-946

FARMERS APPRECIATION AND MANAGEMENT OF FUNCTIONAL FUNCTIONAL BIODIVERSITY IN ORGANIC APPLE ORCHARDS

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Abstract: The benefits of functional biodiversity (FB) for pest control are under debate among practitioners. Little is known about farmers' practices and motivations to foster FB.

We assume that the use of monitoring methods would help the farmers to better appreciate the benefits of FB and thus implement favourable practices.

Therefore, we undertook a comprehensive strategy consisting of semi-directive interviews and participatory workshops to describe farmers' practices and perception, and design monitoring methods adapted to their needs. Our findings provide empirical evidence that FB is associated with multiple services and dis-services.Additionally, the farmers' experience and time are two important conditions for farmers' involvement for FB.

Four main attitudes towards the management of FB were characterized: wait-and-see, naturalist, regulation, and multifunctional. These attitudes provide a useful framework to design support tools and research programs in line with farmers' needs

Keywords: Agroecological transition, Ecosystem services, Farmers' knowledge, Participatory research, System redesign

Parallel 4: Plant Health management I

OWC2020-SCI-1151

LOW INCIDENCE OF FUSARIUM GRAMINEARUM IN ORGANIC FARMING ON BREAD WHEAT GRAINS OVER A 13-YEAR PERIOD

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Abstract: Organic farming has been questioned about its ability to manage *Fusarium* infestation compared with conventional farming. In this study, we monitored, over a 13-year period in several sites in France, the fungal incidence of four genera of fungi on bread wheat grains from organic farming. We collected samples immediately after harvest in conditions of natural contamination on a list of winter wheat varieties from 2006 to 2018 in several sites in France.

From each sample, 100 kernels were surface disinfected, plated on potato dextrose agar, and colonies were identified at the genus level, and at the species level for *Fusarium graminearum*. The fungal incidence observed on kernels over the period was on average 88 ± 16% (i.e. mean ± standard-deviation).

Kernels were mainly infected by fungal species of the genus *Alternaria* (71 ± 25%), while the incidence of *Fusarium graminearum* is usually very low in our context (1 ± 2%), with the exception of year 2008 (49 ± 12% and 17 ± 9%, respectively in the two sites studied), which is confirmed by the highly significant effect of the year and the 'year × site' interaction. To conclude, in our study, *Fusarium graminearum* appeared not to be a major concern for wheat production in organic farming systems.

Keywords: bread wheat, France, fungal incidence, *Fusarium graminearum*, long term experiment, organic farming

OWC2020-SCI-1160

WHITE LUPIN (LUPINUS ALBUS) ANTHRACNOSE RESISTANCE PRE-BREEDING PROJECT IN SWITZERLAND

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Abstract: White lupin (*Lupinus albus*) could contribute to the recent increase of organic grain legume production in Switzerland. However, its production is impaired by anthracnose (*Colletotrichum lupini*), against which FiBL is running a resistance pre-breeding project.

In 2019, 196 new genetic resources and 60 F4 breeding lines were compared on-farm to the progeny of 288 accessions selected from 2015 to 2018. Relative disease scores compared to reference cultivar Amiga (mean score 6.9 on a scale from 1 (no symptoms) to 9 (plants completely dead) were calculated and ranged from -2.25 to +2.

Mean relative scores of selected genotypes and breeding lines were -0.7 and -0.5, respectively, compared to -0.33 in the new accessions.

The frequency of more resistant genotypes was about twice as high in the selected accessions and breeding lines than in the new accessions. These are valuable data for breeding as well as for development and validation of genetic markers for resistance screening.

Keywords: anthracnose, Colletotrichum, genetic resources, on-farm, resistance breeding, white lupin

OWC2020-SCI-1459

COMPARATIVE STUDIES ON THE EFFICACY OF SELECTED BOTANICALS AGAINST DIAMONDBACK MOTH (DBM) *PLUTELLA XYLOSTELLA* L. ON KALE

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Abstract: Kale (*Brassicaoleracea*) is widely grown and consumed in Kenya. However, productivity is hampered by diamondback moth (DBM), *Plutella xylostella*. Farmers largely depend on synthetic pesticides to control DBM despite undesirable effects on the environment and human.

This study assessed the efficacy of PEN, a combination of five different botanicals namely *Tagetes minuta,Lantana camara, Capsicum annum,Allium sativum* and *Azadirachta indica*-neem cake powderon mortality of DBM larvae as alternative to synthetic pesticides. Complete Randomized Block design was used in screen house experiments.

The median lethal time (LT_{50}) and lethal concentration (LC_{50}) after exposure of DBM larvae to various formulationsvaried between 2.1-5.3 days and 97.6-117g/ml respectively.

There was significant variation on DBM larvae mortality across the different treatments with the highest percentage mortality recorded at 71.5% obtained at 150% (0.98g/ml) while the lowest was 9.8% obtained at 50% (0.32g/ml).

These findings revealed potential of botanicals as an effective tool to manage DBM.

Keywords: Kale, mortality, neem cake powder, synthetic pesticides

OWC2020-SCI-929

BIOPESTICIDE COMPOST FROM FOOD WASTE AND CHINESE MEDICINAL HERBAL RESIDUES

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Abstract: Pest issue remains as one of the major factors reducing crop yields of local organic farmers in Hong Kong, especially due to increase in soil temperature caused by climate change in recent years.

An innovative composting approach has been proposed by co-composting food waste (FW) with Chinese medicinal herbal residues (CMHR) to produce low cost compost with bio-pesticide properties derived from CMHR.

Their antipathogenic effect against the pure culture of two phytopathogens, *Alternaria solani* and *Fusarium oxysporum* were ~54% and ~38% higher than that of food waste compost, respectively. Mature compost at 0, 2.5, 5 and 10% was respectively applied to soil inoculated with either *A. solani* or *F. oxysporum*. The results showed that 5% (dry weight basis, w/w) FW-CMHR compost was the optimum application rate, and was about 1.2 times and 2 times that of the yield of Chinese cabbage and cherry tomator growing in control soil without inoculum.

Keywords: food waste, biopesticide, Chinese medicinal herbalresidues, composting, crop growth

Parallel 4: Plant and soil health: systems approaches

OWC2020-SCI-1316

HOLISTIC APPROACH TO CONTROL SOIL-BORNE PESTS IN ORGANIC ORCHARDS: THE CASE OF MAY BEETLE

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Abstract: The lack of plant protection products to control soil-borne pests in organic farming has resulted in Poland and several other EU countries in increasing damages by grubs of the European cockchafer (*Melolontha* sp.) to fruit orchards and plantations.

We have developed a holistic strategy including various control methods and agronomical practices to control *Melolontha* spp. in organic strawberry plantations which can be potentially applied also to other fruit crops.

The strategy includes measures that are targeting all the life stages of the pest' biological cycle. The results indicated that the such holistic strategy allows reducing the number of active grubs and the damage to plants.

Keywords: Biocontrol, European cockchafer, mechanical methods, phytosanitary practices

OWC2020-SCI-665

PLANT AND SEED HEALTH IN ORGANIC SYSTEMS: EMBEDDED IN OR DISCONNECTED FROM INTERACTIONS WITH MICROBIAL COMMUNITIES?

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Abstract: A wide range of different, sometimes mutually exclusive, approaches to plant health are practiced within organic farming and seed systems. Plant health management may seek to completely exclude plant pathogens from growing environments and seed systems in a mechanistic, reductionist perspective.

On the other hand, it may also aim at resilient cropping systems, involving plant defense mechanisms and complex microbial communities in a more holistic approach. How organic communities define and manage plant health will have implications on the design of organic seed systems and farm agrecosystems, as well as on future research agendas.

Debates on approaches to plant health have been sparked within community seed networks in France and Belgium. Based on practical experiences and on a review of interdisciplinary literature ranging from crop ecology to microbiology to the social sciences, the options available to organic agriculture in terms of plant and seed health are elucidated.

Keywords: health management approaches, microbial communities, plant and seed health

OWC2020-SCI-1360

ANALYSES OF THE RHIZOSPHERE MICROBIOTA IN THREE DIFFERENT CROP SYSTEMS (CONVENTIONAL, ORGANIC AND SYNTROPIC AGRICULTURE), USING A PORTUGUESE MAIZE POPULATION AND CCP ('PIGARRO' AND 'SINPRE').

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Abstract: Maize is one of the most important crops in the world for feed and food, which makes its contribution to organic farming crucial. The adaptation to organic agriculture can depend on the interaction between the microbiota present in the rhizosphere, allowing a more efficient extraction of nutrients from the soil for growth and development.

The aim of our study was to understand how different production systems (conventional, organic) and different open-pollinated maize populations ('SinPre' and 'Pigarro') can influence the rhizosphere microbiota.

The data collected from the maize trial comprehends phenological data plus the structural diversity of the bacterial and fungal communities from the maize rhizosphere.

Three replicates of three plants by two maize populations were collected for each cultivation system, at a depth of approximately 15 cm, forming a total of 15 composite samples. The bacterial microbiota was determined from DNA extracted from maize rhizosphere samples based on the V3-V4 region of the bacterial 16S rRNA and from ITS2 region of the fungal ITS gene using Illumina's MiSeq sequencing.From our results, we can conclude that the farming system has an impact on fungal diversity since a higher diversity was found in organic farming systems when compared with the conventional.

In addition, the fungal microbiota was more diverse in 'Pigarro' rhizosphere in comparison with 'SinPre'.Comparing the diversity between 'Pigarro and 'SinPre' bacterial populations, the first presented always the highest number of genera despite the farming system. Contrarily to what we observed for the fungal diversity, the number of shared bacteria was similar in both farming systems.

The main conclusion was that the farming systems have significant impact in maize rhizosphere microbiota. In addition, the maize rhizosphere microbiota is population specific.

Keywords: Conventional farming, Organic Farming, Maize, Microbiota; Fungi; Bacteria

OWC2020-SCI-1465

"MICROBIAL TERROIR OF A BIODYNAMIC VINEYARD": THE ENVIRONMENTAL DRIVERS OF DIVERSITY AND ASSEMBLAGES OF MICROORGANISMS AT LOCAL SCALE

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Abstract: Many studies have highlighted the crucial roles of microorganisms in crop performances and adaptation against stresses. An opportunity to bring biodynamic knowledge and practices closer to the holobiont approach, an expanding scientific field in ecosystems, have been initiated at Château Palmer by a definition of the *terroir* based on microbial biogeography.

We addressed the hypothesis of existing non random patterns in microbial biogeography and determined the key drivers of bacteria and fungi assembly. We based our analyses on 40 parcels selected in the vineyard of Château Palmer (Margaux, France), that has been working under the principle of biodynamics since 2014 on the entire vineyard.

We used high-throughput amplicon sequencing to characterize their endospheric bacteria and fungi microbiota. We have then tested the effect of soil characteristics, grape varieties and age, and vine cultural practices on OTUs composition, richness, and diversity of these microbial assemblages.

Keywords: amplicon sequencing, endospheric microbiote, microbial biogeography, microbial terroir, Vineyard

OWC2020-SCI-777

YIELD, PROFITABILITY AND SOIL HEALTH AS INFLUENCED BY LONG-TERM APPLICATION OF BIOMANURES, BIOFERTILIZERS AND CROP RESIDUES IN ORGANIC RICE-BASED CROPPING SYSTEMS

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Abstract: For wider adoption of organic systems in India, the crop production technologies need to be evolved for varied soils and cropping systems. Among other field limitations, inefficient nutrient management results in low yields under organic systems.

A 10 years' field experiment evaluated the effect of two rice-based cropping systems and seven nutrient management practices on yield, economics and soil health under organic management. Rice-wheat-mungbean system recorded significantly higher profits, and 13% and 6% higher grain yields of rice and wheat crops, respectively, over rice-wheat system.

Levels of organic carbon, total N, available nitrogen, phosphorus, potassium and micronutrients increased significantly and substantially due to inclusion of mungbean in rice-wheat cropping system. Application of FYM + crop residue + biofertilizers was most profitable practice in rice-based cropping systems.

Keywords: Biofertilizers, mungbean, nutrient management, organic farming, rice, wheat

Parallel 4: Plant health management II

OWC2020-SCI-1104

CONTROLLING SOIL-BORNE DISEASES BY COMPOSTS

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Abstract: Controlling soil-borne diseases is crucial for farmers because these pathogens can persist in the soils for a long time due to their form of resistanceand are able to stay on the crop residues.

To fight against the presence of these pathogens, research in organic agriculture (OA) has shown the interest of certain intercultural plants but it's a restrictive field technique. We tested a method easily usable in fields: mechanical amendment by compost.

This method has positive effects on agronomic characteristics of soils, and microorganisms growing in composts can directly influence soil microbial communities [1-3].

We performed a screening of 18 various composts, with a focus on manufacturing process, agronomic values and suppressive effect against three pathogenic fungi regularly encountered in vegetable crops: *Pythium ultimum*, *Rhizoctonia solani*, *Fusarium oxysporum*. The purpose of this study was to characterize composts for use in agriculture to control these soil-borne diseases in vegetable crops.

Keywords: Compost, Disease, Plant health, Soil health

OWC2020-SCI-1149

TESTING MICROBIAL INOCULANTS AND PRECROP EFFECT ON ORGANIC POTATO IN HUNGARY

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Abstract: In frame of the SolACE Horizon 2020 research project the effects of different pre-crop and inoculation treatments on organic potato varieties under combined stress conditions were examined. In the rotational trial rye and soy pre-crop treatments were applied, and four potato varieties were examined under optimal vs. no irrigation and nitrogen treatments, and their combinations.

In the inoculation trial another four varieties with three microbial inoculant treatments, under optimal vs. no irrigation and phosphorous supply, along with the combinations of these treatments were tested.

The first year's results showed no major effects of pre-cropping and microbial inoculants on potato performance under combined stress. Thus, further investigations are required to strengthen our understanding of these agrotechnical innovations.

Keywords: microbial communities, potato, precrop effect, SolACE

OWC2020-SCI-1175

CURRENT USE OF COPPER AND MINERAL OILS INPUTS IN ORGANIC PRODUCTION ACROSS 10 COUNTRIES IN EUROPE

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Abstract: The use of contentious inputs in organic growing was mapped across Europe in the H2020 project Organic- PLUS (GA774340) during 2018. This paper presents results on the use of copper and mineral oils linked to plant protection in several horticultural crops grown across 10 countries in Europe. Among the investigated crops (mainly citrus, olive, tomato, potato, strawberry), large amounts of copper are used mainly by Mediterranean growers in citrus, olive and potato.

For crops like citrus and olives the limit of 6 kg per ha and per year may not be always respected. Tomato producers apply high amounts of copper in winter crops (greenhouses). The project aims to develop alternatives to these contentious inputs, which will be presented.

Keywords: citrus, contentious inputs, greenhouse, olive, tomato

OWC2020-SCI-1413

IMPACT OF A MYCORRHIZAL INOCULUM ON TOMATO AND PEPPER ORGANIC PRODUCTION: A TRANSDISCIPLINARY APPROACH IN NORTHERN ITALIAN CONTEXT

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Abstract: The paper explores the impact of a mycorrhizal with microbial consortium inoculum on a tomato and bell pepper production, considering agronomic and qualitative parameters and sensory performance. The research was conducted in summer 2019 at the garden of the University of Gastronomic Sciences (Italy), which uses organic practicties.

Two varieties of tomatoes ("Costoluto" and "Cuore di Bue") and one variety of bell pepper ("Quadrato di Carmagnola") were cultivated in the greenhouse, comparing mycorrhizae (M) versus control (C) samples. Analyses included: quantitative analysis on fruits, qualitative analysis (pH, Brix measurements and NIRS on fruits) and sensory evaluations of tomatoes. Results show: a clear diversification of M versus C from NIR; a negative impact of the mycorrhizal inoculum on the quantitative yield; minimal perceivable differences between M and C in sensorial analysis, which did not negatively affect preferences.

Keywords: arbuscular mycorrhiza, NIR SCiO, soil quality, taste, yield

OWC2020-SCI-369

SUSTAINABLE CONTROL OF YELLOW MITE (POLYPHAGOTARSONEMUS LATUS BANKS) INFESTING CHILLI (CAPSICUM ANNUM L.) BY USING BIOPESTICIDES

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Abstract: Chilli (Capsicum annum L.) plant is highly susceptible to Polyphagotarsonemus latus (Banks).

The incidence of this mite population always remained higher on upper canopy of the plant.Among the seven treatments evaluated microbial toxin- avermectin resulted in the best suppression of mite population (86.32% suppression), closely followed by chemical insecticide, fenazaquin (73.07%) and mixed formulation of botanical pesticide, azadirachtin with botanical extract, Spilenthes (70.99%).

Microbial toxin and botanicals are bio-pesticides having less or no hazardous effects on human health and environment, and therefore, they can be incorporated in Integrated Pest Management (IPM) and organic farming.

