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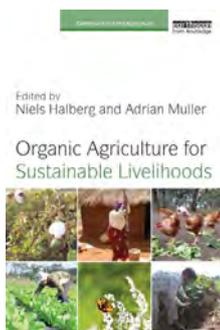
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We listen to our readers's response with pleasure, as we are here for you!
Therefore, any responses are more than welcome, be it about the new format, suggestions to improvements, changes, content or anything you can think of.

Contact us at: Camilla.Mathiesen@icrofs.org

New book:
Organic Agriculture for Sustainable Livelihoods
Edited by Niels Halberg & Adrian Muller



This book provides a timely analysis and assessment of the potential of organic agriculture (OA) for rural development and the improvement of livelihoods. It focuses on

smallholders in developing countries and in countries of economic transition, but there is also coverage of and comparisons with developed countries. It covers market-oriented approaches and challenges for OA as part of high value chains and as an agro-ecologically based development for improving food security. It demonstrates the often unrecognised roles that organic farming can play in climate change, food security and sovereignty, carbon sequestration, cost internalisations, ecosystems services, human health and the restoration of degraded landscapes. **Read more and buy it at:** <http://www.routledge.com/books/details/9781849712965/>

ISO FAR Board meeting in Republic of Korea

ISO FAR – International Society of Organic Farming Research, www.isofar.org, is the international organisation for researchers involved in Organic Agriculture. ICROFS is represented in the board of ISO FAR by Ilse A. Rasmussen, who was elected to the board at the general assembly of ISO FAR in 2011. The board has held several skype meetings, but had its first face-to-face meeting after the election in Korea on September 15-16, 2012. 9 of the 12 board members were present, and one even participated part of the time through skype. A very important topic for discussion was the World Organic Expo 2015 in Korea, which ISO FAR will support through scientific input. Another issue was the Journal of Organic Agriculture, the offi-



cial journal of ISO FAR. ISO FAR members get free access to the online version of the journal, and even for non-members, the most downloaded papers are freely available.

The journal needs more submissions of high-quality papers. In connection with the board meeting, the board members gave presentations at "International Symposium on the Development of Organic Agriculture", which was held by Chungbuk Provincial Government and Goesan County on September 14th, 2012, and at 2nd ISO FAR International Symposium on Asian Organic Agriculture, 17th September 2012, Dankook University, South Korea, which was a part of the celebration of the 65th anniversary of Dankook University.



CORE Organic II

The CORE Organic II consortium has selected two projects for funding of the second call. The two projects are very big, both involving nearly all countries taking part in the call. The plant breeding project selected is COBRA - Coordinating Organic plant BREeding Activities for Diversity. The project will be coordinated by Thomas Döring, The Organic Research Centre, United Kingdom. For organic market the selected project is Healthy-Growth - Healthy growth: From niche to volume with integrity and trust. The project will be coordinated by Egon Noe, Institute of Agroecology, Aarhus University, Denmark. A summary of both projects and a list of countries in the consortium can be found at the website: www.coreorganic2.org The third call is still open until 7 November 2012. The thematic research area is phosphorous management. Please see website for more information. The CORE Organic II consortium will apply for further support from the European Commission in the form of an ERA-NET Plus project to continue the collaboration.



Analysing 15 years of Danish Organic research

A comprehensive effect analysis of 15 years of organic research has been carried out and presented at

a conference in August 2012 at "Christiansborg" in Copenhagen for the Minister for Food & Agriculture. You will find the analysis "Organic Research and Development 1996-2010 – Effects on industry and society" at www.icrofs.dk (in Danish, English version will be available later) Here you will also find the new Research and Development Strategy from ICROFS.

International organic research



ICROFS' third topic theme: Organic research in Canada

ICROFS news presents three articles from OACC (organic agriculture centre of Canada) - one general article on research and organic agriculture in Canada, one on organic greenhouse production research and one on phosphorus research.



Research activities on sustainable and organic agriculture in Canada

In this issue - and in forthcoming issues - *ICROFS news* will bring a number of topic themes presenting current research programmes in different countries on the globe.

Organic Agriculture Centre of Canada: Linking Organic Knowledge



By Andy Hammermeister
Director, Organic Agriculture Centre of Canada

Organic research in Canada has never been stronger! With a national centre, the Organic Agriculture Centre of Canada, focused on developing and communicating the science behind the growing field of organic agriculture, a strong and expanding organic market, and a country- and discipline-spanning research program, the Organic Science Cluster, the future of organic agriculture in Canada is bright.

Get to Know the Organic Agriculture Centre of Canada

The Organic Agriculture Centre of Canada (OACC) was founded in 2001, and as the only institution of its kind in Canada, plays a leading role in organic research and education. Guided by a vision of sustainable and science-based organic agricultural systems supporting healthy Canadian communities, OACC's mission is to facilitate research and education for organic producers and consumers to build sustainable communities. The OACC team has a high degree of enthusiasm for our mission and a strong commitment to academic rigour. OACC cultivates strong linkages with producers, scientists, government extension agents and industry stakeholders right across the country from our base at Dalhousie University's Agricultural Campus (formerly the Nova Scotia Agricultural College), nestled in the center of Canada's ocean playground province, Nova Scotia.

Since our establishment eleven years ago, the OACC

has worked with over one hundred farmers and over eighty researchers across Canada. With the support of our industry partners, we coordinate national, strategic research initiatives such as the Organic Science Cluster.

Linking Organic Knowledge

OACC's goal is ultimately to link sound, scientific knowledge about organic agriculture with those on the ground who put this information into practice: the farmers, students, stakeholders and consumers of organic products. OACC strives to provide resources and respond to the needs of the Canadian organic community. We focus on providing resources through our website, www.oacc.info, and free monthly E-kzine, maintaining current content and links to organic science, extension and education information relevant to Canadians.

Linking organic knowledge requires both give and take. While OACC strives to provide information to organic stakeholders, we also ask the organic community to bring their information and needs to us. To ensure that the research projects undertaken have meaningful impact,

OACC regularly invites farmers across Canada to provide input on what research would be most meaningful for them. These research needs are then prioritized, to ensure that the projects with potential for the most impact are pursued.

Canada's Organic Science Cluster

Perhaps the most exciting developments for organic research in Canada have come in the past three years. In 2009, OACC, in collaboration with the Organic Federation of Canada, received federal government funding to develop the Organic Science Cluster. This unassuming name belittles the impact and import of this project, which funnels over \$8 million in research funding into Canada's organic industry. The Organic Science Cluster spans the country with activities in nine of the ten Canadian provinces, engaging all major agricultural universities in Canada and enlisting the collaboration of federal Agriculture and Agri-Food Canada scientists. This equates to over 80 scientists at 36 research institutions participating in organic research projects that are supported by over 30 industry funders.

Supporting Growth..

Canada's organic community and industry are both strong, but there is always room for improvement. The organic sector in Canada is currently experiencing notable growth, expanding at a rate of 15-20% per year. Yet, approximately 80% of organic food consumed in Canada is imported. The funding for the Organic Science Cluster, awarded through Agriculture and Agri-Food Canada's Growing Forward Program, is meant to support growth in the organic sector by strengthening the science behind organic agriculture in Canada, ultimately helping the country's organic farmers capture more of this \$2 billion domestic market while also improving their ability to compete on a global scale. Most of this research, while directed toward organic agriculture, can also be applied to conventional production systems, thereby drawing interest to the cluster from producers across Canada.

...By Strengthening the Science Behind Organic
The Organic Science Cluster is helping to develop the science that underpins the ability of Canada's organic



industry to increase the quality and quantity of products produced, while also characterizing and promoting the aspects of organic production that are important to Canadian consumers. With ten main research components, which are further divided into 28 research activities, the cluster has brought about an abundance of research projects that span a wide range of topics and areas.

Scientists are now working at setting the groundwork for significant improvements in phosphorus use efficiency in organic crop production, leading organic into an era of low-till production without herbicides, providing a landmark breakthrough in energy efficient organic greenhouse production, developing effective systems for management of organic horticultural crops, characterizing the contribution of organic production to reducing greenhouse gas emissions, establishing benchmarks for animal health and welfare in dairying, developing new meat preserving methods, and addressing barriers in high value fruit production.

Organic agriculture is strengthening in Canada, with support for key research at a time when there is renewed emphasis on innovation, efficiency in energy, labour and economics, and capturing value-added markets. The future does, indeed, look bright. For more information about the OACC and Canada's Organic Science Cluster, please visit www.oacc.info.



OACC certified organic research field. Photo by Joanna MacKenzie

Organic Produce in the Winter: Organic Greenhouse Production Research in Canada



By Joanna MacKenzie, Organic Agriculture Centre of Canada

Fruits and vegetables account for just over 40% of the organic consumption in Canada. Yet, it has been estimated that only 15% of organic products consumed in Canada have been produced inside this country's borders. While cold and blustery winters provide Canadian organic agriculture a natural advantage in terms of pest control, it also greatly shortens the growing season, creating a dearth of fresh locally-produced organic products through the long winter months.

Researchers have set out to develop production systems that will allow local supplies to meet consumer demand. Many efforts are now focused on the development of organic greenhouse and high tunnel practices that fall in line with organic principles. Yet, organic greenhouse production is not without its own challenges, which lie largely in the cost of heating, the development of growing media and fertilizers, and the management of pests and diseases. As part of Canada's Organic Science

Cluster, researchers across Canada, led by Martine Dorais, David Ehret, Steeve Pépin, Damien deHalleux and Blanche Dansereau, are banding together with innovative industry partners. With financial support from the federal government, this group has set out to develop organic greenhouse production systems that address these challenges. Together, their projects will identify solutions to make organic greenhouse production in Canada more competitive and profitable, including activities that: identify growth

enhancers and supplements that reduce disease and pest incidence, improve quality and productivity, develop growing media and fertility amendments for organic production, develop innovative solutions to increasing energy efficiency, and develop lighting solutions that will allow continuous, year-round production of organic vegetables.

Growing Media

Unlike conventional producers who often rely on soil-less or hydroponic systems to allow for precise control of nutrient supply, organic growers must, by definition, grow in a soil-based medium. The ideal potting mix must meet both the organic standards and the needs of the seedlings in terms of nutrients, water retention and porosity. At the same time, these mixes should be affordable and

environmentally sustainable. Today, researchers are exploring the ideal components and make up of such an alternate growing media, with much focus on mixes that contain peat and compost, with an eye toward creating a soil-based medium that allows organic greenhouse crops to thrive.