Keywords: avermectin, bio-pesticides, Neem, organic farming, Spilanthes

OWC2020-SCI-624

SCREENING OF ALTERNATIVES TO DECREASE COPPER DEPENDENCY FOR PLASMOPARA VITICOLACONTROL IN ORGANIC GRAPE PRODUCTION

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Abstract: Downy mildew caused by *Plasmopara viticola* is a major pest in viticulture worldwide. Organic viticulture is highly dependent of copper-based product to control this disease. Because copper has negative environmental impact, strategies to decrease dependency to copper-based products are needed. In that context, during 2005-2017 period, we have assessed the efficacy of 35 compounds to control downy mildew on-farm. This study presents a selection of our results. The screening showed that several formulated products and compounds have an efficacy to control the downy mildew when they are compared with the untreated control, but none at an efficiency similar to copper. When alternatives compounds are associated with a low copper dose, significant additional effect are rarely observed over the whole season.

Keywords: Plasmopara viticola, downy mildew, viticulture, Copper, Alternatives

Parallel 5: Soil fertility

OWC2020-SCI-1057

PHASING OUT PEAT AS GROWING MEDIA – IS IT POSSIBLE?

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Abstract: In areas with a limited outdoor growing season, pre-cultivation is an option. Pre-cultivation may also be an advantage in organic growing in order to give vegetables and herbs a head start on weeds. Good quality seed and transplanting media suitable for organic growing is of utmost importance for a satisfactory economic outcome.

There is also an increasing demand for peat free or peat reduced products. In tests conducted by The Norwegian Centre for Organic Agriculture (NORSØK) it was shown that commercial products, both peat based and peat free, don't always perform as intended resulting in low quality transplants. Some self-made products based on horse manure and leaf mould were tested, a few of them produced transplants of good quality.

Some modifications need to be done, especially in order to reduce weed seeds.

Keywords: growing media, peat free, sowing substrate, Transplant media, Transplant quality

OWC2020-SCI-1109

FIRST RESULTS OF EXPERIMENTS FOR CARBON ENRICHMENT WITH DIFFERENT LAND USE TECHNIQUES UNDER ORGANIC AND CONVENTIONAL FARMING

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Abstract: Since agricultural soils are far from saturation (Vaccari et al.2011), there is a potential of carbon (C) sequestration with land use change. At the Thuenen-Institute of Organic Farming in Germany several stationary field experiments were established to increase soil organic carbon (SOC) content with different land use techniques.

On the sites no differences in initial SOC and total nitrogen (N_{tot}) contents of soils, before implementation of the trials were detected. In the first year significant lower yield and also chlorophyll contents were found in organic spring wheat on plots without ploughing.

Compared to the use of wood-chips and seed treatment with N-binding bacteria organic manures improved the yields. Undersown crops in organic faba beans and conventional rapeseed caused no significant yield effects.

Keywords: C sequestration, N-bacteria, organic manure, ploughing, undersown crop, wood chips

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IT IS TIME TO PHASE-OUT THE USE OF PEAT IN ORGANIC HORTICULTURE

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Abstract: Peatlands are vital to the wider environment in terms of their biodiversity, to aid natural flood management and as significant carbon stores. In view of this, the UK Government has developed a framework for the restoration and protection of peatlands in England, including targets for phasing-out the use of peat in horticulture.

To support organic growers working towards this ambition, the activities of the UK Growing Media Initiative (GMI) were reviewed, together with research evaluating the performance of peat-free growing media approved for use in organic horticulture.

The GMI's work has focused on how to define sustainable growing media and the Responsible Sourcing and Manufacture of Growing Media Calculator is now available for use.

By using the calculator together with the results from fitness for purpose trials, the organic horticulture sector has a real opportunity to set its own benchmark for what it would consider to be responsibly sourced materials and to develop its own roadmap to successfully end the use of peat.

Keywords: organic horticulture, peat, peat-free growing media, vegetable transplants

OWC2020-SCI-1417

IMPROVING PHOSPHATE ROCK USE EFFICIENCY IN ORGANIC FARMING

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Abstract: Between 45 to 81% of the total phosphorus (P) fertilizer applied to soils in sub-Saharan Africa is absorbed in the soil, which among other factors reduce crop yield and contributes to high poverty in the region. The objective of the study was to assess the effect of different phosphorus rock (PR) management on carrot yields, P recovery and use efficiency.

Different volumes (100, 200, 300, 400, and 500 mLs) of organic (lemon and pineapple) juices and water were used to dissolve 100 g of PR. The available P concentration in the solution was determined using a standard protocol. The solution with the high P concentration as well as powdered PR was each composted with manure and crop residues. Thereafter, a field experiment was set up on Humic andosols and Orthic acrisols to compare the effect of the dissolved PR applied directly with compost, to dissolved PR composted, powder PR composted, powdered PR applied directly with compost, Triple supper phosphate applied directly with compost, compostand the soil alone (as a control).

Our findings showed that lemon juice could release over 65% of the available P from PR and the combined application of the dissolved PR and compost at planting increased P recovery and use efficiency, and carrot yields on both soils as compared to the other treatments.

Keywords: Compost, Organic juices, Phosphate rock dissolution, Phosphorus recovery

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EFFECT OF LEGUMINOUS LIVING MULCHES BY CONTROL OF THEIR GROWTH ON N2 FIXATION AND CABBAGE GROWTH IN ORGANIC VEGETABLE PRODUCTION

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Abstract: Living mulches (LM) in organic vegetable production are used for erosion control. Furthermore, leguminous LM can fix nitrogen (N) and thus supply the main crop with N.

In order to investigate this nutrient effect, a two-factorial field experiment was carried out in 2019 in Stuttgart, southwest Germany. As first factor, white cabbage (Brassica oleracea convar. capitata var. alba) was intercropped with two leguminous LM (Trifolium repens cv. 'Rivendel' and T. repens cv. 'Pipolina'), with a non-leguminous LM (Lolium perenne cv. 'Premium'), and no LM as controls.

As a second factor, LM were either tilled before planting the cabbage, were left on the field and mulched during the vegetation period, or not treated at all.

First results of this investigation suggest that leaving LM on the field, subsequently referred to as "no growth control", led to lower N status in the main crop, but LM as soil cover had a generally positive effect on the N status in soil due to reduced N transfer to deeper soil layers.

Keywords: clover, cover crop, nitrogen, nutrient imbalances, strip-till

OWC2020-SCI-414

CO2MPOSITIV- OPTIMIZATION OF ORGANIC MATERIALS CYCLES OF VITICULTURE IN LUXEMBOURG

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Abstract: The residue grape marc is transformed into a regional, high-quality fertiliser by optimizing the composting process. Ways are shown that improve the organic materials cycles in Luxembourg's viticulture in order to minimize the need for mineral nitrogen and phosphate fertilizers and pesticides.

The use of the composting process in agriculture and the use of compost products are one possibility to increase sustainability and counteract climate change.

Locally produced compost products help to promote humus formation and thus help to protect the climate. The aim of the project is to promote wide support for organic fertilisation and composting. Thus, first windrow composting, where grape marc, green waste and other biodegradable material are mixed, has started in 2019.

The compost as well as compost tea are applied on trial plots in an organic vineyard to investigate the effects on soil fertility.

Keywords: compost, grape marc, organic materials cycle, organic vineyard, soil fertility

OWC2020-SCI-657

EFFECTS OF ALTERNATIVE FERTILISERS FROM FOOD AND HOUSEHOLD WASTE AND CLOVER BASED ON YIELD OF ORGANIC CABBAGE (BRASSICA OLERACEA CONVAR. CAPITATA VAR. ALBA L.)

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Abstract: Organic vegetable farms are highly specialized and therefore, the production is very dependent on external nutrient inputs by commercial fertilisers permitted in organic farming, often of conventional origin.

Food and household waste and/or cloverbased fertilisers could replace and/or be additional alternatives to commonly used fertilisers and close rural-urban cycles. The effect of different alternative plant and waste based fertilizers were studied in a field trial using cabbage (*Brassica oleracea* convar. *capitata* var. *alba* L.) in Stuttgart, Southwest Germany. Total yield (head and residues), marketable head yield (> 1 kg) and non-marketable head yield (< 1 kg) were measured.

All fertilisers increased the total biomass yield and marketable head yield of cabbage significantly, with horn grit (widely used commercial fertiliser in organic vegetable production) fertilisation showing the highest yields (Total yield: 88.6 Mg fresh matter (FM) ha^{-1}, Marketable head yield: 39.8 Mg FM ha^{-1})of all treatments.

Clover pellets, tofu whey, biogas digestate from organic household waste and clover based biogas digestate showed results comparable to farmyard manure and could be potential new fertilisers for organic vegetable production without compromising the yield.

Keywords: Biogas digestate, Nitrogen, Organic fertiliser, OrganicPlus, Plant-based fertilisers, Vegetable production

Parallel 5: Cover crops & fertilization

OWC2020-SCI-1098

DOUBLE CROPPING, PLANT-BASED FERTILIZATION AND WINTER PLANT COVER IN VEGETABLE PRODUCTION FOR SUSTAINABLE INTENSIFICATION – A SYSTEM'S APPROACH

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Abstract: The global agenda asks for high and efficient food production in a sustainable way. A major part of the solution is a significant increase in vegetable consumption, which asks for an implementation of sustainable intensification in organic farming production of open-field vegetables.

The aim of this study was to advance the design of cropping systems and their nitrogen management to achieve high yielding systems, while limiting nitrate leaching. A 5-year crop rotation trial was designed, including double cropping, plant-based fertilisers, catch crops, green manures and plough-free controlled traffic farming.

The system was compared to a more standard organic crop rotation, fertilised by liquid manure. Crop yields, root growth, plant and soil nitrogen pools, soil microbial activity and nitrate leaching potential were studied in two years.

Results showed that yields calculated per area were maintained for each crop, and increased for the season in the double-cropped system for at least two out of four fields of the rotation. Effects on soil nitrogen availability and leaching potential were ambiguous. Soil microbial activity, measured as potential nitrogen mineralisation and enzymatic activity, increased by more than 15% in the double-cropped compared to the standard system in the crop rotation. In conclusion, yields and soil fertility increased in the double-cropped system fertilised by plant-based sources and managed by plough-free controlled traffic farming.

However, the high soil fertility asks for an increased focus on winter plant cover to avoid high leaching losses and to align to the principles of sustainable intensification.

Disclosure of Interest: H. Kristensen: None Declared, J. Soerensen: None Declared, M. Hefner: None Declared, R. De Visser is consultant for: organic vegetable producers

Keywords: Keywords: cut-and-carry fertilisation, intercropping, nitrogen mineralisation, root growth, soil fertility, vegetable yield

OWC2020-SCI-1122

STRAWBERRY LIVING MULCH IN ORGANIC VINEYARDS

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Abstract: A living mulch system can improve soil nutrient status and structure, provide beneficial habitat for biodiversified coenoses and spatial competition against weed infestation, and support a rhizosphere-enhanced diversity in microbial populations that can suppress soilborne pathogens.

Strawberry living mulch in vineyards has been evaluated for two years through a participative approach involving researchers and producers.

From the results of the experimental work, it appears that living mulch obtained with wild strawberry combined with a horizontal blade weeder reduces the need for further soil management, starting from the second year after vines planting, and assures a full soil cover during winter, thus reducing soil erosion and weed competition.

It maintains a diversified coenosis and represents a source of potential second income. Several advantages, as well as some weak points of the technique, have been shown, and some technical tips have been issued from the practical activities. Low input weed management is the first advantage derived from introducing living mulches.

Such service is especially relevant for the area surrounding the trunk, where management is particularly complex and requires frequent manual interventions.

Furthermore, installing a permanent mulch guaranteed a constant soil cover, and especially in hilly regions can drastically reduce the risk of erosion and leaching during rainy periods, compared to mechanical tillage.

Mulching species could also provide an accessory for agroecological services and contribute in creating resilient biological communities; biodiverse populations able to dynamically evolve, matching the changes on environmental conditions.

Keywords: Fragaria vesca, mixed crops, system design, weed control, multifunctionality

OWC2020-SCI-195

STRIP INTERCROPPING PROMOTES NUTRIENT-SNATCHING BY DEEP ROOTS

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Abstract: The potential of intercropping systems for acquisition of deep-placed nutrients is still not well-known. We examined root growth and nutrient uptake potential of a strip intercropping system with a deep-rooted perennial and a shallow-rooted annual crop species.

We compared root growth of sole-cropped winter rye (Rye), rye "intercropped" with an adjacent lucerne strip (Rye|Luc), and sole-cropped lucerne (Luc).

Tracer uptake of the crops were measured, including tracer uptake of lucerne grown adjacent to winter rye (Luc-Rye) was determined to reveal the possibility of nutrient-snatching.

Our results showed that roots recovered from below the rye in the Rye|Luc intercropping contained roots from both crop species and did not reduce overall root growth. Nutrient uptake potential by Rye|Luc was equivalent to rye as a sole crop, meaning that no competition were observed. Lucerne grown adjacent to labelled rye (Luc-Rye) was able to reach the nutrient source under winter rye by its deep roots.

We conclude that strip intercropping shall consider the contrasting root systems of cropping components in order to maximize the resource use efficiency from deep-soil layers.

Keywords: deep roots, intercropping, subsoil

OWC2020-SCI-246

FABA BEAN: A POTENTIAL INTERCROP IN ORGANIC VEGETABLE PRODUCTION IN A EUROPEAN PERSPECTIVE?

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Abstract: Intercropping can provide ecological and yield benefits when selecting crops and management practices that balance the competition for resources. A field experiment was carried out under temperate conditions to study the effect of intercropping faba bean (*Vicia faba* L.) and pointed cabbage *(Brassica oleracea* var. *capitata* f. *conica)* on yield and plant nitrogen (N) uptake.

Both crops were grown in mono cropping (MC) and intercropping systems (IC). The yield of pointed cabbage per meter row was 28% higher under IC compared to MC. The ratio between marketable yield and total yield of pointed cabbage was also higher in IC. However, faba bean yield per meter row was reduced by 15% under IC.

There was an indication of higher total N accumulation under IC followed by cabbage-MC and faba bean-MC. Soil mineral N at harvest (0-2.5 m depth) was lower in cabbage-MC, followed by IC and faba bean-MC. The intercropping system had a positive land equivalent ratio (LER) of 1.06, which points to the potential of using faba bean as an intercrop in sustainable organic vegetable production systems with higher N use efficiency.

Results will be discussed in the wider perspective of several European trials on intercropping from the SureVeg-project (Strip-cropping and recycling for biodiverse and resource-efficient intensive vegetable production) and point to new knowledge for farmers wanting to implement intercropping.

Keywords: Land equivalent ratio, Nitrogen use efficiency, soil mineral nitrogen, Vicia faba L.

OWC2020-SCI-463

HARVESTING OUR FERTILISERS FROM THE SEA - AN APPROACH TO CLOSE THE NUTRIENT GAPS IN ORGANIC FARMING

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Abstract: Organic production in Europe is currently dependent on the input of fertilisers derived from conventional agriculture, such as farmyard manure, slurry and fertilisers derived from slaugther residues.

A significant part of the nutrient flows in our food systems goes in one direction, from land to sea, via sewage and leaching. Harvesting marine organisms for fertilisation or utilising residual materials e.g. from fish industry as fertilisers, may close such nutrient gaps and promote active cycling of nutrients.

At NORSØK, we are studying the use of algae fibre from seaweed (rich in potassium (K), magnesium and sulphur) and fishbones (rich in nitrogen (N), phosphorus (P) and calcium) as fertilisers. In a pot experiment with ryegrass (11 treatments, 4 replicates, 5 harvests), high yields were produced with fishbones, and the short-term N availability was much higher than for mineral N fertiliser. The same result was confirmed in a field experiment with dried poultry manure as control treatment (1 fertilisation level, 5 fertilisers, 4 replicates, random block design), and an outdoor pot experiment (2 fertilisation levels, 5 fertilisers, 4 replicates, random block design). Plants with a long period of nutrient uptake benefited from algae fertiliser.

However, seaweeds contain significant amounts of arsenic (As), and easily available K may impact a balanced mineral content in the food or feed products. Excess P in the fishbones may cause eutrophication of this fertiliser is applied to cover N demands of the crop. Research is needed to make a well-balanced commercial fertiliser.

Keywords: arsenic, fish-based fertiliser, Nitrogen, phosphorus, plant nutrient uptake, seaweed fertiliser

OWC2020-SCI-712

SUNFLOWER ASSOCIATED WITH LEGUMES-BASED COVER CROP: A WAY TO INCREASE NITROGEN AVAILABILITY FOR THE FOLLOWING WINTER WHEAT?

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Abstract: Sunflower is one of the most important crop of organic crops systems in the South of France. In this region, sunflower is mostly cultivated before soft winter wheat, which is very often deficient in nitrogen because of a lack of nitrogen in the soil when the wheat needs it. To increase the soil nitrogen availability, one way is to introduce a legumes-based cover crop before wheat, which is sown just after the previous crop harvest. Thus, the time between sunflower harvest and wheat sowing is often too short to produce enough biomass.