Fertility

A growing medium is not the only component of the greenhouse system that needs adaptation for organic growers. Fertility sources are another critical area where organic alternatives must be found for the synthetic liquid fertilizers relied upon by conventional producers. With attention focused on both solid and liquid organic fertilizers, researchers are on track to developing fertility regimens for organic greenhouse crops. To date, researchers have ex-



Artificial Wetland, Photo by Martine Dorais



Growing media, Photo by Martine Dorais



Organic greenhouse tomatoes, Photo by Martine Dorais

explored a number of potential fertility sources, including waste products from other industries, such as feather meal, crab or shrimp meal and kelp meal, as well as composts and bat guano. Going beyond fertility sources, researchers are also exploring other growth enhancers and supplements, such as biochar and microbial inoculants, which can support the healthy growth of organic greenhouse crops.

Greenhouse producers, whether organic or conventional, must be mindful of their operation's effluents, which often contain run-off with high concentrations of nitrates, phosphates and other nutrients that can have negative effects on groundwater. Researchers are looking beyond what nutrients are supplied to the plants, and are also exploring the manage-

ment of what comes out, in an effort to maximize efficiency and mitigate environmental risks. Research is focused on reducing the nutrient load in runoff by adjusting fertilizer rates and timing to better match the needs of the plants and also on examining the potential for recirculation and remediation of greenhouse effluent. Constructed wetlands, gravel beds planted with plant species and microorganisms that filter nutrients out of circulated greenhouse wastewater, and passive bioreactors are two of the innovative strategies that are currently being studied.

Energy Use

To be aligned with organic principles, greenhouses should be as closely in tune with nature as possible, and should limit excessive uses of energy. With this is

mind, researchers are also exploring ways to optimize energy use in greenhouses, focusing on lighting and climate control. The use of lighting to extend the photoperiod during the short Canadian winter days can consume much energy, but is a necessity. To reduce energy use, researchers are examining the potential for implementing novel lighting strategies, including the use of light emitting diodes, intercropping of two species for more effective light use, or optimization of light use through the placement and timing of lighting. Heating in the winter and cooling in the summer are also critical for greenhouses in Canada, and again, are processes that can consume much energy. Novel recirculation and heating and cooling systems are also being exami-

ned with a critical eye.

High Tunnels

The use of high tunnels to extend the growing season for high value fruit crops, such as raspberries and strawberries, is also being explored. Researchers are focused on developing the suite of management strategies, in particular fertility regimes, that will allow the development of profitable and productive high tunnel systems.

With all of the innovative research underway, Canadians, and others, can soon look forward to fresh, local organic produce even in the depths of winter. The projects described in this article are part of Canada's Organic Science Cluster. For more information about the cluster projects and partners, please visit www.oacc.info.



Raspberry high tunnel, Photo by Martine Dorais

Phosphorus: Researching a Limiting and Limited Nutrient



By Joanna MacKenzie, Organic Agriculture Centre of Canada
Adapted from its original version written by Tanya Brouwers for OACC

Phosphorus, a macronutrient vital for crop production, may be one of the largest challenges for agriculture in many parts of the developed world. Not only is this nutrient often used in high concentrations, which produces the related issue of environmental contamination, but it is, at the same time, an essential nutrient in limited supply. Here we have a nutrient that requires more efficient management for the sustainability of the whole planet and researchers who are up to the challenge.



Soy bean root, photo Tandra Fraser

Phosphorus

Phosphorus is a critical nutrient for crop production, stimulating root growth, promoting the maturity of crops, and stimulating seed production. Yet, phosphorus is one of the most challenging nutrients to manage and access for both plants and farmers. Of all the phosphorus deep in fertile fields, only a fraction exists in a plant-available form. Take, for example, Canadian topsoils, which can contain

anywhere from 100 to 2500 kg/ha of phosphorus. Of that total, only a fraction, sometimes less than one percent, is in a solubilized form that is available to a crop.

Not only is soil phosphorus elusive, it is also finite. And, this critical macronutrient is often exported off of farms, bound to the proteins and other nutrients in crops sold for food and feed. Some predict that rock phosphate, the lifeline of

many organic and conventional farmers, will have all but disappeared in mere decades if extraction rates continue as they are today.

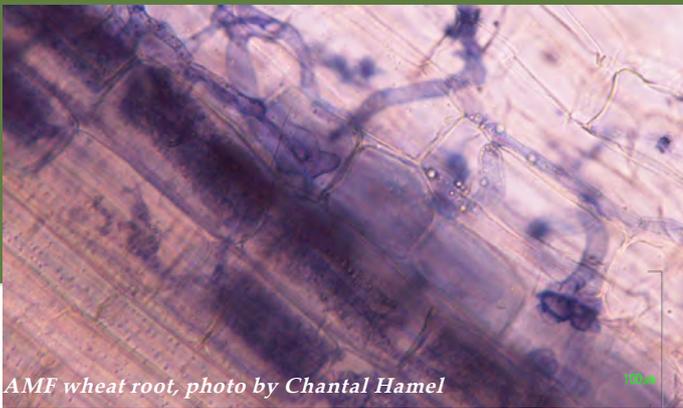
Arbuscular Mycorrhizal Fungi

Yet, agricultural soils are filled with microorganisms that are responsible for decomposing organic matter and increasing accessibility of nutrients, especially phosphorus, to plants. Of particular interest is a special group of soil

microorganisms known as the arbuscular mycorrhizal fungi (AMF). AMF form specific associations with plants, supplying the plant with nutrients in exchange for carbohydrates. This gives AMF the unique potential to greatly increase the capacity of plants to take up nutrients, such as phosphorus. Attaching themselves to the roots of host plants for a ready supply of energy-granting carbohydrates, AMF multiply and spread