An alternative is to sow the cover crop during the sunflower cultivation, so to be intercropped into it. In a trial repeated over 3 years (from 2015 to 2017) in the southwest of France, Terres Inovia tested this practice, by intercropping 3 kinds of legumes-based cover crops into sunflower: alfalfa, purple vetch and legumes mixture. Over the 3 years, the growth of the cover crops was satisfying, and the average amount of nitrogen returned to soil after cover crops destruction was of 40 kg N/ha for purple vetch, 18 kg N/ha for alfalfa and 19.5 kg N/ha for legumes mixture.

Nevertheless, cover crops impact severely sunflower performance because of competition for water and poor weed control due to no hoeing. Sunflower yield was reduced on average by 45% over the 3 years. This economic loss was partially compensated by a benefit on wheat yield, which was observed in 2016 and 2018, but only for wheat following sunflower intercropped with alfalfa.

Keywords: cover crop, nitrogen availability, sunflower

Parallel 5: Cover crops

OWC2020-SCI-1096

WINTER-HARDY VS. FREEZE-KILLED COVER CROP MIXTURES BEFORE MAIZE ON AN ORGANIC FARM WITH REDUCED SOIL CULTIVATION

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Abstract: The advantages and disadvantages of a winter-hardy vs. a freeze-killed cover crop (CC) mixture were studied on an organic farm in Lower Austria in two consecutive experiments. Effects on soil inorganic nitrogen contents, weed density and the yield of a following maize crop were assessed.

The winter-hardy compared to freeze-killed CC mixture, both consisting of legumes and non-legumes, reduced soil nitrate contents over winter, leading to a reduced nitrate leaching risk, whereas the yield of a following grain maize crop was not significantly affected.

Weed density was high in both CC treatments, presumably due to a reduced, non-inverting soil cultivation before maize, and higher in the winter-hardy CC treatment at one of the assessment dates. Combined with an adapted soil cultivation, both winter-hardy and freeze-killed CC mixtures were suitable CCs before grain maize.

Keywords: catch crops, grain maize, legumes, non-inverting cultivation, weed density

OWC2020-SCI-366

SCREENING COVER CROP SPECIES FOR IN-ROW AND INTER-ROW IN CANADIAN ORGANIC VINEYARDS

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Abstract: Grape growers are increasingly interested in cover cropping to enhance long-term productivity while improving the ecosystem health. A wide range of cover crop species for in-row and inter-row use in vineyards were evaluated in two provinces of Canada in 2019.

Superior species were selected based on characteristics such as seeds availability and cost, establishment, dry biomass, growth rate, canopy cover, weed suppression, height, host for pest and diseases, maturity date, drought tolerance, traffic tolerance, and risk of being invasive. Among tested species for British Columbia superior species were Ladino white clover and spring lentil for in-row, and ryegrass, fescue, cereal rye, tillage radish, vetch and berseem clover for inter-row.

In Ontario, superior inter-row species were crimson clover, pearl millet and yellow clover. Field studies are planned to assess the effect of the superior cover crop species on soil ecology, yield, and fruit quality/composition in the next three years.

Keywords: Cover crops, In-row, Inter-row, Wine grape

OWC2020-SCI-525

EXPLORING THE TOTAL SOIL VOLUME: ROOT LENGTH DENSITIES AND ROOTING DEPTH OF DIFFERENT COVER CROPS DETERMINED WITH THE PROFILE WALL METHOD

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Abstract: Roots of cover crops are important for nutrient uptake and prevention of nitrogen leaching. Root length density (RLD) and rooting depth of eight cover crop species were determined with the profile wall method before and after winter. High RLD was found for winter rye and crimson clover.

A gain in RLD during winter was detected for winter rye and crimson clover, whereas bristle oat, oil radish, oil radish 'deeptill' and phacelia reduced RLD during winter. Great rooting depth before winter were found for oil radish and winter turnip rape.

Mixtures of cover crops with a high RLD and a deep-rooting cover crops might be an approach to enlarge nitrogen uptake from the soil by cover crops' roots.

Keywords: catch crop, cover crop, profile wall method, root length density, rooting depth

OWC2020-SCI-982

CONTRIBUTION OF COVER CROP ROOTS TO SOIL FERTILITY AND CROP NUTRITION IN ORGANIC SPRING WHEAT IN QUEBEC, CANADA.

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Abstract: Assessing the contribution of cover crops (i.e. crops that are planted to improve soil health – not for harvest) to soil fertility is particularly complex. Little is known about how much N and how N from decomposing cover crop roots will become available to subsequent crops. The objective of the project was to determine the respective N contribution of shoots and roots of annual cover crop species to crop N uptake in organic spring wheat.

A 2-year field experiment was conducted twice (2016-2017, 2017-2018) in Quebec, Canada. Cover crops were grown and terminated in Year 1, and a cash crop of spring wheat was grown the subsequent year (Year 2).

Four annual cover crop species (common vetch, field pea, forage radish, and cereal rye) and four cover crop biomass input levels (shoot only, root only, and shoot plus root) were tested. Forage radishes and peas produced the highest total biomass (shoot and root) while radishes produced the highest root biomass.

Common vetch had higher shoot N concentration than other species whereas its root N concentration was similar to radishes and peas. At spring wheat seeding, soil mineral N content (0-45 cm) was significantly higher in whole CC treatments (39 kg N ha^{-1}) compared to treatments of shoot or root only (33 and 29 kg N ha^{-1}, respectively). In 2017, spring wheat yields were higher following the whole CC than following the shoot or root parts only. Improving our understanding on soil N budget may help to reduce N losses from cover crop-based cropping systems such as organic farming systems.

On a broader scale, this research aims to reduce the impact of organic farming on the environment by increasing its N use efficiency.

Keywords: Cover crops, mineralization, nitrogen availability, nutrient cycling, root, soil fertility

Parallel 5: Arable crops

OWC2020-SCI-1072

ON-FARM TESTING OF EMMER AND EINKORN LANDRACES UNDER ORGANIC CONDITIONS IN HUNGARY

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Abstract: Nowadays even organic agricultural and food systems mostly rely on a few species and within these species only a limited number of varieties. Diversification is key to a more healthy and balanced diet as well as to possible adaptation to the challenges of climate change and newly emerging pests and diseases. Ancient cereals like emmer and einkorn are good alternatives to common wheat, especially under marginal farming conditions.

In order to facilitate their cultivation and use, based on a 3-year small plot experiment, the best performing cultivars were selected and re-introduced into on-farm (ÖMKi) and on-station (ATK) trials in 2018, including 9 emmer (7 winter and 2 spring) and 2 einkorn landraces together with 1 registered emmer (as standard) and 3 registered einkorn (Mv Alkor as standard) varieties.

The results of the first year of on-farm data show a higher yield of winter emmer cultivars (around 2 t/ha in average), compared to einkorn (1 t/ha in average), some of the landraces being as high yielding as registered varieties of both species.

Although locations with their soil quality and agricultural techniques play a major role in the performance of tested cultivars, emmer and einkorn landraces proved to be sustainable alternatives for organic farmers for diversification, also in case of marginal farming conditions.

Keywords: einkorn, emmer, landraces, organic, value chain

OWC2020-SCI-1085

IDENTIFICATION OF LENTIL GENOTYPES (LENS CULINARIS MEDIK.) SUITABLE FOR CULTIVATION IN TEMPERATE CLIMATES BY YIELD AND RESISTANCE TO LODGING

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Abstract: Lentils are a promising crop in organic agriculture in Germany. Due to growing awareness of the origins of food, consumer demand for locally produced organic lentils is increasing in Germany, and the production cannot keep up with the demand.

However, the commonly cultivated varieties are not well adapted to the German climate and are susceptible to lodging, so domestic production of lentils is difficult.

In order to find suitable genotypes with increased yield and quality traits, such as a high percentage of filled pods and minimal lodging, a field trial was carried out in 2019 in southwest Germany as a part of a large project. Several lentil genotypes were compared with respect to their morphological performance in the field.

First results indicate that lentil variety 'Dunkelgrün marmorierte Alblinse' is most promising so far.

Keywords: morphology, phenology, pods, pulses, varietal differences

OWC2020-SCI-1119

ANCIENT WHEATS – AS AN EXAMPLE OF DIVERSIFICATION IN ORGANIC AGRICULTURE

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Abstract: Species diversity is one of the highest in organic agriculture yet arable farming is still characterized by the dominance of a few cereal species.

The present work summarizes the results of a 3-year experiment on hulled wheats as potential candidates of food system diversification. 10 winter and 3 spring emmer and 5 winter einkorn accessions, most of them being landraces, were investigated on 10m^2 plots under marginal sandy soil conditions in East-Hungary.

Most winter accessions adapted well to these conditions, producing grain yield above 3 t/ha in 3-year average, and some landraces were even ranked higher than registered varieties.

Einkorn proved to be resistant to leaf fungal diseases, however, *Fusarium* infected both species similarly. Compared to emmer, einkorn seeds contained higher bound flavonoids and had higher antioxidant activity.

Based on our findings on grain yield and quality traits both emmer and einkorn can be a good alternative for organic growers.

Keywords: einkorn, emmer, diversity, organic farming, landraces, DIVERSIFOOD

OWC2020-SCI-1182

C AND N CYCLING IN SOYBEAN, LUPIN, PEA AND FABA BEAN VARIETIES AT TWO SITES OF CENTRAL GERMANY UNDER ORGANIC FARMING

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Abstract: Sustaining productivity of organically managed cropping systems requires detailed information on legumes´ C and N above and below ground plant parts to nourish soils. We aim at elucidating the relationship between soil texture and 6 legumes´biological nitrogen fixation as well as quantifying potential litterfall and root contributions to SOC build up. Field experiments were set up in 2019 on two long term organically managed farms in Western Germany with contrasting soil types (sandy vs silty clay loam) which will run over two years (2019-20, 2020-21).

Treatments consist of a fallow plot, a non-nodulating soybean isoline, 2 winter (*Vicia faba* and *Pisum sativum*) and 4 summer (*Vicia faba, Pisum sativum, Glycine max* and *Lupinus albus*) grain legumes randomly replicated 4 times, manually inoculated with the commercially available Rhizofix at seeding stage. Plants will be sampled at the 50% flowering stage (in June) and biomass will be distinguished into roots, nodules, shoots, leaves, pods, and litterfall and assessed for Ctot, Ntot, ^{15}N and ^{13}C partitioning with an EA-IRMS.

Comparison of plants´ $\delta^{15}N$ weighted mean to the non-nodulating soybean will allow for the estimation of %Ndfa based on the Natural Abundace (NA) method. We hypothesize that highest %Ndfa will be encountered in varieties that can more effectively adapt to local conditions by better nodulating with available rhizobia and that this will result in enhanced C and N yields per hectare, both above and below ground.

Water deficiencies will be assessed by comparing $\delta^{13}C$ values of same genotypes cropped at the two sites and foresee that heavier soils will be able to retain more rainwater resulting in lower water stress. Root architecture and length will also play an important role in assessing water stress and provisioning. All in all, the study will provide valuable information for organic farmers on legumes´ varieties degree of nitrogen fixation under different soil textures as well as suggest contributions of root biomasses to SOM cycling.

Keywords: C cycle, N cycle, grain legumes, organic farming, modelling

OWC2020-SCI-1292

CARBON BALANCE AND ECONOMICS: TRADE-OFFS OR SYNERGIES IN THE CASE OF ANAEROBIC DIGESTION OF CEREAL STRAW?

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Abstract: Straw is known to crucially contribute to the carbon supply of arable soils, essential for long-term soil fertility and productivity. However, straw also has become an important commodity for material or energetic utilization.

A complete straw removal from the field may threaten carbon reproductive capacities and soil fertility. In anaerobic digestion, the carbon is partially returned to the field via digestate, potentially avoiding negative priming effects of carbon depletion or nitrogen immobilization by the wide C:N-ratio of undigested straw.

The article at hand evaluates the anaerobic digestion of straw compared to leaving it on the field with regard to carbon dynamics and economic performance in stockless organic farming systems based on scenarios for different soil-climate conditions in Germany.

Assuming justified yield increases by integrating a spatio-temporal flexible fertilizer (biogas digestate) into stockless organic farm systems, both carbon stocks as well as economic revenues may be improved, regardless of soil or climatic conditions and despite higher logistic costs. Thus, straw removal, subsequent anaerobic digestion as well as return of biogas digestates may be able to contribute to both preserving soil functions as well as economic sustainability.

Keywords: anaerobic digestion, biogas, crop rotation, humus balance, stockless organic farming, straw

OWC2020-SCI-593

NUTRIENT BUDGETS AND THEIR IMPLICATION ON SOIL FERTILITY IN ORGANIC FARMING ACROSS EUROPE

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Abstract: Knowledge of nutrient budgets of organic farms and their effect on soil nutrient contents across Europe is relatively limited. Therefore, a meta-analysis was conducted to investigate the nutrient supply of organic farms as affected by budgeting method, farm type and studied country. Further, an assessment was performed relating nutrient budgets with soil nutrient contents across five countries.

We found an average surplus of N, an almost balanced budget for P and a deficit for K. Yet, nutrient budgets varied over a wide range.

Farm type, more than the studied country or budgeting method, was able to explain some of the variations, with vegetable farms having higher surpluses, especially for N, than dairy farms, followed by mixed or stockless farms. Soil nutrient contents showed also considerable differences among farms and countries. A relationship between soil nutrient content and budget was found only for P, which indicates negative P budgets as a real risk for soil P depletion.

Keywords: Europe, meta-analysis, nutrient management, soil depletion, soil nutrients, Sustainability

Rahmann, Rey, *et al.* (2021) Book of Abstracts of the
Science Forum "From its roots, organic inspires science, and vice versa".
Thünen-Report 88, Trenthorst/Rennes, pp 238

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SPECIES MIX AS COVER CROP TO PRACTICE NO TILLAGE IN ORGANIC ARABLE PRODUCTION

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Abstract: Cover crop no tillage (CCNT) technique could provide a diversity of benefits on soil quality in organic production system including spring cash crop such as soybean. However, CCNT remains poorly practiced by organic farmers due the challenges to manage weeds and cover crops without neither soil tillage nor herbicide.

This paper aims to investigate the effect of a mix of cereal grains as cover crop compared to pure species to reduce weed pressure and the effect on soybean in organic CCNT system. Trials were conducted at four locations in France to compare three cover crops: rye, triticale and mix of rye/triticale. The cover crops are rolled and soybean is directly planting into the mulch.

The mix of rye/triticale cover crop conducted to an intermediate weed control between the pure species from the soybean planting to the harvest. The mix of rye/triticale as rolled cover crop provided similar soybean yield than with pure rye (2.5 $t.ha^{-1}$) which is superior to the soybean yield obtained with triticale cover crop (2.0 $t.ha^{-1}$).

Keywords: direct seeding, mulch, organic soybean, roller crimper, weed control

Parallel 5: Weed control

OWC2020-SCI-1036

EFFECTS OF MECHANICAL WEED CONTROL IN ORGANIC SOYBEAN CULTIVATION ON YIELD AND WEED BIOMASS IN LUXEMBOURG

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Abstract: Organic soybean cultivation in Luxembourg is still in its initial stage, with knowledge gaps mainly in mechanical weed control. Within the framework of the project LeguTec, five weed control methods in soybean cultivation are tested under real conditions on three organic farms distributed over Luxembourg in 2018 and 2019.

The focus lies on treatments with a harrow, hoe, finger weeder, mixed cropping and combination.

The field trials are conducted in four replicates including control plots. Different rating parameters are taken before and after each weed treatment as well as at flowering and at harvest to assess the efficiency of the used technique in relation to yield. First results of the two years show higher yields and less weed biomass at flowering in hoeing treatments than in harrowing treatments. Significant correlations can be derived from yield and weed biomass at flowering.

Keywords: LeguTec, Luxembourg, mechanical weed control, organic agriculture, Soybean

OWC2020-SCI-1279

IMPACT OF DIFFERENT MECHANICAL WEED CONTROL METHODS ON WEED COMMUNITIES, IN ORGANIC SOYBEAN CULTIVATION, IN LUXEMBOURG.

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Abstract: Knowledge gaps have been identified for legumes cultivation, especially in terms of weed control, while soybean production is still at its initial stages in Luxembourg.

The project LeguTec tests different mechanical weed control methods, in organic soybean cultivation. The impact of weeding are observed from an ecological point of view in term of species number and diversity of weeds.Two experimental sites at organic farms were the basis of experiments in 2018 and 2019.

Seven different weed control treatments were tested. For each, the number of weed species as well as their identification have been assessed at several times. The Shannon index has quantified the diversity of weeds. 49 weed species have been found in total for all sites. Calculated Shannon index were common values for organic fields. Weed control has shown a negative impact on weed diversity.

The use of a hoe tends to lower the most the number of species and the diversity of weeds. Low abundant species were more likely to disappear while few species, 1 to 4, keep dominating.Hoeing is reducing the most weed diversity, while being the most successful method tested within the framework of the project LeguTec.