Soil sampling, photo: Tandra Fraser



AMF wheat root, photo by Chantal Hamel



AMF in soil, photo by Chantal Hamel

through the soil. They form expansive hyphal networks, somewhat reminiscent of highways, which can access phosphorus distant from the plant.

Innovative and Essential Research

Given all of this, the importance of finding ways for farmers to manage both the phosphorus and microorganisms in the soil that can collect this vital nutrient becomes apparent. Researchers in Canada's Organic Science Cluster set out to do just that.

Two main research groups, led by Dr. Derek Lynch at Dalhousie University and Dr. Chantal Hamel

of Agriculture and Agri-Food Canada, have focused their efforts on two fronts: examining the impact of management practices on soil phosphorus and populations of AMF, and characterizing the AMF that are present in soils and the most effective at mobilizing phosphorus.

Looking at the Large Scale...

When tested, organically managed soils are often shown to be low in phosphorus. Yet, crops thrive, suggesting that there are mechanisms that allow the crops to access otherwise unavailable stores of this nutrient. To grasp what processes might be at play

and how to promote them, Lynch and colleagues are examining the impacts of organic management practices on soil phosphorus and AMF dynamics.

Their work involves examinations of phosphorus cycling under both annual and perennial legume-based crop rotations. By studying the plants and the surrounding soils, they hope to gauge how various management practices impact the availability of phosphorus and the composition of the soil microbial community. In addition, the researchers are evaluating the effects of various organic fertility sources, such as legume green manures and organically-allowed amendments, on soil phosphorus and uptake by plants. In the end, they hope to identify management strategies that promote the optimal use and cycling of this limited and limiting nutrient.

..and the Minute Scale

While Lynch and crew work on a large scale, Hamel and colleagues are looking at the microscopic scale, working at characterizing and quantifying the AMF present in the soil and their ability to contribute to crop phosphorus nutrition. Once more is known about this soil group, management practices can be better tailored for maintaining and promoting natural soil populations, or even supplementing natural populations with more efficient commercial strains.

vered that, although AMF constitute a whole phylum of the Fungi, only a dozen species are dominant in agricultural fields right across Canada. Yet, there is surprising diversity within the group. Some, for example, form large networks, others are easily parasitized, others still perform poorly in dry soils, and still others more efficiently capture phosphorus; in soils where plant-available phosphorus is limited, this characteristic might be the most desirable of all.

From all of the data and samples collected, the relative abundance and distribution of AMF in farmers' fields can now be estimated from a standard soil test and a GPS location using a computer model. A commercial diagnostic tool to evaluate the health of the communities of these beneficial soil fungi in cultivated Canadian Prairie soils is now under development.

While much work remains to be done, Canadian researchers are leading the charge in working to ensure that organic farms can use phosphorus effectively and efficiently well into the future, thanks in large part to hard working farmers and their management practices, and tiny labourers in the soil.

The projects described in this article are part of Canada's Organic Science Cluster. For more information about the cluster projects and partners, please visit www.oacc.info.

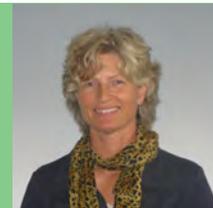
Hamel and her research group have to date disco-



Soy bean root, photo: Tandra Fraser

Productivity and Growth in Organic Value Chains (ProGrOV)

2nd Project Training Workshop and Project Meeting, 19-23 September 2012



By Lise Andreasen, International Coordinator, ICROFS

Which type of mulching can at the same time reduce the farmers' need for weeding and help providing sufficient yields of marketable bell peppers and tomatoes to the customers in Dar Es Salaam? This is one of the questions the students of the Tanzanian part of ProGrOV are testing at farmers' fields in Lushoto high in the Usambara Mountains of north-East Tanzania.

A group of organic farmers have found a market in Dar but how may such organic markets in the tourist sector develop further and what

are major obstacles to this? In ProGrOV students and scientists work together with the organic industry in identifying the bottlenecks and possible solutions for strengthening the organic value chains. Thus, ProGrOV has an interdisciplinary and participatory approach to improving organic production and marketing (as described in the article 'Innovation Research in Organic Value Chains' published in ICROFS News, September 2011.

This year the annual gathering of the plus 30 project participants – students and their supervisors from Soikoine University of Agricul-

ture in Tanzania, Makerere University in Uganda, University of Nairobi in Kenya; supervisors from Aarhus University and University of Copenhagen, the Organic Movements from Tanzania, Uganda and Kenya; and the coordinators from ICROFS – was held in Arusha in Tanzania at the MS-Training Centre.