Keywords: Soybean, weed ecology, Luxembourg, organic agriculture, LeguTec

OWC2020-SCI-557

A CO-DESIGN PROCESS BASED ON ON-FARM INNOVATION TRACKING TO BUILD CREEPING THISTLE CONTROL STRATEGIES SUITED TO LOCAL ISSUES

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Abstract: Disruptive innovation is needed to support organic agriculture, i.e. to think out of 'conventional agriculture' and to build innovative cropping systems suited to local issues. Indeed, it involves finding new way to work with these stakeholders while creating new cropping systems. This innovation process is particularly difficult when scientific knowledge is missing.

This paper describes the implementation of an approach combining tracking on-farm innovations and co-design workshops to manage creeping thistle in arable organic farms in the Northern France context.

A wide range of useful results for farmers and advisors has been produced (e.g. knowledge on innovative practices and on their combinations). Some key points are highlighted for the implementation of such approach, particularly, diversifying sources and type of knowledge to help stakeholders be disruptive.

Keywords: co-design, creeping thistle, tracking innovations on-farm, organic cropping system.

Parallel 5: Cropping system 1

OWC2020-SCI-1150

SILAGE FROM INTERCROPPING OF MAIZE WITH COMMON BEANS (PHASEOLUS VULGARIS) AS ROUGHAGE FOR FATTENING PIGS

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Abstract: Maize silage is a high-energy roughage that can be fed to fattening pigs to provide both employment and additional nutrients. Intercropping of maize with common beans was tested to produce a roughage higher in proteinbut was still found to contain considerably less protein than grass-clover silage, which is frequently fed to pigs. In a fattening trial with 144 pigs, maize-bean silage was compared to grass-clover as roughage.

Although silage consumption in early fattening was lower when maize-bean silage was fed, neither fattening nor slaughter performance differed. So maize-bean silage as roughage was equally efficient as grass-clover silage, but did not show nutritional benefits.

Keywords: Corn, organic agriculture, pig production, roughage, silage

OWC2020-SCI-1278

SYSTEMS AGRONOMY FOR RE-DESIGNING ORGANIC GRAIN LEGUME CROPPING SYSTEMS

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Abstract: The integration of grain legumes into European agricultural systems could contribute to the transition to more sustainable food production. While the general benefits from legume cultivation are widely known, especially in organic farming, there is little evidence on how to re-design organic cropping systems with legumes to make this option more attractive to farmers. The objectives of this study were to describe the constraints and opportunities of organic grain legume production perceived by farmers, explain the agronomic impacts of current grain legume cropping, explore technical options to improve grain legume agronomy, and to re-design current grain legume cropping systems in a participatory process with farmers.

A co-design approach was implemented with organic farmers, advisors and scientists on 25 farms in northern Germany, that were part of two large demonstration networks of about 100 farms supporting grain legumes across Germany. We used the DEED research cycle (Describe, Explain, Explore and Design) as a conceptual framework combining on-farm research, crop rotation modelling, and on-station experiments.

From it, we identified nine agronomic practices that either were novel or confirmed known strategies under new conditions, to re-design organic grain legume cropping systems at the field and farm level. We also demonstrate how to complement knowledge of farmers' perceptions (Describe step) and formal knowledge from classical on-station experiments and modelling (Explain step) with on-farm research including the local views of farmers (Explore step) to identify tailored options for specific farm contexts rather than prescriptive solutions (Design step) to intensify legume production.

This approach therefore contrasts with traditional methods that are often solely participatory and qualitative or model/experimental-based and quantitative. Hence, our results provide new insights in how to re-design cropping systems using a combination of participatory and quantitative approaches. While participatory approaches are common in developing countries, this study shows their potential in an industrialized context with large-scale farmers in Europe. These novel findings can be used as a starting point for further adaptations of organic cropping systems and contribute to the transitioning towards economically and environmentally more sustainable food and feed systems.

Keywords: Action research, DEED framework, experimentation, lupin, Participation, Soybean

OWC2020-SCI-287

POTENTIAL OF MIXED INTERCROPPING FOR ENHANCED BREWING QUALITY OF MALTING BARLEY (HORDEUM VULGARE) UNDER ORGANIC GROWING CONDITIONS IN NORTH-WESTERN GERMANY

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Abstract: To assess the effect of intercropping on malting quality a field trial with spring barley (*Hordeum vulgare*) and legume (pea) as well as non-legume (camelina and linseed) intercrops in two additive seeding ratios as well as sole cops was established in 2017 at the organic experimental station of University of Applied Sciences Osnabrück in North-Western Germany.

Two tested malting barley cultivars (cv. Marthe and cv. Odilia) showed different performance, but all variants achieved brewing quality.

Results after two years indicate that linseed and camelina were able to limit protein content. For best land-use efficiency of malting barley production intercropping with linseed showed best results.

Mixed intercropping can help to promote internal efficiency loops and is therefore a promising sustainable intensification strategy for more resilient future crop production under changing climate conditions.

Keywords: cereal-legume intercropping, cereal-non-legume intercropping, cropping systems, resource-use efficiency, sustainable intensification

OWC2020-SCI-586

REDESIGNING EUROPEAN CROPPING SYSTEMS BASED ON SPECIES MIXTURES – OUTCOMES AND LESSONS LEARNT FROM THE H2020 PROJECT REMIX

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Abstract: ReMIX is a H2020 multi-actor project that will allow to redesign cropping systems based on the agroecological principle of crop diversification for the benefit of farmers and the whole EU agricultural community. ReMIX exploits the benefits of species mixtures to design more diversified and resilient agroecological arable cropping systems.

Based on a multi-actor approach, ReMIX produces new knowledge that is both scientifically credible and socially valuable in conventional and organic agriculture. The project tackles practical questions and co-design ready-to-use practical solutions.

The project spans from the specification of end-user needs and the co-design of in-field and on-farm experiments to demonstrations with evaluation of new varieties and practices. ReMIX contributes to the adoption of productive and resilient agricultural systems.

Keywords: Horizon 2020, Intercropping, Legumes, Multi-actor approach, Organic agriculture

OWC2020-SCI-794

DIVERSIFICATION OF ORGANIC FARMING BY IMPLEMENTING STRIP CROPPING IN VEGETABLE FARMING OF THE NETHERLANDS

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Abstract: Organic and conventional vegetable are grown mainly in monoculture fields at most medium and large-scale vegetable farms in western Europe. To develop a resilient and profitable system with increased biodiversity levels, research is done on strip cropping systems compared to monoculture systems. Strip cropping is defined as growing two or more plant species in strips that wide enough to allow mechanisation but narrow enough to facilitate ecological processes. In the Netherlands a strip cropping system was designed and examined on a medium sized organic farm. The results from 2018 show that strip cropping offers an opportunity for integrating ecology and agriculture.

Keywords: above ground biodiversity, crop diversity, strip cropping

OWC2020-SCI-840

SHARED RESEARCH QUESTIONS ON SOIL QUALITY IN ORGANIC FARMING SYSTEMS

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Abstract: In 2018, a participatory national workshop was organized by ITAB (Organic Food and Farming Technical Institute) and INRA (National Institute for Agricultural Research) in order to highlight issues on soils in Organic Farming (OF) systems.

The objectives were: i) to identify the key research questions to be addressed on soils in OF, ii) to make it possible to facilitate network and project building from interactions between academics and stakeholders.

Over 150 participants from academic and professional origins attended the workshop which was designed according to The Town Hall Meeting (THM) methodology.

High level discussions among participants and panel experts ended up with a list of 20 research questions which confirmed the important lack of knowledge on that topic and the needs for research on the following issues: soils functioning with a focus on biogeochemical cycling and biological interactions; long term effects of agricultural practices, more or less specific to OF; soils protection; tools for soils diagnosis and management.

Keywords: THM method, participatory workshop, soil quality, biogeochemical cycle, ecosystem service, fertility

Parallel 5 :Cropping system 2

OWC2020-SCI-1062

RELEVANCE OF REDUCED TILLAGE PRACTICES ON SOIL BIOLOGICAL, CHEMICAL AND PHYSICAL QUALITY AND ECOSYSTEM SERVICES UNDER ORGANIC FARMING CONTEXT IN BRITANY

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Abstract: Avoiding or limiting ploughing under organic farming management remains a big challenge for organic farmers. By developing an holistic approach, the aim of this study was to evaluate the impact, under organic farming management, of different tillage techniques on soil biological, physical and chemical quality and ecosystem services.

In an experimental site located in Britany (France) four tillage techniques were compared: conventional ploughing (CP), agronomic ploughing (AP), superficial non-inversed tillage (C15) and very superficial non-inversed tillage (C8). Results, obtained during 10 years (from 2003 to 2013), showed a strong temporal variability between years, however some results appeared consistent.

Positive impact of reduced tillage on hydraulic conductivity and organic matter content was limited to the 0-5 cm depth. No-inversed tillage (C15, C8) and agronomical ploughing (AP) significantly improved microbial biomass. C8 is the only technique which significantly decreased nematofauna. Earthworm biomass significantly decreased under conventional ploughing (CP) due to the decrease of anecic species while ploughing techniques (CP, LA) preserved total earthworm abundance due to endogeic species. Endogeic species had a negative impact on hydraulic conductivity whereas anecic enhanced the conductivity and Carbon and Phosphorus contents.

No-inversed tillage techniques (C8, C15) leaded to a decrease of the crop yield, due to an increase of weeds which increased water and nutritive competition. This study highlighted the interests and limits of no-inversed techniques and agronomical ploughing applied in organic farming management for enhancing soil quality and crop yield.

Keywords: reduced tillage practices, organic farming, soil quality, soil biodiversity, ecosystem service, crop yield.

OWC2020-SCI-1174

ROLLER-CRIMPING AS AN ALTERNATIVE TO INCORPORATION OF AGRO-ECOLOGICAL SERVICE CROPS CHANGES NITROGEN DYNAMICS IN ORGANIC CABBAGE PRODUCTION UNDER NORTHERN AND WESTERN EUROPEAN CONDITIONS

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Abstract: Agro-ecological service crops (ASCs) are used to improve organic vegetable production in terms of weed suppression, nitrogen (N) recycling, or addition of N through symbiotic N_2 fixation by legumes.

Full incorporation (FI) of ASCs is commonly conducted to terminate ASCs, but alternative termination can be obtained by roller-crimping (RC) in reduced tillage systems. Field experiments were conducted in Estonia, Denmark, and at three locations in Belgium during two growing seasons (autumn 2015-2017) to investigate the effect of ASC termination method (FI and RC) and ASC species (pea, pea/cereal mixtures and cereals), compared with a bare soil control, on soil mineral N content, cabbage yield and N accumulation.

Cabbage yield and N accumulation were reduced under RC compared to BS and FI in a majority of cases mainly due to reduced soil mineral N availability, in some cases owing to a later ASC termination time.

Furthermore, slower mineralisation of soil organic matter and ASCs at the soil surface contributed to the yield reduction under RC as compared with FI. Cabbage yield could be maintained under RC at standard fertilisation rate following pea ASC in Denmark.

The RC system needs further investigation to improve N availability to the succeeding crop before it can be implemented in organic vegetable production.

Keywords: cover crop, soil mineral nitrogen, winter barley, winter pea, winter rye

OWC2020-SCI-1213

DEVELOPMENT, EVALUATION AND DEMONSTRATION OF A NO-TILL TECHNIQUE WITH A MODIFIED ROLLER CRIMPER IN ORGANIC AND CONVENTIONNALLY-MANAGED SYSTEMS IN EASTERN CANADA

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Abstract: According to many, soil tilling is one of the practices contributing the most to soil degradation. In conventional systems, farmers can practice no-till with the use of chemical herbicides to kill cover crops prior to the next planting whereas their use is forbidden in organic systems. Alternatives to herbicides are available to farmers including the utilization of a roller crimper, a farm equipment developed by the Rodale Institute.

The roller crimper is a water-fill drum with chevron-patterned blades attached to the front of a tractor. This technique allows farmers planting soybean into a roller-crimped rye cover crop. A critical step with this technique is the timing of cover crop termination.

The roller crimper is used when rye has reached flowering stage. Under Southern Quebec climatic conditions, this brings us to mid-June which is too late for soybean planting.

Inspired by other techniques developed in the United States, a nearby farmer decided to conceive a new model of roller crimper that would adapt the technique to the climatic and cultural conditions of Eastern Canada farms. The expected results are the development of approaches without herbicide use, promote organic soybean production and reduce soil erosion and improve their health in Eastern Canada.

Keywords: conventional farming, Cover crops, no-till, organic farming, Soybean, winter rye

OWC2020-SCI-1247

*STRIP-CROPPING SYSTEMS*STRIP-CROPPING SYSTEMS ROBOTIZATION: PROTOTYPE DESIGN GUIDELINES FOR TARGETED FERTILISATION

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Abstract: Organic agriculture has an increasing demand, driving conventional farmers to change their businesses [1]. In some cases, the lack of attention for biodiversity and soil fertility of current practices may damage the credibility of organic products [2]. The SUREVEG project focuses on the implementation of strip-cropping in organic production to improve soil fertility and biodiversity throughout Europe.

The aim is to enhance resilience, system sustainability, local nutrient recycling, and soil carbon storage [3]. However, husbandry crops grown and mixed in a strip design pose new challenges regarding mechanisation, which in many cases can only be overcome by increasing human tasks [4]. To counteract the additional labour of a multi-crop system, one of the main objectives of this project is the development of automated machinery for the management of strip-cropping systems.

A robotic tool is proposed, which will be operating upside down, attached to a wide-span mobile carriage similarto gantry systems used in Controlled Traffic Farming. Within the project framework, a modular proof-of-concept version is being produced, combining sensing technologies with actuation in the form of a robotic arm.

Despite many robotic developments recently presented, which are designed for weed removal, this proof-of-concept will focus on providing precise organic fertilization. Fertiliser needs will be identified in real-time and carried out on a single-plant scale. Design guidelines of the proposed prototype have been detailed.

The planning and control of the manipulator are being developed in two ways: using conventional algorithms and applying machine learning techniques. First results have been also obtained with the sensorics onboard the robotic platform, by using a combination of LiDAR systems and multispectral cameras to localize single plants, and to detect their status, according to fertilisation demands.

Keywords: fertilization, LIDAR, manipulator, multispectral camera, robotics, strip cropping

OWC2020-SCI-570

COMPARING ENERGY EFFICIENCY AND GREENHOUSE GAS EMISSIONS IN CACAO PRODUCTION SYSTEMS

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Abstract: High dependence on non-renewable energy and greenhouse gas (GHG) emissions are a clear symptom of unsustainability in food production systems. We compared the energy use and efficiency, the productivity and GHG emissions per ha and per kg of products harvested of 4 cacao production systems, i.e., agroforestry systems and monocultures under organic and conventional management during 5 years in a newly established experimental plantation.

Our results showed that agroforestry systems and organic management reduced the demand of non-renewable energy and GHG, and increased the energy efficiency. In addition, the return of energy per unit of labour invested was higher in the agroforestry systems. Organic agroforests were the most sustainable systems according to the indicators analysed.

Organic sector should discuss considering agroforests as part of the requirements for certification, since, in addition, they contribute to reduce deforestation and increase farmers' livelihood and food security.

OWC2020-SCI-588

EVALUATING THE STRENGTHS AND WEAKNESS OF CONVENTIONAL, NO-TILL AND ORGANIC CROPPING SYSTEMS: AN ASSESSMENT OF YIELD, SOIL PROTECTION AND ENVIRONMENTAL PERFORMANCE

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Abstract: In a comprehensive study on 60 observed fields in organic, conventional and no-till cropping, a coherent set of different indicators for cropping management, crop performance and soil physical, chemical and biological properties has been developed to describe and assess these systems.

The high yield level in conventional, the soil surface protection and diversity of crops in no-till, and the higher soil organic carbon content and the complexity of root-associated microbial networks in organic systems underline the areas for improvement to be considered for the further development of sustainable cropping systems.

Keywords: cropping systems, indicators, on-farm, Soil health

Parallel 5: Productivity of OA in the Tropics

OWC2020-SCI-1003

ORGANIC RICE STANDARD: TRANSITION TOWARD SUSTAINABLE ORGANIC FOOD SYSTEM

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Abstract: Strategic research is important to understand drivers of sustainable organic food from production to consumption and link this to real world example. In this research we elaborate the organic rice standard in Indonesia.

The research is attempted to identify the current condition of organic rice standard in Indonesia and finding the gap that could possible to enhance the sustainable approach. Is the organic rice standard suitable for supporting sustainable organic food system or not? We conduct three-year research starting from cultivation, processing and consumption of organic rice in Indonesia.

We found that (1) Cultivation organic rice is fitting the sustainable approach in term of less residue of pesticide, better farmer incomes as well as protecting biodiversity (2) Organic rice processing following the conventional milling standard and resulted the decreasing of nutritional ingredient (3) Consumer perception on organic rice is highly on the healthiness attribute which cannot be easily proven as long as the milling approach using conventional standard.

From this study we conclude that the gap of research in processing and consumption of organic rice should be in the priority, i.e. what is the standard of milling in organic rice? Or what is the perception of consumer on organic brown rice in Indonesia. Based on this, we could develop the organic food system start from an example of organic rice.