Three main items were on the agenda of this intensive 5-day project meeting:

- Training for MSc and PhD students and monitoring of progress in the studies
- Workshop with stakeholders from the

tourism sector

- Field visits to organic production sites

Training

How to design organic and interdisciplinary research approaches' is a question that the supervisors of ProGrOV address as part of the training. At each annual gathering a course is put together for the students. This time the focus was on research communication and scientific approaches applied in an organic value chains approach.



Discussions at the field trial in Lushoto Mountains – organic tomatoes and green pepper.

Field trip to organic vegetable farmers – demonstrating the art of making compost



The students had in advance prepared posters regarding their individual studies and presented their work to update the project participants on progress and to initiate the interactive training in oral and written scientific communication. Covering the walls of the conference room, the posters also provided a colorful and very informative environment for the workshop. This was followed by sessions on theoretical aspects of science and discussions on how science is influenced by and interacts with practice when working with organic value chains in interdisciplinary approaches and research teams.

Workshop with stakeholders from the tourism sector:

Participation of relevant stakeholders is essential in ProGrOV. As the research in Tanzania is focused on value chains that aim for the tourism sector as market, the project had invited stakeholders from the tourism sector to provide advice and ideas for the research projects and to help identify challenges

and potentials of organic value chains, for example, for organic vegetables.

It was a truly international group of people that met at the stakeholder workshop. In addition to the stakeholders from Tanzania, the project had invited ICROFS Executive Board member to the workshop and several had accepted this opportunity to learn more about ProGrOV. Thus, the workshop had guests from several continents: Roberto Ugas, Professor at Universidad Nacional Agraria La Molina, Peru, and representing IFOAM's World Board, Professor Louise Jackson from University of California, Davis; Dr. Bernard Hubert, Research Director at INRA, France, and President of Agropolis International, France; Dr. Henrik Wegener, Provost from the Technical University of Denmark; Aage Dissing representing Organic Denmark; and from Tanzania Dr. Mwatima Juma, Chairman of Tanzania Organic Agriculture Movement (TOAM) and IFAD Country Officer in Tanzania.

The ProGrOV Team



Field visits to organic production sites:

The field visits are an important source of information and inspiration. This year it took place in the foothills of Kilimanjaro with the choice of:

- a visit to organic coffee growers of the Kilimanjaro Native Cooperative Union where coffee is grown in a multistory intercropping system that included beans, coffee, bananas and various fruit trees or leguminous fodder trees, as well as
- a visit to organic vegetable producers that among other interesting issues demonstrated the making and use of compost and legumes for maintaining soil fertility.

The on-site demonstrations of crop management and the experience in marketing shared by the farmers during the field visits were of high value and gave the project participants' insight and understanding of the diversity of organic systems.

The annual project training workshop and project meetings are the only time

where all participants are together and, therefore, a very important event for project implementation, communication, coordination and management. It is, however, in spite of a very condensed programme also an occasion where the 'ProGrOV family' is having a good time and enjoy the company in a more informal way.

The project is presently in its second year. The MSc students will be finalizing their thesis within the coming year and the PhD students are in the process of the official approval of their research proposals with the majority having started implementation of fieldwork already. In addition to the outcomes of the individual studies the project will through the interactions and discussions at the project workshop and the knowledge and experiences gained in the project develop the concepts of a participatory value chains approach to organic research.

Read more on the ProGrOV project at <http://www.icrofs.org/Pages/Research/progrrov.html>

Root carbon input in arable cropping systems: A largely untold story



By Ngonidzashe Chirinda & Jørgen E. Olesen, Department of Agroecology, AU, John R. Porter, Department of Agriculture & Ecology, Crop Science. KU.

A study that was recently published in *Plant and Soil* (Chirinda et al., 2012) shows that on a sandy loam soil, carbon (C) input from macro-roots of cereal crops play a relatively larger role in organically managed systems than in inorganic fertilizer-based systems. Additionally, the inclusion of catch crops in organic cropping systems, for instance when under-sown in winter wheat, enhanced grain yield of the subsequent spring barley without reducing its macro-root biomass. Finally, if data on shoot biomass is available, the use of fixed biomass shoot-to-root ratios to estimate root biomass leads to erroneous estimates of root C input when comparing different crop management systems.



The long-term experiment at Foulum

Why crop roots matter
Soil carbon (C) inputs are derived from several sources including plant roots, retained shoot residues and in some cases from applied manure. Manure and shoot derived C inputs are relatively easy to determine. Conversely, high costs associated with most current methodologies have caused knowledge on root C input to remain limited. The resultant knowledge gap causes high uncertainties in estimating C input in arable systems. Since root biomass is resistant to decomposition, partly due to protection from decomposition through interactions with soil minerals, its residence time in soil is generally higher than that of shoot-derived C. These aspects amplify the importance of considering root biomass in enhancing C sequestration. Therefore, if the objective is to increase soil C sequestration, cropping systems with high root C input are desirable. However, because economic yields are more important to farmers,

there is a trade-off between potential C sequestration through high root biomass and food production. On the other hand, the potential for enhancing C sequestration, through higher root biomass, may contribute to soil fertility and thus long-term sustainability of crop production systems. Therefore, it is essential to consider how cereal crops grown in low input organic and high input inorganic fertilizer-based systems would investment in root versus grain biomass. In an effort to avoid the costs associated with current root study methodology, root C input is mostly estimated from fixed shoot-to-root (S/R) ratio. We assume that due to dissimilar root dynamics under different nutrient management regimes, this strategy may lead to erroneous estimates of root C input.