Keywords: Organic Food Systems, Organic rice, Contaminant, Cultivation, Processing, Consumer preference, health attributes

OWC2020-SCI-273

AGRONOMIC PERFORMANCE OF SOYBEANS AS IMPACTED BY SOIL- AND FOLIAR- APPLIED ORGANIC FERTILIZERS IN THE TROPICS

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Abstract: Organically produced soybean is <0.1% of total world production despite its increasing demand in the world market. Therefore, field trails were carried out in southwestern Nigeria during the late cropping seasons (July – Nov.) of 2017 and 2018 to evaluate the agronomic performance of three improved soybean varieties: TGx 1448-2E, TGx 1835-10E and TGx 1989-19F as affected by foliar: Arati Baja (1.01% N), Arati Nawoz (2.01% N), D I Grow (3.19% N and 1.49% N) and soil applied organic fertilizers: (Aleshinloye Grade B, O.56% N and 1.48% N), and control (no fertilizer). The experimental design was Randomized Complete Block Design in a 3 × 5 factorial arrangement in three replicates.

Fertilizer application and varietal effects were significant ($p<0.05$) on nodulation at 10 weeks after sowing, weight of pods and seeds per plant, and grain yield in both years. It was concluded that the soil organic fertilizer or any of the foliar fertilizers can enhance soybean cultivation in the tropics.

Keywords: agronomic traits, foliar fertilization, nodulation, soil organic fertilizer, soybean seed yield

OWC2020-SCI-671

PRODUCTIVITY AND PROFITABILITY OF ORGANIC AND CONVENTIONAL FARMING AFTER 12 YEARS CONTINUOUS CROPPING - FARMING SYSTEMS COMPARISONS TRIALS IN KENYA (SYSCOM)

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Abstract: Contributing to the global debate if organic can feed the world, the Research Institute of Organic Argriculture (FiBL) has started two long-term trials in Kenya. These trials compare organic and conventional farming system at two input levels (high and low). After 12 years of continuous cropping, we found differences in productivty and profitability of organic and conventional farming systems depending on the crop: Grain maize, baby corn and common bean were able to achieve similar yield in organic and conventional, whereas leafy cabbages and potatoes showed lower yields in organic.

Thus, higher, but also lower profitabiltiy was achieved with organic farming compared to conventional. We assume that improvement of organic management practices (like pest management and nutrient supply) and reduction of production costs (labour) in low-yielding crops could increase productivity and profit. However, organic farming showed more positive effects on soil fertility, human health and biodiversity compared to conventional in our trials.

Keywords: Faming systems, Kenya, Long-term experiment, Yield gap

OWC2020-SCI-976

DEVELOPMENT OF THE FIRST ORGANIC RICE VARIETIES TOLERANT TO SALINITY

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Abstract: Sea coastal tracts often confront the combined menace of salinity and flood. Compared to any other development approach, breeding for salt stress tolerance is a more promising, energy efficient, economic, and socially acceptable approach.

Varieties having traits amenable for organic farming (organic varieties) are the missing link in the organic production chain. Here we report development and commercial release of four saline tolerant organic rice varieties which are first of its kind, christened as 'Ezhome -1' , 'Ezhome -2', 'Ezhome -3' and 'Ezhome -4'. They are also non lodging, high yielding, and having good cooking and nutritional qualities.

They are suited to saline flooded sea coastal ecosystem as well as non-saline tracts. The varieties were developed by adopting conventional breeding linked with novel strategies of organic plant breeding and participatory plant breedingand growing the entire filial generations and all yield trials in the problem area of farmers.

Keywords: rice, salinity and flood tolerance, organic variety, Kaipad

POSTER SESSION 1: Ecological Approaches to Systems' Health

OWC2020-SCI-1176

BIOECOLOGICAL FUNCTION AS AN ADDED VALUE OF AGROSILVOPASTORAL ECOSYSTEMS. CASE STUDY IN A SPANISH DEHESA

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Abstract: The use of conventional and intensive exploitation practices, as opposed to the organic ones, has caused a loss of the ecological value in many natural ecosystems.

A clear example is the dehesa ecosystem in Spain, a semi-natural system that has a great diversity of flora and fauna and in which the intensive and industrial productive systems are replacing the traditional practices, which have maintained biodiversity in these ecosystems through centuries. This research aims to endorse the organic practices as a way not only to maintain but also to enrich the biodiversity of these silvopastoral traditional systems whilst improving the economical resources of the farm.

An organic farm located in the central-western Spain was selected to analyze its animal and plants diversity and therefore its natural capital, using direct and indirect observations.

Keywords: biodiversity, organic production, environmental sustainability

OWC2020-SCI-1205

TESTING OF PLANT EXTRACTS AS ANTIPARASITIC AGAINST GASTROINTESTINAL HELMINTHS WITH TRADITIONAL AND NEW TECHNOLOGIES

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Abstract: Plant extracts represent interesting alternatives to synthetic antiparasitic drugs against gastrointestinal helminths ("worms"). These have been used intensively over the last decades and antiparasitic resistance is increasing worldwide.

In the present study three plant extracts (*Malva sylvestris, Chamomilla recutita* and *Althaea officinalis*) were assessed for their antiparasitic properties against gastrointestinal worms. A traditional microscopy method (larval development assay, LDA) and a molecular analysis (Droplet digital PCR,ddPCR) were performed using a laboratory strain of *Haemonchus contortus* (target organism).

All three extracts had a certain antiparasitic effect up to 20 mg/ml concentration, but a stronger effect of *M. sylvestris* and *A. officinalis* than *C. recutita* was observed, even at lower concentrations. Correlation between both methods (LDA and ddPCR) was low (R^2=0.39), but it will be investigated with further studies.

The availability of molecular methods for the screening of alternative antiparasitic substances is relevant to the organic husbandry since it would provide a robust, standardized and objective tool to get access to effective alternatives to traditional antiparasitic drugs against gastrointestinal worms.

Keywords: Anthelmintic, assessment, ddPCR, plant extracts, technology

OWC2020-SCI-1304

EXPLOITING THE MULTIFUNCTIONAL POTENTIAL OF BELOWGROUND BIODIVERSITY IN ORGANIC FARMING: A CHANCE FOR IMPROVING HORTICULTURAL PRODUCTIONS.

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Abstract: A project (EXCALIBUR) has been started aiming to deepen the knowledge on soil biodiversity dynamics and its synergistic effects with prebiotic and probiotic approaches in horticulture.

In this context, new multifunctional soil microbial inoculants (bio-inocula) and bio-effectors will be tested on three model crops of economic importance (tomato, apple, strawberry) under different experimental and open-field conditions across Europe.

Excalibur plans to develop a comprehensive strategy of soil management improving the effectiveness of biocontrol and biofertilization practices in organic farming also through the development of a Decision Support System (DSS) and tools for monitoring inocula in the soil. Such activities are expected to encourage the adoption of best practices derived from the new strategy by the farmer's increasing also the awareness on the potential benefits of soil biodiversity maintenance for crops' performance.

Keywords: bioeffectors, biofertilizers, biopesticides, microbial inocula, soil biodiversity

OWC2020-SCI-1328

THE MULTIFUNCTIONAL CHALLENGE OF FUTURE AGRICULTURE – ANSWERS FROM 40 YEARS DOK RESEARCH

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Abstract: Achieving sufficient and stable crop yields with limited cropland and without excessive use of non-renewable resources under a changing climate are the multifunctional challenges of future agriculture. We compared the performance and sustainability of organic and conventional cropping systems in the DOK long-term systems comparison after 40 years of management. For the first time we present a comprehensive evaluation of the whole DOK design including the systems with reduced stocking rates.

Yield, nutrient dynamic and soil quality evaluations showclearly the trade-offs between productivity and sustainability in organic as well as in conventional systems. Low input conventional systems reveal the best input-output performance but lowered soil quality; regular organic systems were most sustainable but achieved only moderate non-legume yields.

Keywords: Yields, yield stability, NPK-budget, nitrogen use efficiency, trade-off

Rahmann, Rey, *et al.* (2021) Book of Abstracts of the
Science Forum "From its roots, organic inspires science, and vice versa".
Thünen-Report 88, Trenthorst/Rennes, pp 238

OWC2020-SCI-1418

EFFECT OF VERMI-COMPOST AND SESBANIA ACCULATA GREEN MANURING ON INDIAN FALLOW LAND TORIA OILSEED PRODUCTION

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Abstract: A field experiment was carried out during summer and winter season of 2004-05 and 2014-15 to study the effect of nutrient management by using value added vermi bio-manures and green manuring effect on Toria crop in sandy loam soil at abandoned Farm land of Indian Veterinary Research Institute, Bareilly, U.P., India.

Result indicated that application of vermi bio-manure @ 10t/ha produced more yield than green manuring. In both years vermi compost manuring produced more yield in comparison to green manuring during 2004-05 and 2014-15. The reason might be that vermi-compost supplied early nutrients than the green manuring.

Among the Toria varieties PT-330 produced maximum yield (13.2 and 11.4 q/ha) in both the trials. Oil content was also found higher (33.7% and 36.3%) in the P-330 variety and followed by PT-570. Second maximum green yield 12.5 q/ha and 10.7q/ha and wherein oil content was observed 36.4% and 34.5%, respectively.

Soil fertility status was improved during long term effects (10 years) process in both green manuring and vermi-compost application trials. Major and minor nutrients were increased due to availability of more organic carbon, increase soil moisture contents and higher soil microbial activities during the period of 10 years.

Keywords: organic manure, toria, green manuring, yield

OWC2020-SCI-202

INSECTS DIVERSITY IN SOYBEAN CROPS UNDER ORGANIC AND CONVENTIONAL FARMING

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Abstract: In the conditions of the Right-Bank Forest Steppe of Ukraine (Kyiv region), diversity of entomocomplex in organic soybean fields was investigated. Biodiversity indexes (Shannon's and Simpson's) were calculated. It was found that the total number of individuals, species and families was higher in organic fields on 88.5, 68.0 and 122.2%, compared to conventional respectively and on 33.3, 9.1, 20.7% in the protective forest plantations adjacent to the organic fields compare to conventional, respectively. Pests from 13 families were identified.

On fields with conventional technology pests from 9 families were found (on 2.3% less from all individuals). It was investigated that the share of insect pests in protective forest plantations adjacent to organic fields was on 16.9% lower than in those adjacent to conventional fields.

The values of biodiversity indexes in organic landscapes are greater.

Keywords: agroecosystems, biodiversity, insects, organic farming, soybean

OWC2020-SCI-375

PROMOTING SOIL HEALTH IN ORGANICALLY MANAGED SYSTEMS

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Abstract: Little information is given to farmers on specific combinations of organic amendments, crop types, sequences, rotation duration, or weed management strategies that lead to improved soil health.

Although there are numerous studies that compare organic systems to conventional systems, there exist few studies that compare organic systems to each other for determining how to improve soil health metrics. In this review, we focused on 11 indicators of soil health.

Overall, the published research focused on four key practices: (1) cover crops; (2) rotation diversity and length; (3) tillage; and (4) organic amendments. We found that including a semi-perennial crop, like alfalfa, consistently improved soil carbon (C), nitrogen (N), and aggregate stability.

There is a great deal of variety and nuance to organic systems and more research should focus on how to optimize practices to improve and maintain soil health.

Keywords: Cover crops, Soil health

OWC2020-SCI-449

CARBON SEQUESTRATION BY ORGANIC CONSERVATION TILLAGE – A COMPREHENSIVE SAMPLING CAMPAIGN IN NINE EUROPEAN LONG-TERM TRIALS

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Abstract: Conservation tillage is suggested to sequester carbon although a stratification of soil organic carbon rather than a total increase is mostly observed.

It is not clear whether conservation tillage in combination with organic farming practices has a higher potential. Beyond, many datasets are biased in terms of sampling depth.

A joint sampling campaign in nine European long-term trials considered soil organic carbon stocks until 100 cm soil depth comparing reduced tillage with ploughing under organic farming conditions.

First results show a significant increase of carbon stocks in 0-30 cm and also in 0-100 cm depth with the conversion to reduced tillage.

Keywords: Carbon sequestration, climate change, Conservation tillage, soil organic carbon

OWC2020-SCI-606

CULTIVATED LANDRACES WHEAT, OLD CROPS BUT PROMISING FUTURE FOR RESISTANCE TO BIOTIC STRESSES: THE SPECIFIC CASE OF A FUNGUS DISEASE, FHB (FUSARIUM HEAD BLIGHT). A REVIEW.

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Abstract: The present review attempts to synthesize the information available on landraces wheat, cultivated in organic farming, especially their resistance qualities to fungi diseases and FHB (Fusarium Head Blight) in particular, a widespread and destructive disease of grain cereals.

Infection can also cause a reduction in grain quality through the synthesis of mycotoxins. Wheat landraces have been shown to be valuable sources of resistance to pathogens and there is more to be gained from such sources. However, changes are needed to promote the exploitation of diversity in landraces and encourage their use.

OWC2020-SCI-650

AGROFORESTRY - ORGANIC - PARTICIPATORY HOW TO CLUSTER THESE TERMS IN A PLANT BREEDING PROGRAM?

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Abstract: "Agroforestry", "Organic" and "Participatory" are 3 keywords not enough affixed and thought together. The challenge is to link them into breeding programs to release AgrOrgForestry-adapted varieties. To be adapted both to Agroforestry and to Organic conditions, a crop variety must present environmental responses traits but also effects traits. Participatory Ecobreeding is the most useful way to breed such variety. The involvement of a great diversity of actors (farmers, processors, consumers, researchers, etc) renew the way to envision agroforestry and organic breeding and to target no more GMO but SMO and even SEMO (Socially and Environmentally Modified Organisms).

Keywords: Effect traits, Resources traits

OWC2020-SCI-710

GREENRESILIENT: INNOVATIVE CROPPING SYSTEMS IN ORGANIC GREENHOUSE PRODUCTION

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Abstract: European organic greenhouse production systems are extremely differentiated. The more intensive ones have been object of debates, in the last decade, and a strong request for innovative solutions to reduce the level of intensification comes from the "organic sector". An agroecological approach to organic production in protected conditions can be an option.

This paper describes how scientists with competencies in soil science, agronomy, plant pathology, entomology and environmental sustainability assessment interact in the framework of GREENRESILIENT project (CORE Organic Cofund) to implement more resilient cropping systems in protected condition

Keywords: cropping system redesign, functional biodiversity, life cycle assessment, nutrient availability

OWC2020-SCI-753

ORGANIC SYSTEM BASED EVALUATION OF TOMATO (SOLANUM LYCOPERSICUM) FOR PARTICIPATORY PLANT BREEDING IN BANGLADESH

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Abstract: For Participatory breeding program FGD and online survey was conducted with atakeholders to identify key plant traits and a total 32 diverse set of tomato germplasm was evaluated under organic management using Augmented design to better understand horticultural constraints and identify adapted germplasm for further development. Stakeholders rated more number of fruits per plant, nutrition color (lycopene, β carotene), flavor, virus resistances, stronger root, storability as their top breeding priority, safety was the prior quality characters of tomato.

The ANOVA indicated significance difference among genotypes, the result indicated the existence of high morphological variation in tomato genotypes grown in organic system based condition.

Yield per plant showed significant variation with the quality parameter like lycopene and β-carotene. To screen out suitable cultivars through multivariate analysis and genetic diversity in tomato genotypes based on 17 characters was estimated using Mahalanobis's D^2statistics. Eight different homozygous divergent genotypes were selected from five different clusters using variance ranking among genotypes within cluster.

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Keywords: Participatory breeding, Lycopene, Stronger root, SPAD value

OWC2020-SCI-873

YIELD AND QUALITY EVALUATION OF CAPSICUM GENOTYPE UNDER MESH NET (UMN) AND OPEN FIELD AT ORGANICALLY MANAGED SOIL IN BANGLADESH

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Abstract: The study has been carried out at organically converted field under olericulture division of HRC, BARI Gazipur during November 2017 to March 2018 to find out suitable genotypes in terms of horticultural traits and nutritional quality along with growing methods.

The two factor experiment was set in a split design where net protection was under main plot and eight capsicum genotypes including 2 released varieties were grown in the sub plot with three replication.

Number of fruits per plant varied significantly and the highest number of fruits were yielded by CA0034-3 (17) followed by CA 0036 (16) and CA 0034 (15) under net condition. The lowest numbers of fruits were produced by genotypes BARI mistimorich 1 (6) at UMN. Single fruit wt also differed significantly among the genotypes and also had influenced by net. BARI mistimorich 1 and 2 produced the weightiest fruits (124 and 112 g) at UMN while the same varieties produced the lightest fruits (81.2 and 51.8 g) UMN is a good technology to produce capsicum. BARI mistimorich 1 and 2 are the two varieties released by BARI for conventional farming.

In this study it was concluded that the released variety showed good growth along with other genotypes CA 0031 and CA0036 in terms of lycopene and β carotene content.

Disclosure of Interest: M. N. Uddin received grant/research support from: AFACI ANSOFT, RDA, Korea , T. Hasan received grant/research support from: AFACI ANSOFT, RDA, Korea , M. S. Hossain received grant/research support from: AFACI ANSOFT, RDA, Korea , M. A. Siddiky received grant/research support from: AFACI ANSOFT, RDA, Korea

Keywords: Net protection, quality, capsicum, lycopene, nutrient uptake

POSTER SESSION 2: Product and Process Quality in Organic Agriculture: Methods and Challenges

OWC2020-SCI-1257

POMOLOGICAL, PHYSICO-CHEMICAL AND ORGANOLEPTIC CHARACTERIZATION OF ORGANIC AND CONVENTIONAL POMEGRANATES (PUNICA GRANATUM L.)

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Abstract: This work aims to assess the pomological, physico-chemical and organoleptic characteristics of organic and conventional pomegranates (*Punica granatum* L.) and to determine the effect of organic farming system on the quality of pomegranates production.

The trial was set up in the South-East of Tunisia and more precisely in the region of "Gabès" which is well known by the pomegranate variety "Gabsi". The production of this variety was monitored under the organic and the conventional farming systems with the same pedoclimatic conditions.

Quality of pomegranates'variety "Gabsi" was assessed in the two production systems by the pomological parameters (fruit weight, fruit size, peel thickness, juice yield ...), the physicochemical characteristics of the juice (pH, titrable acidity, soluble solids content (°Brix) reducing sugar content, polyphenols, anthocyanin content, antioxidant activity ...) and by the sensory aroma profile.

Results have revealed significant differences between organic and conventional pomegranates in several parameters. In fact, pomological descriptors have shown that organic pomegranate fruits were characterized by a thicker and a redder peel than those of the conventional ones.

Physico-chemical characteristics were also influenced by the farming systems except for the parameter of reducing sugar content. Acidity, total soluble solids (°Brix) and dry matter content were higher in organic pomegranate juice than in the conventional one respectively with the values (0.61 vs 0.48, 16.17% vs 12.83% and 28.93% vs 25.73%). In addition, polyphenols and anthocyanins were more present in the Organic pomegranate juice compared to the conventional one (1287.63 vs. 1089.53 mg gallic acid / L and 52.88 vs 40, 04 mg cyanidin-3-glucoside / 100 ml respectively).

For consumer panel test, descriptive sensory analysis have shown that organic pomegranate juice was bitter and more acid than the conventional one due to its higher richness on antioxidants, but not different in the other organoleptic parameters.

Keywords: conventional, organic, pomegranate, quality

OWC2020-SCI-1339

EFFECTS OF PROCESSING TREATMENTS IN CAROTENOIDS AND VITAMIN C CONTENTSFOR DIFFERENT ORGANIC TOMATO VARIETIES

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Abstract: This study investigates the effects of different processing treatments (hot air at 40 and 70 °C with and without blanching or milling) on the carotenoids and vitamin C contents of diverse organic tomato varieties: Citrina, Golden Jubileé, Tigrella, Red Cherry, Red Peach, and Roman Specled.

Lycopene was identified in the highest amount, followed by β-carotene. Lutein showed a lower content, which was almost similar in all tomato powders. The high lycopene and β-carotene contents were determined in tomato powders obtained by milling before drying at 70 °C. In powders obtained from tomato dried at 70 °C after blanching and dried, both lycopene and β-carotene appear in lower concentrations than those blanched and dried at 40 °C.

This study shows that there were variations in the content of carotenoids that depend on the drying method as well as the processed varieties.

OWC2020-SCI-253

YIELD AND FRUIT QUALITY OF TOMATO GRAFTED ONTO ROOTSTOCKS PARTIALLY RESISTANT TO ROOT-KNOT NEMATODES IN A NATURALLY INFESTED GREENHOUSE

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Abstract: Root-knot-nematodes (RKN), *Meloidogyne* spp., are major soilborne diseases in protected tomato production and grafting with resistant or partially resistant rootstocks has been showing promising results. The experiment was carried out in a sandy soil greenhouse in the Littoral NW Portugal.

Tomato cv. Anairis was grafted onto rootstocks Embajador, Emperador, Multifort and Silex, with non-grafted and self-grafted plants used as controls, in an experimental design of 6 treatments in three randomized blocks, to evaluate the effects on yield and fruit quality. Soil samples were collected at planting and at the end of the trial to estimate soil populations of RKN.

At the end of the trial, plants were uprooted to evaluate the numbers of galls, egg masses and female fecundity. The potential benefits of increased yield by plant grafting have not been revealed. However, plants grafted onto any of the tested rootstocks suffered significantly less nematode damage, which are in agreement with previous findings in organic and transitional fields when soil RKN pressure was low.

As tomato production in organic greenhouses can be affected by RKN due to relatively short rotations, grafting with appropriate rootstocks may play an effective role in RKN management when high populations of nematodes are present.

Keywords: Root-knot-nematodes, tomato, vegetable grafting

POSTER SESSION 3: Transitioning Towards Organic and Sustainable Food Systems

OWC2020-SCI-1033

EVALUATING THE POTENTIAL OF BIODEGRADABLE FILMS AS ALTERNATIVES TO FOSSIL FUEL-DERIVED PLASTIC MULCHES FOR WEED CONTROL IN ORGANIC FIELD VEGETABLE SYSTEMS

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Abstract: Plastic mulches are increasingly used in vegetable production systems where they are a cost-effective means of weed control. However they are usually made from fossil fuel-derived plastic and so there is concern about the environmental implications of their production, use and disposal.

This paper describes two trials that were conducted in the UK in 2019 under organic management to compare a durable woven polypropylene mulch, a polyethylene film mulch, two commercial GM-free corn starch biodegradable film mulches and two innovative potato starch biodegradable film mulches with weeded and unweeded controls.

In the trial with onions as a test crop the weeds were very competitive and quickly overwhelmed the crop both in unweeded controls and when using mulches that were easily damaged by weeds that grew beneath them. In the trial using cabbages as the test crop the more fragile mulches were able to suppress the weeds during the critical early growth period until the plants became competitive.

Plant based biodegradable film mulches have an environmental cost in terms of the inputs needed to grow, process and transport them. More research is needed to evaluate the potential of locally sourced mulch materials such wood chips from agroforestry systems and to continue to develop better biodegradable materials.

Keywords: biodegradable plastic, field vegetables, mulches, weed control

OWC2020-SCI-1145

NITROGEN MINERALIZATION AND CARBON STATUS IN AMENDED SOIL WITH BIOGAS RESIDUES

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Abstract: The aims of the study were to investigate the N mineralization potential and C status in the incubation experiment after application of digestates (solid and liquid) to the soil, and to compare with the impact of manures (solid and liquid).

Biogas residues and manures were collected from three random bioenergy production systems, using cattle manure as the main substrate, and other substrates are residues from sugar and oil industry, corn and wheat silage, etc.

The results show that all applied digestates and liquid manure increased NH_4–N and NO_3–N in soil at the beginning of the incubation. However, at the end of the 56 days of incubation, except two liquid digestates, studied organic materials led to immobilization of mineral N in soil.

Keywords: digestate, nitrogen immobilization, organic fertilizer

OWC2020-SCI-1156

SOYBEAN DEMAND OF ORGANIC AND CONVENTIONAL FARMS IN LUXEMBOURG

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Abstract: To face the Luxemburgish ambitions to reduce soybean imports, soybean demand of Luxembourg was assessed for organic and conventional agriculture and separately for ruminants and monogastrics. In SoyMAX, soybean demand according to the common feeding practices was calculated and in SoyMIN, soybean demand was calculated according to a reduced soybean input in the feeding ration.

In SoyMAX the demand in Luxembourg for soybean extraction meal is 29.182t and 16.940t in SoyMIN. Including a national soybean production, a soybean autarky of 29,8 % could be reached.

Concerning organic monogastric ration, soybean extraction meal demand could be reduced from 304 t to 245 t. Cultivation organic soybean in Luxembourg could come to a soybean autarky of 54 % for organic monogastric sector.

There exist different ways to reduce soybean imports. Nevertheless, to establish a national soybean production the whole chain needs to be build up including a processing facility and a national protein strategy is needed to develop a holistic strategy for Luxembourg.

Keywords: Luxembourg, Reduce soybean imports, Soybean autarky, Soybean demand

OWC2020-SCI-1178

LIVESTOCK FARMING SYSTEMS AND THE FRENCH SOCIETY: KEY CONTROVERSIES AND EXPECTATIONS

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Abstract: For several years, French livestock farming has been questioned by society. Those questions concern its environmental impact, sanitary risks or animal treatment and ask, more generally, livestock farming's place among a society that is more and more concerned about its alimentation.

Critics reflect different expectations towards agricultural systems: 25% of the French population want a gradual disappearance of intensive farming systems for the benefit of under official quality signs (organic, AOP, etc.) or implementing alternative practices; 10% want the development of intensive farming to increase the production and be more competitive; and between them many want a gradual but not radical improvement of the intensive system, with stronger environmental and animal welfare requirements.

Keywords: controversy, farming systems, Intensive agriculture, livestock farming, organic farming, society

OWC2020-SCI-1208

ORGANIC FOOD AND FARMING SCALING: A SEARCH STRATEGY TO IDENTIFY RELEVANT LITERATURE

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Abstract: While Organic food and farming (OFF) sector grows, this development is gaining interest in the scientific arena. As part of its new program on organic scaling (METABIO), INRAE wishes to monitor and analyze the evolution of the scientific literature on the conditions, determinants and consequencesof this transition.

But, building a search query, *ie* a combination of keywords to get relevant literature from a bibliographical database, is yet challenging on such emergent and fuzzy topic.

We present here the search strategy we developed based on both expert knowledge and an iterative and inductive process of lexical query improvement.

We show that our sophistication approach allows to capture literature with a good quality. Moreover, we detail the constraints weighting on such a strategy and the advantages of the iterative approach in the acquisition of knowledge on organic scaling.

Keywords: bibliometrics, information retrieval, organic scaling, query building, research planning

OWC2020-SCI-1355

ALTERNATIVE PRODUCTS ON COFFEE LEAF MINER OVIPOSITION

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Abstract: This study, aimed to evaluate the influence of alternative products on the oviposition of *Leucoptera coffeella*. The tests were performed in a lab on seedlings of coffee IAPAR-59 which were eight months of age and had at least four pairs of leaves.

The treatments were: control without application, distilled water, propolis extract, lime sulphur, silicate clay, neem oil, pyroligneous extract with pepper and garlic, kaolin, and kaolin + neem oil.

The treatments were sprayed with a pressure of 2 bar.

We evaluated the effect of pesticides on *L. coffeella* oviposition on treated leaves. The evaluation results of the test oviposition leaf miner no choice were subjected to analysis of variance, using the non-parametric Kruskal-Wallis test followed by Dunn's test of multiple comparisons at 0.5 %. The propolis extract, neem oil, neem oil + kaolin, and pyroligneous extract with pepper and garlic repelled oviposition of *L. coffeella*. Thus, although still to be evaluated under field conditions, it is possible that the application of these products can reduce coffee plant colonization by *L. coffeella*, thus avoiding high pest populations.

KEYWORDS: *Leucoptera coffeella*, organic coffee, clay silicate, propolis extract, plant extracts.

OWC2020-SCI-1431

NITROGEN CONSERVATION WITH COVER CROPS: EFFECT OF CN RATIO AND N LOSSES OVER WINTER ON THE POTENTIAL TO SUPPLY SUCCEEDING CROPS

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Abstract: A field trial with different cover crops was carried out in 2018 in Hennef, Germany, to clarify the fate of plant nitrogen over winter. High amounts of nitrogen (up to 100 kg ha-1) were taken up by aboveground plant biomass before winter. Nitrate leaching was avoided in a large scale compared to the untreated control.

After winter 10 to 55 % of shoot nitrogen were lost with the highest decline in legumes and the lowest in crucifers.

If mulched, losses raised up to 90 %, e.g. for narrow-leaved lupin. Nitrogen losses were slightly lower, when mulch was incorporated by rotary tilling.

The CN ratio in stems became wider after winter. Only in leaves the CN ratio was narrow enough to cause an effect on nitrogen supply to the succeeding crop. A trend to higher soil mineral N in spring was only noted in treatments with frost hardy cover crops.

Keywords: CN ratio, cover crops, nitrate leaching, nitrogen supply, succeeding crops

OWC2020-SCI-216

NUTRITIONAL VALUE AND CONTENT OF BIOACTIVE COMPOUNDS IN RASPBERRY FRUIT FROM ORGANIC, BIODYNAMIC AND CONVENTIONAL FARMS

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Abstract: Organic farming is very popular in the world. Biodynamic farming is less recognized both by practice and science. There is very sparse data about the nutritional value of biodynamic plant crops. The aim of the study was to investigate if there are significant differences in the nutritional value and content of bioactive compounds in raspberry fruit produced in biodynamic (BIOD), organic (ORG) and conventional (CONV) systems.

The results were divergent - in 2016 ORG raspberries contained more bioactive compounds than CONV. In 2017 the results were opposite - CONV fruits had significantly higher level of bio compounds than ORG ones. Composition differences between BIOD and ORG raspberries were also not consistent and showing various trends in the subsequent study years.

There is a need for long lasting studies looking for the main factors deciding about the composition of fruits in dependence on the cultivation system.

Keywords: bio compounds, biodynamic, conventional, organic, raspberry

OWC2020-SCI-282

ENCOURAGING REGISTRATION OF VARIETIES FOR ORGANIC AGRICULTURE IN FRANCE

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Abstract: France aims to establish a national catalogue with varieties suitable for organic production to support the development of organic agriculture.

To this end, proposals are to clarify the criteria specific to varieties for organic production, based on the needs of organic sectors, and to build evaluation systems adapted to each species, combining, at different levels, trials under organic and conventional conditions.

Keywords: adapted varieties, organic agriculture, registration, specific traits, Varietal evaluation

OWC2020-SCI-289

INTEGRATED ANALYSIS OF THE IMPACTS OF ORGANIC FARMING AT FARM AND FOOD SYSTEM LEVEL IN LUXEMBOURG

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Abstract: The Luxembourg government aims to achieve 20% organic agriculture until 2025 and 100% organic agriculture until 2050. The aim of the project is to analyse the impact such a change will have at the farm, as well as on the food system level in Luxembourg.

This will be done by conducting a sustainability assessment at the farm-level and the food system-level. For the farm-level sustainability assessment, farm management systems and their respective sustainability implications according to the FAO SAFA Guidelines (Guidelines for the Sustainability Assessment of Food and Agriculture Systems) will be assessed using the SMART-Farm Tool.

At the food system-level, the mass-flow model of the agriculture and food sector Soil and Organic Livestock (SOL)-Model will be employed to analyse the environmental implications of dietary patterns and agriculture production systems, where the data from the farm-level assessment will be used to increase specificity of the scenarios.

Keywords: Food system, Luxembourg, organic farming, SMART-Farm Tool, Sustainability assessment

Rahmann, Rey, *et al.* (2021) Book of Abstracts of the
Science Forum "From its roots, organic inspires science, and vice versa".
Thünen-Report 88, Trenthorst/Rennes, pp 238

OWC2020-SCI-334

ORGANIC SHARE OF TOTAL FARMLAND AND OF TOTAL RETAIL SALES AS INDICATORS TO MEASURE PROGRESS TOWARDS SDGS 2 AND 12

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Abstract: Globally, organic farming continues to grow and has reached wide acceptance amongst farmers, consumers, market actors, and policymakers.

According to the latest available data (per 31.12.2017), almost 70 million hectares are under organic agricultural management, and this constitutes 1.4%t of the global agricultural land.

The indicators "share of the organic area of total agricultural area" and "share of organic retail sales of total retail sales" are used in some countries to show the progress towards achieving the Sustainable Development Goals.

In order to enhance the use and reliability of the indicator "organic area share" and "organic retail sales share" , better data are needed. Better support for data collection from governments and international institutions could help to improve the situation.

OWC2020-SCI-350

PEAT, PLASTIC AND FERTILISERS IN ORGANIC GROWING ACROSS EUROPE - CURRENT USE AND FUTURE OPTIONS

Anne-Kristin Løes* [1], Ulrich Schmutz[2], Nikolaos Katsoulas[3], Rafaela Caceres[4], Francisco Manuel de Cara[5], Gabriella Cirvillieri[6], Alev Kir[7], Lucas Knebl[8], Krystyna Malinska[9], Frank Oudshoorn[10], Ben Raskin[11], Francis Rayns[12], Sophie Valleix[13], Judith Conroy[12] and Members of work package SOIL in the project Organic PLUS: https://organic-plus.net/wp5-soil/

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Abstract: The use of contentious inputs in organic growing was mapped across Europe in the H2020 project Organic-PLUS (GA774340, https://organic-plus.net/) during 2018. This paper presents results on peat, plastic and animal-derived fertilisers in horticultural growing.

Broadly, the use of peat and plastic is similar as for non-organic production. Many organic growers use transplants, and the growing media usually contain peat. For plastic, the use is widespread for mulching and frost protection. Plastic is also used as tree guards and attaching clips.

As a fertilisation input, dried poultry manure is used in all countries. Many more commercial fertiliser products are in use. They are often made from animal hide or vinasse. The application of such products varies widely between countries.