How the study was conducted

This study was aimed at determining macro-root C input from two cereal crops

(i.e., spring barley and winter wheat) grown in organic and inorganic fertilizer-based crop rotation systems (Figure 1) in a long-term experiment at Foulum, western Denmark (Olesen et al., 2000; see photo 1). The cropping systems reported here include, (1) an inorganic fertilizer-based cropping system (C4/+IF/-CC) crops with high N inputs (165 and 130 kg N ha⁻¹ for winter wheat and spring barley, respectively) in the form of ammonium nitrate fertilizer, and agrochemicals were used for pest and weed control, (2) an organic cropping system (O4/+M/-CC) which received low N (108 and 57 kg total-N ha⁻¹ for winter wheat and

spring barley, respectively) in the form of pig slurry, and weeds were controlled through mechanical weeding. While both C4/+IF/-CC and O4/+M/-CC did not include spring undersowing of catch crops (ryegrass and clover mixtures) at any stage within the crop rotation systems, results from another (3) organic cropping system (O4/+M/+CC) in which catch crops were undersown in the cereal and pulse crops and which received pig slurry at N rates similar to those in the O4/+M/-CC, are also reported. Shoot biomass and macro-roots of spring barley and winter wheat were determined at the flowering

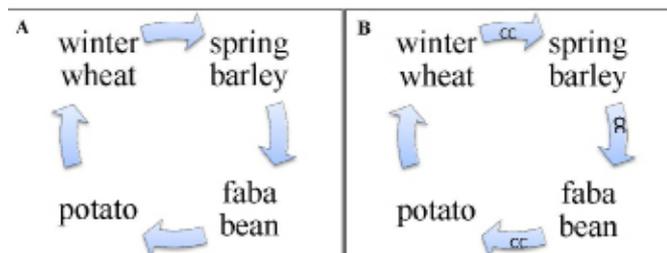


Figure 1: Crops rotated in the organic and inorganic fertilizer systems with (A) and without (B) catch crops (CC).

Table 1 – Shoot and root C (g C m⁻²) amounts and biomass shoot-to-root ratio (S/R) for spring barley and winter wheat at anthesis and harvested grain DM yields (g DM m⁻²) measured in 2008.

System	S/R	Grain DM	Shoot C	Root C
Winter wheat				
C4/+IF/-CC	5.4a	947a	505a	92a
O4/+M/-CC	3.0a	503b	391a	131a
O4/+M/+CC	3.9a	631b	439a	113a
Spring barley				
C4/+IF/-CC	3.7a	548a	259a	69a
O4/+M/-CC	1.9b	329b	169b	90b
O4/+M/+CC	2.4b	518a	254a	106c

Values with different letters for the same crop and within the same column (variables) are significantly different.

stage through destructive sampling. Soil cores containing crop roots were collected from within and between crop rows at 0-30 cm depths. The crop roots were separated from soil particles using tap water and collected on a sieve. Shoot and root biomass were determined from oven-dried samples. Furthermore, harvested grain yields from organic and inorganic fertilizer-based systems were determined.

The main findings

Results in Table 1 indicate that for the spring barley crop, root C amounts (g m⁻²) were higher in the organic O4/+M/-CC compared to those observed in the inorganic fertilizer C4/+IF/-CC system. Similar trends were observed for the winter wheat crop but the result was not statistically significant. The similarity of observed trends (though not always statistically significant) adds weight to the notion that root C input is potentially higher in organic compared to inorganic fertilizer-based systems.

The inclusion of catch crops in organic systems (O4/+M/+CC) meant that the spring barley crop which followed winter wheat with undersown catch crops, received high N input from both catch crop residues and fertilization. The spring barley root C amounts and grain yields were higher than those observed in the organic system where catch crops were excluded (O4/+M/-CC). Apparently, the grain yields of spring barley were similar in the inorganic fertilizer-based system and the organic system where catch crops were included. On the

other hand, since N supply from both manure and catch crop residues was high in the organic system which included catch crops, this implies that we cannot solely attribute the high root biomass observed in organic systems to limited N availability. Therefore, there is need for more research specifically focused on root and shoot growth response to different nutrient elements and to different root biological environments. What is clear from these results is that organic farming systems have the potential to increase root C input without compromising grain yield.

The results in Table 1 show that biomass shoot-to-root (S/R) ratio for spring barley was significantly higher in

the C4/+IF/-CC compared to the organic systems. The biomass S/R ratios for winter wheat followed a similar trend as spring barley but were not statistically different across systems. These findings highlight the notion that plants establish different functional biomass S/R ratios in response to external resources constraints, e.g., soil nutrient and water content. Therefore, contrary to what is commonly assumed in inventory studies and crop modelling, the proportion of assimilates that goes to roots is not fixed. Using the results in Table 1 and making use of the biomass S/R ratio of the inorganic fertilizer-based system only, we would underestimate root biomass in the comparable organic systems by about 50%.