The project aims to develop alternatives to these contentious inputs.

Keywords: animal-derived fertiliser, contentious inputs, growing media, mulching, Organic PLUS project, soil amendment

OWC2020-SCI-358

STRATEGIES FOR WATER PROTECTION BY OPTIMISED N MANAGEMENT

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Abstract: Nitrogen (N) pollution of groundwater bodies is often a result of high livestock densities combined with use of mineral N fertilisers in Northwest Germany, specifically in combination with sandy soils and high amounts of precipitation.

Organic agriculture is discussed as an alternative management practice reducing nitrogen losses due to area-based livestock densities and waiving of mineral N fertilisers. A field trial with integrated ceramic suction cups over three years showed potential for reduced N loads under conventional management specifically with organic fertilisation. Now, the field trial is under transition into organic farming with promising additional benefits for drinking water quality and the great potential to develop optimised N management strategies.

Keywords: nitrate directive, nitrate leaching, nitrogen transfer

OWC2020-SCI-397

MEASURING EFFICIENCY OF ABOVEFARM SUSTAINABILITY RATING SYSTEM FOR ORGANIC FARMING. A CASE STUDY OF TEN CROP PRODUCTION ORGANIC FARMS IN CHINA, EAST-ASIA AND EUROPE.

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Abstract: In the last decades a broad number of tools have been developed to assess farms sustainability performance though their application had scarce influence on farmers' and consumers' decision-making toward sustainability.

Limitations lay mainly in evaluation tools' efficiency. Moreover, little attention was paid on evaluating organic agriculture and enhancement of best practices. Abovefarm sustainability rating system for organic farming aims at overcoming these limitations. The rating system: (i) translates IFOAM principles of "fairness", "ecology", "care" and "health" into sustainability indicators; (ii) measures through thresholds the level of farms' sustainability; (iii) provides an independent and free of charge tool; (iv) promotes best practices by selecting farmers who engage in sustainable practices.

The aim of this study is to design and test Abovefarm rating system for its efficiency, in order to boost organic 3.0 at global level.

Keywords: Abovefarm, Best practices, China, Organic 3.0, Organic agriculture, Sustainability evaluation

OWC2020-SCI-453

STEROIDOME AND METABOLOME ANALYSIS IN SALIVA FROM IMMATURE TO PUBERTAL GILTS TO IDENTIFY POTENTIAL BIOMARKERS OF RECEPTIVITY TO BOAR EFFECT

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Abstract: Our objective was to develop alternatives to hormones for estrus synchronization in gilts. Gilts exhibit a pre-puberty period with high urinary estrone concentration during which boar exposure could induce the first ovulation. We searched for salivary biomarkers of this period.

Urine and saliva were collected on six 140-day-old gilts until puberty for estrone assay, metabolome and steroidome analysis. We identified 23 metabolites and 28 steroids in saliva. The concentration of 8 of them showed significant variations at the pre-puberty period, they were candidate biomarkers. Saliva was collected from 30 gilts exposed to a boar and subjected to estrus detection from 150 to 175 days of age.

Metabolome and steroidome analyses allowed the identification of 33 metabolites and 29 steroids in saliva. Their concentrations were not significantly different between receptive and non-receptive gilts. Thus, we could not identify salivary biomarkers of the period of receptivity to the boar effect.

Keywords: boar effect, metabolome, porcine, saliva, steroidome

OWC2020-SCI-574

OLIVE BRANCH PRUNING MATERIAL AND BIODEGRADABLEALTERNATIVE PERFORMANCES ON ORGANIC PEPPER (CAPSICUM ANNUUM L.) PRODUCTION IN TURKEY

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Abstract: Contentious inputs in management of organic farming include the use of plastic for mulching in vegetable crops. The Horizon2020 project Organic-PLUS (GA774340) aims to develop and promote alternatives to fossil-derived plastic used for mulching. In Turkey, one promising alternative tested in field during 2019 was finely chopped pruning materials from olive (*Olea europaea* L.) branch, which performed well on organic growing of pepper (*Capsicum annuum* L.) in field.

Olive material showed better weed suppression than biodegradable plastic mulch in irrigated pepper during summer in a field experiment in Izmir/Turkey. One reason for this is that the plastic foils degraded too quickly under Turkish field conditions with a pepper crop.

Pruning materials for mulching is an interesting alternative, but practical method for producing and applying this material in field needs to be developed.

Keywords: Biodegradable plastic, olive branch prunings, organic farming, pepper (*Capsicum annuum* L.), weed suppression

OWC2020-SCI-602

THE CONSTANT AND NECESSARY REDUCTION OF RESIDUES FROM ORGANIC PLANT PROTECTION IN EU

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Abstract: The real-time management of residues of plant protection products (PPP) is a general issue for food producers and/or exporters. Organic biopesticides are described and listed in Annex II of Regulation (EC) No 889/2008 but the organic regulation is subsidiary to the general PPP regulations. Authorized pesticides under European Regulation (EC) No 1107/2009 (Reg. 1107/2009) are granted a maximum residue limit (MRL) defined by the European Chemicals Agency (ECHA).

These maximum residue limits are managed by the European Commission and listed in EC Regulation No 396/2005.

However, some Organic plant protection products (phytopharmaceutical products allowed in Organic Production) generate residues (i.e. spinosad, Azadiractin A) and therefore survey of these residues.

A "Global residue index" was generated in our institute, taking in consideration 3 classes (LMR respectively in Annex IV; Annex V; Annex II and/or III) with corresponding attributed value (0; 1; 2) characterised by an average value (residue classes sum divided by sum of active substances). The evolution of this "Global residue index" (GRI) value was followed through years.

OWC2020-SCI-795

FIELD BALANCES OF ORGANIC APPLE ORCHARDS IN TWO REGIONS OF GERMANY

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Abstract: Fertilizers used for organic apple production contain multiple nutrients with a nutrient composition that differs from that of the harvested products. Some plant protection agents also contribute to an input of nutrients.

To gain information on the status of nutrient balances and to identify potential causes for imbalanced nutrient flows, a survey was conducted in two main apple growing regions of Germany. The current management was analysed based on field balances of apple orchards using data spanning a five-year period.

The averages showed small surpluses of P (3 kg ha^{-1}), a deficit of K (-10 kg ha^{-1} a^{-1}) and stronger surpluses of N (26 kg ha^{-1}), Ca (36 kg ha^{-1}) and S (50 kg ha^{-1}). Base fertilizers had a liming effect, while some commercial fertilizers, pesticides and the offtake of harvest products had an acidifying effect. The severity and range of nutrient imbalances differed between the regions and was dependent on the kind of fertilizers (base or commercial) and pesticides used.

Keywords: fertilization, field balance, nutrient input and output, nutrient use efficiency, organic apple production, sustainability

OWC2020-SCI-895

SEEDS OF RESILIENCE: THE CONTRIBUTION OF COMMONS-BASED ORGANIC PLANT BREEDING AND SEED PRODUCTION TO SOCIAL-ECOLOGICAL RESILIENCE OF THE AGRICULTURAL SECTOR

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Abstract: Building resilience in our food systems is a priority to meet challenges such as climate change. However, there has been little systematic research on the role of seed production in fostering agroecological resilience. The ongoing privatization and concentration in the seed industry result in the development of only a small number of high-yielding varieties. To counter this trend, new organizational approaches in plant breeding and seed production build upon common ownership and collective management. This study analyzes, conceptually and empirically, how commons-oriented seed production promotes the resilience of crop systems in comparison to conventional private-property-based structures.

We apply an indicator-based framework to assess the contribution of the two types of governance systems (conventional and commons-based) to the resilience of crop systems. To derive qualitative data, we carry out a document analysis of publications from breeding and seed producing organizations. Subsequently, we comparatively assess the impact of the two types of organizational structures on agroecological resilience. The paper shows that conventional seed production has advantages in terms of production efficiency under controlled cultivation conditions as well as greater financial viability.

However, commons structures in the seed sector promote agroecological resilience in several aspects. They foster diversity at genetic, crop species and landscape level, create redundancy of different seed supply channels, and increase autonomy from external resource inputs and international markets. The resilience of governance structures is also strengthened through a high degree of self-organization of farmers along the value chain, participatory breeding approaches and greater access rights to seeds.

Keywords: Agroecosystems, commons, resilience, seeds, plant breeding

OWC2020-SCI-930

FOOD SYSTEMS SUSTAINABILITY TRANSITION: A MULTI-LEVEL ANALYSIS OF CONVENTIONAL, VERTICAL AND ORGANIC VEGETABLE PRODUCTION IN THE YANGTZE RIVER DELTA GOLDEN TRIANGLE (CHINA)

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Abstract: The dominant global corporate food regime disrupts ecological and social spheres. Attempts towards transition toward more sustainable food regimes exist but the pathways are manifold. The aim of this study is to disentangle potential pathways for sustainability transition of the Yangtze River Delta (YRD) food system in China. Thus, we measure and contextualize the level of sustainability of alternative and dominant vegetable production regimes.

Three farms were selected as case studies: conventional (representing the dominant corporate regime), vertical (representing a corporate-environmental niche) and organic (representing an ecological niche).

Results illuminate the motivation of potential pathways of sustainability transitions in the YRD. The dominant corporate regime is currently influenced in terms of sustainability by a) technological innovation coming from the corporate-environmental niche, and b) ecological and social innovations coming from the ecological niche.

Keywords: China, Embeddedness, Food system, Sustainability transitions, True value accounting

OWC2020-SCI-966

COMPARATIVE STUDY OF ORGANIC FARMING PRACTICES AMONGST RURAL HOUSEHOLD LIVESTOCK, CROP AND FISH FARMERS: THE CASE OF SOUTH-SOUTH, NIGERIA.

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Abstract: Comparative analysis of organic farming practices amongst farmers in South –South Nigeria was carried out. Multistage random selection technique was employed to select rural households engaged in fish, livestock and crop production Organic farming practices amongstcrop farmers were the use of farmyard manure, intercropping, mulching and spot bush burning. Among livestock farmers were access to fresh drinking water and adequate feeding. Out of the fourteen practices outlined, fish farmers engaged in the use of three of such practices - eco-friendly design, site is far from polluting substances and pond protection from predators.

There was significant difference in the farmers' level of use of organic farming practices based on their states of origin (Akwa-Ibom, Bayelsa and Delta). It was concluded that farmers' in Akwa-Ibom state make use of organic farming practices best, followed by Bayelsa state and the least is Delta state.

Keywords: fish farmers, livestock farmers, organic, rural households

OWC2020-SCI-1110

IMPACT OF CLOVER-GRASS BASED FERTILIZER ON YIELD OF POTATO (SOLANUM TUBEROSUM) IN STOCKLESS ORGANIC FARMING SYSTEMS

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Abstract: Clover-grass (CG) is an important crop in organic rotations due to its nutrient input, its importance as ruminant feed, and for weed control. In stockless organic farming, CG is no longer needed as animal feed but new uses as fertiliser or feed stock for biogas production may gain importance. To test the use of CG products as fertilizer, a two-year field experiment was set up at the organic research station Kleinhohenheim in SW-Germany.

The study assessed the efficiency of different forms of CG based fertilizers (silage (spring and autumn application), pellets, biogas digestate, fresh cut and carry, all spring application) compared with animal based fertilizers (farmyard manure and horn grit) for fertilisation of potatoes (*Solanum tuberosum*).

Total fresh tuber yield in the first year (2018) ranged from 28 Mg ha-1(control) to 34 Mg ha-1 (biogas digestate). In the second year of the experiment (2019), the fresh tuber yield ranged from 33 Mg ha^{-1} (silage spring) to 37 Mg ha^{-1} (pellets). The treated plots were not significantly different from the unfertilized control, but clover grass pellets (37 Mg ha-1) showed significant higher yield than unfertilized control (33 Mg ha^{-1}) and silage applied in spring (31.6 Mg ha^{-1}).

Keywords: Animal based fertiliser, Clover-grass based fertiliser, Nitrogen dynamics,

Organic fertiliser

POSTER SESSION 4: Innovation in Organic Farming: "Thinking Outside of the Box"

OWC2020-SCI-1067

OPTIMAL UTILIZATION OF NATURAL PHYTASE ACTIVITY IN FEED GRAINS FOR MONOGASTRIC ANIMALS

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Abstract: The aim of this work is to improve the phosphorus utilization in organic pigs and poultry, for lower phosphorus usage and leakage. To reduce leaching of phosphorus in the manure from monogastric animals, it is essential that phosphorus utilization in the feed for pigs and poultry is optimized.

Monogastric animals are unable to digest the phosphorus containing phytate, as they lack digestive enzymes (phytase) that can break it down. All cereal species have phytase in the kernels, but the amount varies between species and varieties. New feed mixing concepts are developed, to reduce addition of phosphorus in the feed.

On-farm trials in pig herds will be conducted in farms with home-mixed feed and with fabricated and pelleted feed, where a large proportion of grain is not being pelleted. The results will show whether the slaughter pigs are provided with sufficiently digestible phosphorus with the new feed concepts. Similar trials will be conducted in poultry farms.

Keywords: cereals, leakage, monogastrics, phosphorus, phytase, pigs

OWC2020-SCI-1125

INSTITUTIONAL INNOVATIONS FOR ORGANIC AGRICULTURE IN AFRICA

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Abstract: What are the main drivers and bottlenecks that shape the development of the organic sector in Africa? Which factors can support an organic transition in Africa? In this paper, we hypothesize that in order to scale up organic agriculture, food system actors must engage not only in technological innovations in production and processing, but also in institutional innovations.

A change in scale means here an increased geographical presence and organizational capacity, distributed and autonomous activities, and a strong movement to share experiences across Africa. By institutional innovations, we mean new rules of exchange for fair and inclusive markets, new technologies and practices to guarantee organic quality, and innovative public policies.

Based on three national cases (Uganda, Tanzania, Morocco), we propose a methodology to explore the potential synergies among these three types of institutional innovations.

Keywords: Africa, institutional innovation, market development, Participatory Guarantee Systems, public policy

OWC2020-SCI-1166

MANAGEMENT OF A PERMANENT COVER CROP IN AN ORGANIC FARMING SYSTEM

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Abstract: The current societal, political and regulatory context is bringing farmers to search and develop low-input cropping systems, particularly in organic farming. Sowing a permanent cover crop is a practice of interest for those systems.

Several functions can be highlighted: enhancing the symbiotic activity of the cover crop species to bring nitrogen into the system and limit the use of exogenous fertilizers, weed control through canopy competition, and erosion mitigation in sloping plots.

In organic agriculture, the non-chemical management of a permanent cover crop can be difficult and existing mowing solutions can only be done in the fallow period. Thanks to the collaboration between ARVALIS and an agricultural machinery manufacturer, an inter-row mower prototype was created to manage the cover crop into the main crop.

This mowing is made possible by the tractor's self-guiding system, which is also used for sowing the permanent cover crop and the main crop.

This technique has already been tested in the south of France where a trial with alfalfa and wheat was carried out. The first results are very encouraging; in the situation where alfalfa is mowed three times, wheat yields reach 26.6 q/ha and 13.9% of protein.

To confirm these initial results, a larger-scale experiment was set up with other permanent cover legumes species and different mowing methods using the innovative inter-row mower prototype.

The innovative nature of this technique for managing permanent cover crop thus offers multiple perspectives for the agro-ecological systems of tomorrow.

Keywords: agro-ecology, mowing, organic agriculture, permanent cover, self-guiding system

OWC2020-SCI-1282

YIELD PERFORMANCE AND LER OF SELECTED ORGANIC MIXTURES OF LUPINS WITH SPRING CEREALS

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Abstract: The aim of the research was to assess the productivity of various organic cereal-grain legumes mixtures and to indicate their most favorable variants. The trial has been located in the IUNG-PIB Experimental Station in Osiny (eastern Poland) on a loamy sand soil. The presented results included two years (2018-2019).

The following crops and cultivars were taken into account in the trial design: yellow lupine (Perkoz - self-determinate cultivar and Baryt - traditional cultivar); narrowleaf lupine (Regent - self-determinate cultivar and Kurant - traditional cultivar); oat (Krezus cultivar) and spring triticale (Mazur cultivar).

The land equivalency ratio (LER) was calculated on the basis of determined yields. It was done in order to assess the yield benefit in a mixture. High values of LER noted for mixtures of spring cereals with lupines demonstrated their good mixing ability. It was shown higher values of LER for mixtures with oat than with spring triticale independently on the species of lupine.

Keywords: intercropping, yield

OWC2020-SCI-1308

DIGITAL TECHNOLOGY TO SUPPORT ORGANIC GROWERS? MESCLUN: A WEB APP TO HELP DESIGNING COMPLEX ORGANIC VEGETABLE PRODUCTION

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Abstract: For organic vegetable growers, combining long rotations involving a high level of plant diversity with intercropping can bring economic and ecological benefits but often increase management complexity and workload. To support the decision making of farmers facing such challenges, the research-action objective of the MESCLUN programme is to develop a web application based on the innovative computer technologies of knowledge graphs and semantic web. In this French transdisciplinary project, we articulate methods and frameworks from different fields (agronomy, economy, design, knowledge and computer engineering) with expertise of agricultural practitioners (organic growers, advisors, teachers, organic farming students).

Through an iterative and participatory approach based on co-innovation workshops in 4 contrasted regions of France, we design, develop and test web app prototypes to help farmers to appropriate systemic thinking, explore and assess their "own" solutions in the organisation of complex organic vegetables systems. We will present functionalities/interface of the first web app prototype.

We will for example show how the web app can help growers to plan their crops in space and time considering contrasted fertility and plants health strategies as well as marketing requirements. We will also illustrate how different simulations can be assessed from a socio-economic perspective (workload and income).

Based on those first results, we will examine the specificities, added value and blind spots of our web app compared to other decisionmaking tools in the organic agricultural sector. To feed a more general debate, we will provide critical discussion points on the potentialities and limitations of innovative digital solutions to support decision making in complex organic farming systems.

Keywords: agroecology, computerbased tool, Decision making, Organic vegetable production, Participatory approach

OWC2020-SCI-1349

GENODICS - A NEW MUSICAL AND SCIENTIFIC APPROACH TO THE GROWING OF FRUIT AND VEGETABLES

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Abstract:L'émission d'ondes de nature quantique (onde de De Broglie) lors de l'expression des gènes dans le vivant est prédite et théorisée par la génodique. Au moyen de cette approche, des problématiques agricoles telles que les maladies du bois en viticulture, des bactérioses ou encore des viroses en maraichage, ont fait l'objet d'expérimentations et de traitements sans intrants à travers l'activité de l'entreprise Genodics depuis une douzaine d'années.

Les résultats de certaines de ces campagnes, sur la vigne (Esca et Mildiou), l'endive (Erwinia) et la courgette (WMV2, ZYMV) ont étés compilés afin d'analyser l'impact de la méthode utilisée au plan statistique.

L'ensemble de ces résultats indique une réduction significative de l'impact des pathogènes sur la production agricole, et consolide la fiabilité de la méthode dans un traitement sans intrant de pathologies végétales et sa pertinence dans des parcours agronomiques visant une réduction des intrants, une conversion vers un mode agricultural raisonné ou encore la stabilisation de cultures déjà engagées dans la limitation des traitements chimiques.

OWC2020-SCI-1359

PARTICIPATORY RESEARCH AS A KEY FACTOR FOR THE TRANSITION OF FARMING IN ORGANIC RICE

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Abstract: Italy is the largest producer of rice in Europe (with 1,466 kt in 2015 against 2,946.45 kt in the EU; FAOSTAT). Production is mainly located in the agricultural area of the Lombardy Po Valley, which is among the most productive agricultural areas in Italy.

In these areas, agriculture is mainly based on monoculture and intensive systems, involving a heavy use of chemical inputs. In this agri-environmental context, Organic Rice Cultivation Systems (ORCS) described in this paper represent a novelty.

Their establishment was kick-started by a bottom-up, farmer-driven innovation process, later supported by a more structured participatory breeding initiative. This paper analyses such initiative, which involves a multi-actor network and strives to support farmers' innovation through co-developing sustainable agronomic practices while on-farm testing and selecting of appropriate rice varieties.

The process aims at facilitating the consolidation of ORCS to enable them to become a founding element of the transition to more sustainable solutions for cereal agriculture in the target area as well as others. The results described here highlight the strengths and weaknesses of this methodological approach.

Keywords: Organic Agriculture, Biodiversity, Participation, Decentralization, farmers' knowledge,

OWC2020-SCI-1411

EFFECTS OF ORGANIC SUBSTRATES NATURE ON THE COMPOSTING PROCESS PARAMETERS ANDCOMPOST EXTRACT EFFICIENCY ON SOIL-BORNE PLANT DISEASES

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Abstract: Four Composting windrows were carried out by the wastes (about 8 000 kg) in pyramidal form (height 1.5 m with base of 8m x 2 m) which constitute four different treatments: 1st treatment : 100% Cattle manure, 2nd treatment : 80% Cattle manure + 20% Sheep manure, 3rd treatment : 70% Cattle manure + 20% Sheep manure + 10% Poultry manure and 4th treatment : 50% Cattle manure + 20% Sheep manure + 20% Poultry manure+ 10% crushed wheat straw. Windrows were watered every time is necessary and turned over after 15 days. Temperature rased every two days and samples rased in every turned over.

The physicochemical parameters of composting process revealed that the highest temperature of windrows was in thermophilic phase and has reached 66°C for T_4 rich in carbon than for other treatments. The basic pH in the beginning decreases for all treatments and approaches the neutrality at the end of composting process, essentially for T_1. A decrease of nitrogen percentage during composting probably due to a low level of C/N ratio in the beginning.

The second part of this study starts in the maturity stage, a compost extract were prepared from different composts one volume of compost in 5 volume of water and 5 days of extraction period.

The four obtained compost extracts, were experimented on different plants pathogens (Rhizoctonia solani, Fusarium solani, Fusarium oxysporum, Fusarium roseum, Fusarium graninearum and Phytophtora erythroseptica) in vivo and in vitro.

Keywords: compost extracts, Composting Parameters, Pathogens, Soil-Borne

OWC2020-SCI-239

ORGANIC EPRINTS - HELPING SCIENCE GO TO WORK

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Abstract: Organic Eprints is the only archive in the world for publications based on research in organic agriculture and food systems. Organic Eprints (www.orgprints.org) is an international open access archive of electronic documents related to research in organic food and farming.

The archive contains full-text papers together with bibliographic information, abstracts, and other metadata. It also offers information on organisations, projects, and facilities in the context of organic farming research.

It contains more than 23,000 eprints, more than 18,000 with Open Access. The documents are mainly in English and German, mostly from conferences but also many journal papers. Almost 160,000 downloads are made per month from all around the world. It is free to use, search, download and anyone can upload their own papers if they comply with the objectives of the archive.

Organic Eprints can be used for disseminating knowledge about Organic agriculture research, and both the researchers uploading their papers and the end-users downloading papers would benefit from an even wider use of the archive around the world.

Keywords: dissemination, research

OWC2020-SCI-276

CALIBRATING WATER HYACINTH BASED COMPOST FOR ORGANIC ONION (*Allium cepa*) PRODUCTION

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Abstract: Water hyacinth based compost is a recent innovation aimed at addressing the menace of water hyacinth on water ways. However, there is paucity of information on specific quantity of the water hyacinth compost for optimum yield of onion (Allium cepa).

Thus, the effects of different levels of water hyacinth based compost on the fresh yield of onion (Allium cepa L.), as well as the post-harvest soil fertility in an organic farming system are presented in this report.

An experiment was carried out in two years at the Organic Vegetable Garden of the Teaching and Research Farm; University of Ibadan, to calibrate water hyacinth based compost for fresh yield of onion. The compost was applied at the rates of 0, 30, 60 and 90 kg K/ha in 2015 and 0, 30, 60 and 90, 120 and 150 kg K/ha in the year 2016 in a randomized complete block design with four replicates.

Data were collected on fresh onion bulb weight as well as post-planting soils. Yield data were subjected to analysis of variance (ANOVA) and means were separated using Duncan Multiple Range Test, while soil data were subjected to descriptive analysis.

Keywords: Water hyacinth compost, Potassium, Organic fertilisers, organic farming system, Onion, Soil fertility

OWC2020-SCI-284

PRACTICE ABSTRACTS: A NEW CHALLENGE FOR RESEARCHERS PARTICIPATING IN HORIZON 2020 PROJECTS

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Abstract: The European Union's research and innovation programme, Horizon 2020, requires multi-actor projects to generate practice abstracts. All practice abstracts are produced using the EIP-AGRI common format and made available on the EIP-AGRI website. Although practice abstracts can be valuable tools, they are associated with several challenges.

These include issues related to clarity of content, format, timing, language and accessibility.

This paper outlines these challenges and then provides recommendations for projects as well as EIP-AGRI and the EU in order to address them. We conclude that the EIP-AGRI website could benefit from some changes in order to achieve its goal – measuring the impact of research on practice. However, with some possible enhancements and the continuous integration of these tools into the projects in the European Union's framework programs, this goal can indeed be achieved.

Keywords: Horizon 2020, knowledge exchange, knowledge management

OWC2020-SCI-315

DIVERSITY OF WHEAT CROP MANAGEMENT FROM CONVENTIONAL TO ORGANIC FARMING: SOCIO-ECONOMIC AND ECOLOGICAL ASSESSMENT.

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Abstract: Biological control is considered a promising way to reduce pesticide use in cropping systems. In this study we aimed to assess biological control and natural enemy communities in a diversity of organic and conventional wheat fields. We also aimed to evaluate economic and labor aspects of cropping systems studied.

Twenty pairs of organic and conventional fields were studied in Brittany, France in 2016. Data on carabid abundance and species richness, as well as pest predation rates were collected in fields; crop management and machinery used were also surveyed. We identified 2 organic crop management types and 3 conventional types. Results were not equal for all types of each category.

One type of organic crop management, associated with less work for farmers and more economic profit, was beneficial to carabid beetles. Predation rate was lower only in one type of conventional crop management compared with other management types. This study underlines the need to account for the diversity of crop management strategies to assess socio-economic and ecological aspects in organic and conventional farming systems.

Keywords: agroecology, biological control, carabid, wheat, labor

OWC2020-SCI-715

TOWARDS A POWERFUL KNOWLEDGE DATABASE TO THINK OUTSIDE THE BOX AND SELECT MULTI-PURPOSE PLANTS

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Abstract: Knowledge on plant uses is often compartmentalized into fields. Our hypothesis is that if a plant species allows several uses of interest, in different fields, then its cultivation and formulation may be of interest to new value chains.

Establishing a knowledge database on multi-purpose plants is one way of facilitating interactions between disciplines, in addition to proposing new solutions to be explored in organic or ecological farming. This paper describes how to construct such a Knowledge Database.

A comparison between the uses present in the different tabs makes it possible to identify 16 plant species reported for at least four different uses.

Keywords: None

OWC2020-SCI-842

THE SOCIAL AND ECONOMIC IMPACTS OF DIGITALIZATION IN ORGANIC AGRICULTURE: THE EXAMPLE OF ROBOTS FOR WEED CONTROL IN SWITZERLAND

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Abstract: The goal of this paper is to initiate a debate on the implication of introducing digital technologies into organic farming practice. With the example of a living lab on "Robotics in Swiss Organic Farming", we will present first results of our study in the framework of the on-going EU research project DESIRA.

The living lab consists of a network of farmers, advisors, technology experts, innovators, and consumers to ensure that all relevant perspectives are integrated in the research. At the OWC, we will present the results of a first workshop on the assessment of needs, expectations and impacts of the technology.

Further steps in the project will include creating scenarios for possible, desirable and non-desirable future developments of the technology. By presenting initial results of an on-going research project, we aim to enlarge the audience and discussion group on the introduction of digital technology in organic farming.

Keywords: Digitalization, Ethical code, Innovation, Robots, Socio-economic impacts

OWC2020-SCI-849

BIOSTIMULANTS INFLUENCED GROWTH AND PRODUCTIVITY OF THE ORGANIC STRAWBERRIES

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Abstract: Organic strawberry production is faced with several biotic and abiotic stresses that compromise crop productivity and berry quality. In order to improve yield and berry quality, we have compared the potential beneficial effects of seven biostimulant treatments 1- control without biostimulant (CONTROL), 2- seaweed extract (SEAWEED), 3- mycorrhiza Rhizoglomus irregular (MYC), 4- mix of three bacteria, Azospirillum brasilense, Gluconacetobacter diazotrophicus, and Bacillus amyloliquefaciens (BACT), 5- combination of MYC+BACT, 6- MYC+BACT with a low fertilization (MYC+BACT/LF), and 7- citric acid-based (CITRIC) within a complete randomized block design with five replicates.

Our results showed that some biostimulants did impact the soil relative abundance of fungi and soil CO_2 efflux, while no effect was observed for the microbial activity (FDA) compared with the control. Leaf chlorophyll content and the chlorophyll fluorescence were not significantly affected by biostimulants.

MYC decreased the number of flowering stalks (-18%) compared with control plants, while citric acid increased their dry root biomass (+35%). However, biostimulants did not affect the mineral content of leaves.

Little effect of biostimulants on crop productivity was observed compared with control plants. However, MYC+BACT increased ºBrix (+11%), total polyphenols (+40%) and anthocyanins (+26%) of the berries compared with control. The use of a lower fertilization reduced plant growth and yield.

Keywords: bacteria, Brix, citric acid, fluorescein diacetate, Monterey, mycorrhiza

OWC2020-SCI-892

HOW DO AGRICULTURAL PRACTICES INFLUENCE THE BALANCE BETWEEN SOIL ORGANIC MATTER STORAGE AND CROP YIELDS IN ORGANIC SYSTEMS?

S. Menasseri-Aubry, V. Viaud, M-Elise Samson, M. Chantigny, D. A. Angers, A. Vanasse

Abstract: In organic cropping systems, appropriate ecological agricultural practices (e.g., organic fertilization, rotation's diversification with perennial crops) must induce a balance between yield and soil organic matter storage, to sustain production while preserving soils.

Their efficiencies depend on the whole cropping systems, the type of soil, the considered time scale and the climate. We will illustrate this issue with research results obtained from 3 different field studies conducted in Quebec (Canada) and Brittany (France).

OWC2020-SCI-1311

ORGANIC SEEDS AND VARIETIES IN FRANCE: AN OFFER TO BE DEVELOPED.

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Abstract: The diversity of organic farming systems ("formal organic", agroforestry, permaculture, etc.), the long rotations usually implemented, the diversity of processing (industrial, handmade) and marketing systems (supermarkets, short chain, on farm, etc.) generate a huge diversity of demands in terms of crop species and varieties adapted to organic agriculture.

However, in France, farmers have a limited choice of crop varieties specially bred for organic conditions (only one durum wheat variety and 5 bread wheat varieties). So, they must sow organic seeds of "conventional" varieties.

These organic seeds are largely those of foreign varieties (not listed in the French Catalog but in the EU one) and are therefore not the best suited to the local conditions and needs. It seems urgent to raise awareness among all the actors so that they can get involved in breeding programs to develop varieties and seeds for organic sector, through participatory approaches.

Keywords: Participatory breeding, orphan species, seed sector, variety registration

OWC2020-SCI-1441

HOW DO WE EVALUATE AND GIVE ECONOMICAL VALUES TO ORGANIC FARMING AND FOOD EXTERNALITIES?

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Abstract: In addition to producing food, farming also generates negative externalities (costs) or positive externalities (benefits or amenities) that financial markets do not take into account. These externalities have taken more and more importance in social expectations. Several public tools tend to take them into account, and market initiatives tend also to reveal them and give them value.

The question of quantifying externalities of organic farming (OF) is an old one. There have been numerous papers in different countries producing multi-criteria assessment. Nevertheless, very few of them have tried to give economical values to these externalities in the context of promoting new tools in the future CAP, namely payment for environmental services.

Our methodology consisted in identifying, qualifying, quantifying and assigning economic values, when possible, for environmental and social externalities differentials between OF and conventional farming (CF).

Our results show that OF generates positive externalities differentials on very large items, with a few points to improve, and a concerning point about productivity that impacts some indicators like land use.

This analysis gives not only a summary of established knowledge but also identifies points where knowledge gaps need to be filled or which are controversial, and points methodological difficulties, in particular i) the use of a conventional repository, which evolves, and which can be very territorial dependent, but also ii) the difficulty of establishing causalities between practices and ecosystems services' bouquets, and iii) the problem of payment levels for farmer's practices when the services improvement can be a result of practices' management at different scales.

Keywords: Ecosystem services, Externalities, Human health, Multi-criteria assessment, Public goods, Sustainability

OWC2020-SCI-890

USING PUBLIC FOOD PROCUREMENT TO PROMOTE ORGANIC PRODUCTION AND CONSUMPTION: THE ROLE OF THE REGULATORY FRAMEWORK FOR MULTIPLE POLICY GOALS

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Abstract: Public Food Procurement Programmes (PFPP), including school feeding, are receiving increasing attention as an important policy instrument with the potential to deliver multiple benefits for multiple beneficiaries, including food consumers, food producers and local communities.

A key characteristic of PFPP is that it has the possibility – based on sound policy and regulatory frameworks - to determine not only the way food is produced and procured, but, in particular (i) what food will be purchased (such as local, socio and bio-diverse, nutritious, healthy, culturally appropriate); (ii) from whom (e.g. from local and/or family farming producers, small and medium food enterprises, women, youth and/or other vulnerable groups); and (iii) from which type of production (e.g. from agricultural production that ensure environmental sustainability as well as biodiversity).

In doing so, IFPP has considerable potential to influence both food consumption and food production patterns, contributing to the transformation of local food systems.

Building on the existing literature on food procurement and on two countries experiences this chapter examines the multiple benefits that PFPP has the potential to achieve with a focus on the promotion of organic production and consumption. It will also analyze key enabling and constraining conditions, focusing on the role of conducive regulatory frameworks.

Keywords: organic and local food, PUBLIC POLICIES, public procurement, regulations

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