On the other hand, if we use the biomass S/R ratio of the organic O4/+M/-CC system, we would overestimate root biomass in the inorganic fertilizer-based systems by over 80%.



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Green veal is not dark red



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Among many farmers, butchers and consumers, the expectation is that meat arising from grazing cattle generally is darker than meat from cattle primarily fed cereals. Without necessarily being the truth, this dogma is a constraint to the marketing of 'green' meat. In an attempt to increase the supply of organic meat from young cattle, we need to know which quality parameters are the characteristics for this type of meat, including colour characteristics.

Organic beef from young cattle

The organic rules require that bull calves are raised outdoor at least 6 months a year in Denmark and are fed at least 60% roughage of the total diet. These rules are a constraint for an organic production of beef based on the bull calves born in the organic dairy herds because of extra labor costs, expected lower growth rate, difficulties in raising bull calves outdoor, possibly lower meat quality and lack of sufficiently high organic premium payment for the carcass. Among the meat quality characteristics often considered to be compromised by grazing animals is meat colour, that among most people are thought to be darker compared with

meat from animals fed a cereal-based ration. As a consequence, bull calves born in the organic dairy herds are sold for conventional fattening. The supply of organic beef from young cattle is concomitantly very limited. However, in order to obtain the necessary higher payment for beef from organic-raised young cattle, it is important that consumers like the beef from grass- and herb-fed young cattle, as this is the primary feeds for organic meat-producing cattle.

Experiment with young Holstein bulls calves

We recently completed an experiment aimed at elucidating the effect of purely grass or herb feeding of Holstein bull calves for 8

weeks prior to slaughter at 9-10 months of age on meat colour, fatty acid composition, vitamin content and eating quality of the meat in comparison with meat from traditional rosé veal calves fed a concentrate-based diet and slaughtered at 9-10 months of age. Calves were housed in door in straw-bedded pens and fresh green feed was cut and brought to the barn every morning.

After a 2-week adaption period, 6 bull calves were fed purely grass and 5 bull calves were fed purely herb-based green feed for 6 weeks prior to slaughter. All calves had free access to the feed, and the grass-fed calves ate 50 kg per calf per day of the mainly Perennial ryegrass sward, whereas the herb-fed calves consumed 60 kg per calf per day. The major species in the herb sward was English plantain (56%), and White clover, Sainfoin, White melilot, Salad burnet and Yarrow each constituted approximately 5% of the sward (table 1). As dry matter content and feeding value of the two swards were slightly different, the energy intake was similar on the two treatments. The growth rate was lower than for a traditional veal calf in this period and amounted to 1.0 kg per day for both grass- and herb-fed calves.

At slaughter, meat from 6 traditionally concentrate-fed Holstein bull calves was also included in study. All calves were less than 10 months old at time of slaughter. We chose the young and lean veal calf for this study to avoid interference from the fatty tissue on taste and colour characteristics and focused the study on what happened in the muscle/meat. Carcass weights were 175 to 200 kg.

No dark red meat

The lean/fat colour evaluated on the carcass showed a 'normal' colour score of all three treatment groups giving no evidence for the dogma that meat from grass-fed and herb-fed cattle turned dark. This was supported by measurements of colour traits on both the loin (*M. longissimus dorsi*) and a thigh muscle (*M. semimembranosus*) 2 days after slaughter on steaks bloomed in normal atmospheric conditions for 1 h at 4°C. We assessed L* for lightness, a* for red/green colours and b* for yellow/blue colours, but found no differences between the three feeding strategies (table 2). We have to keep in mind that these calves were only 10 months and the green-feeding was only offered for two months.



No tenderness compromise

The loin and thigh muscles were aged (at 2 C) for additional 7 days, before sensory analysis by a trained panel. Steaks and roasts, respectively, were cooked and served for the panelists. Except for more meat flavor and juiciness in loin and less sweet aroma in the thigh muscle from herb-fed calves compared with grass- and concentrate-fed calves, there were no significant differences in the sensory profile. Furthermore, a mechanical testing device that can measure the shear force to cut through the meat sample were also applied and showed a good 'tenderness' of the meat. In fact herb- and grass-fed meat from the thigh showed a better tenderness than meat from concentrate-fed calves. These findings are important, because it seems unrealistic to increase the

premium payment for organic veal and beef (i.e., where grass and herbs constitute at least 60 % of the ration) if the sensory quality is not good.

Healthy fat in herb- and grass-fed beef

The meat from herb-fed calves contained less oleic acid, and more linoleic acid, α -linolenic acid, α -tocopherol and β -carotene compared with concentrate-fed calves and with grass-fed calves in between. The (n-6)/(n-3) ratio in the meat, which is considered important for the human diet, improved from 8.6 for concentrate-fed to 4.6 and 5.3 for herb- and grass-fed calves, respectively. Despite this positive effect, we have to remember that these calves only contained 1-2% of intramuscular fat in the loin, so the real benefit from the 'improved' fatty acid composition is probably not large.



Marketing potential

Overall, the study showed that green-feeding for a 2-months period prior to slaughter can improve fatty acid composition and vitamin content, produce tender meat with a good flavor and with no signs of a darkening of the meat. All facts are important for the marketing of veal and beef from organic raised cattle.

Acknowledgements

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Table 1 Composition of grass and herb swards fed to the calves

Name	Latin name	Grass	Herbs
% in sward			
English plantain	<i>Plantago lanceolata</i>		56.4
Salad burnet	<i>Sanguisorba minor</i>		4.6
Sainfoin	<i>Onobrychis viciifolia</i>		6.1
White melilot	<i>Melilotus alba</i>		5.7
Yarrow	<i>Achillea millefolium</i>		3.9
White clover	<i>Trifolium repens</i>	2.4	4.3
Perennial ryegrass	<i>Lolium perenne</i>	83.6	0.7
Weeds		14.0	18.4

Table 2 Performance and carcass quality of bull calves fed either purely grass (Grass) or herb-based green feed (Herbs) compared with concentrate-fed bull calves (Con)

Feeding	Grass	Herbs	Con	P-value
Number of calves	6	5	6	
Age at slaughter, days	299	299	< 305	ns
ADG (6 wks), g/d	987	969	~1250	ns
Live weight at slaughter, kg	363	365	~390	ns
Carcass weight, kg	178	185	197	0.10
Dressing, %	49.0	50.7	~ 50.5	0.09
EUROP conformation	2.7b	2.9b	3.7a	0.004
EUROP fatness	1.7	1.8	2.2	ns
Lean/fat colour	3.0	2.8	3.0	ns
L* loin	32.5	31.8	31.5	ns
a* loin	14.2	14.9	13.4	ns
b* loin	5.7	5.8	5.3	ns

ns: Non significant. a b numbers with different superscript are significantly different. Numbers in gray are estimated



Events

Green Ideas 2012, 22 – 24 October, Italy



Green Ideas 2012 will take place between October 22nd to 24th and will be hosted by the University of Gastronomic

Sciences in Pollenzo, Bra, Italy. This year, Green Ideas will expand on the 2011 design challenge on how we may create collaboration opportunities for communities to share green knowledge, also exploring innovative educational methods that educators may engage to take advantage of e-Learning technologies and tools in their everyday work.

Read more at: www.greenideasproject.org

Workshop: Regulation of soil organic matter and nutrient turnover i agriculture 15-16 November, Witzenhausen, Germany

The regulation of soil organic matter and nutrient budgets by management is a central focus in agriculture because these budgets determine the long-term productivity of managed soils, especially organically managed soils. However, the underlying processes controlling the productivity of agricultural systems are not well understood. Therefore, the interdisciplinary research project 'Regulation of soil organic matter and nutrient turnover in organic agriculture' explores strategies to regulate soil organic matter and nutrient budgets by soil management, crop rotation and feeding adjustments. The results of these studies and investigations by other scientists will be presented and discussed within the workshop. Read more at http://www.uni-kassel.de/agrar/dec/static/workshop/workshop1397_info_2012.pdf

Calls

1st RURAGRI ERA-NET CALL

The ERA-NET RURAGRI announces its 1st Call for applications for transnational research linking agricultural, rural and sustainable development aspects. The Call will be open between 18th September 2012 and 30th November 2012.



The Call Announcement and the Guidelines for Applicants can be downloaded from this website. Each Project Consortium needs to appoint a project Coordinator, who will be responsible for submitting the project proposal. Only the project Coordinator should register on the Registration page. Only one application is required covering all the project partners of the consortium.

Once the proposal is registered by the Coordinator, the Coordinator can invite Partners via the Submission Tool to participate in the proposal. Both Coordinator and Partner login to their registered proposal via the Submission Tool.

The proposal application has to be filled in and submitted via the Submission Tool.

Proposals must be submitted by 30th November 2012, 13.00 CET. Read more: <http://www.ruragri-era.net>



Open House i Fruitgrowth project

8. November at AU, Aarslev, you have the chance of tasting the different types of organic apples that have been tested in the project and learn more about the Fruitgrowth project. Read more at www.icrofs.dk



Seminar



NJF seminar 461

Organic farming systems as a driver for change

21-23 August 2013 Denmark

Since 1980's, NJF member from Nordic and Baltic countries have been engaged in research, development and extension work in organic farming and food systems. The seminar in Denmark 2013 is organized in collaboration with International Centre for Research in Organic Food Systems (ICROFS) and Centre for Organic Food and Farming (EPOK)

The seminar will be conducted in English and is arranged around the following four tracks:

1. Societal and economic viability
2. Dependency on non-renewable resources
3. Nutrient sufficiency and management in farming systems
4. Productivity and sustainable production levels in animal and crop production

Offered contributions should be submitted by 15 February 2013. Read more at: www.njf.nu



Read first newsletter from SOLID

SOLID is a European project on Sustainable Organic and Low Input Dairying financed by the European Union. The project runs from 2011-2016. 25 partners from 10 European countries participate in the project. Read more at www.solidairy.eu, where you will also find the first newsletter from the SOLID project covering the following topics:

- Farms in Austria - a description
- Assessing whole farm sustainability
- Cattle and goat breeds adapted to organic and low input dairy production systems: Facts versus fiction
- Novel and underutilized feed resources - potential for use in organic and low input dairy production