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## Kirsten Lund Jensen named new chairwoman of the Programme Committee of ICROFS

Head of Organic Unit at Landbrug og Fødevarer, Kirsten Lund Jensen, has been appointed chairwoman of the Programme Committee of ICROFS. She will succeed Michael Stevns.

The new appointment will to a greater extent bring together the International Board and the Programme Committee of ICROFS, given that Kirsten Lund Jensen has also been a member of the board since October 2013.

Kirsten Lund Jensen



## New employees in ICROFS

Marie-Louise Andersen is the temporary Communications Manager at ICROFS. She will be covering for Camilla Mathiesen who is on maternity leave until September 2015. Marie-Louise comes from a position as journalist at the newspaper Aarhus Stiftstidende. She has a Master's Degree in Journalism.

Marie Louise Andersen



From September 1st Mette Vaarst is part time employed in ICROFS for 1½ year. She is the project leader of the VOVE project. Mette has been employed at Aarhus University since 1991 and will continue her work as senior scientist at Department of Animal Science, Aarhus University.

Mette Vaarst



From October 1st Ulla Skovsbøl is employed as parttime communication manager in ICROFS. Ulla is journalist, cand.mag, in media studies and MA in journalism and globalisation from Swansea University. She is replacing Linda Søndergaard Sørensen, who has been a part of the ICROFS communication team since 2004. She is now full time employed as communication manager at Department of Animal Science, Aarhus University.

Ulla Skovsbøl



## Join the EIP-AGRI focus groups

The European Commission is launching a call for experts such as farmers, advisers, scientists and other relevant actors for four new EIP-AGRI Focus Groups. The Focus Groups will begin their work in November-December 2014 and are expected to present their results and recommendations within 12-18 months. Candidates for each of the Focus Groups below are invited to apply in accordance to the rules set out in this notice for the purpose specified.

The purpose of a Focus Group is to explore practical innovative solutions to problems or opportunities and to draw on and share experience gained from relevant innovative projects.

Read more: <http://ec.europa.eu/eip/agriculture/>



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We listen to our readers' response with pleasure, as we are here for you!  
Therefore, any response are more than welcome, be it about the format, suggestions to improvements, changes, content or anything you can think of.  
Contact us at: [LindaS.Sorensen@icrofs.org](mailto:LindaS.Sorensen@icrofs.org)

**ICROFS collaborates with US Department of Agriculture (USDA) and the Organic Systems Group of the American Society of Agronomy (ASA-OMS)**

By Lise Andreassen, ICROFS

ICROFS has joined forces with USDA and ASA-OMS to organize a conference on Innovations in Organic Food Systems for Sustainable Production and Enhanced Ecosystem Services. The conference is supported by the Co-operative Research Programme on Biological Resource Management for Sustainable Agricultural Systems under the Organisation for Economic Co-operation and Development, (OECD). It will bring leaders in research on organic food systems from 12 OECD countries around the world together to present and assess the current state of knowledge about innovations that enhance both sustainable food production and ecosystem services.

Many ecosystems have been degraded to such an extent that they are nearing critical thresholds, beyond which their capacity to provide useful services may be drastically reduced. Unsustainable agricultural practices have been pointed to as the chief causes of land degradation.

**New project: Deep Frontier**  
A new 5 year project in ICROFS: "Deep Frontier" has been launched by September 1st 2014. The objectives of the DeepFrontier project are to develop and study cropping systems with much deeper root growth and resource use than current cropping systems. The focus will be on soil layers from 1 to 5m depth, below the main root zone of current crops, but within depths which can be reached by plant roots.

Intensification in organic agriculture means intensifying the beneficial effects of ecosystem functions, including soil fertility and biodiversity, and using the biological elements of the eco-systems in a structured, organized and more efficient way, so-called eco-functional intensification.

The idea to jointly organize such a conference was born during a Symposium on Agrobiodiversity and Ecosystem services that ICROFS organized together with the Embassy of Denmark in Washington DC, USA. A group of American researchers, policy makers, and research administrators were in December 2010 invited to discuss 'Biodiversity benefits

organic agriculture and organic agriculture benefits biodiversity- True or False?'

The conference is an opportunity to highlight new knowledge, innovations, potentials and research needs that will strengthen the link between organic food systems, sustainable production and enhanced ecosystem services. The 2-day conference is held as a special symposium of the annual conference of the three societies American Society of Agronomy (ASA), Crop Science Society of America (CSSA) and Soil Science Society of America (SSA).

Read more: [http://www.icrofs.org/Pages/News\\_and\\_events/2014\\_Innovations\\_in\\_organic\\_food\\_systems.html](http://www.icrofs.org/Pages/News_and_events/2014_Innovations_in_organic_food_systems.html)

The project will develop equipment and methods, including a "deep root lab" facility allowing easier access to the study of deep roots and also study effects of deep rooting on soil carbon (C) deposition which can contribute to climate change mitigation and on soil biology. Impact on development of farming systems will come mainly through understanding how deeper rooting can be achieved, including better understanding of rooting depth in current agriculture; understanding of

resource use from deep soil layers, which resources are available, how much can be used and understanding of the potential contribution of deep rooting for sequestering soil carbon as part of agricultural climate change mitigation. The project will be carried out by ICROFS, Department of Agroecology, Aarhus University and Department of Plant and Environmental Sciences.

# International organic research



## ICROFS' sixth topic theme: Organic research in Hungary

ICROFS news presents two articles about organic agriculture and research in Hungary. One general article with an introduction to the development and state of organic agriculture and furthermore, an article about the current state and plans related to organic agricultural research in Hungary.

*Soya onfarm fields in Hungary*

## Organic agriculture and research in Hungary

### Current organic research programmes and projects in different countries

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.



# The development and state of organic agriculture in Hungary



By Zoltán Dezsény and Dr. Dóra Drexler, Hungarian Research Institute of Organic Agriculture (ÖMKi)

**Hungary offers good conditions for organic production. Its constitution bans the use of GMOs. The certified organic area consisted of 136.951 hectares in 2013 including 5.890 hectares of fishing lakes. This is about 2.5% of the total agricultural area. Yet it is also clear that the country's organic sector has not yet reached its potential and that there are numerous unexploited opportunities.**



*Potato harvest*

In Hungary organic farming started in the 1980s, first among the ex-communist European countries. A handful of enthusiastic civil activist, hobby gardeners and university professors founded the Biokultura Club in 1983 and the Biokultura Association in 1986. That time during the socialist regime organic agriculture was considered to be a highly radical perspective. It was not only a totally new approach of food production but also a sort of opposition to the political system.

The same was true for the regime critical environmental movements in the country. By 1988 there were 15 organic farms. This figure rose to 108 by 1995, 471 by 2000 and reached its peak in 2009 when there were 1660 certified organic units. In the coming years the number of certified producers slightly decreased, and due to a minor increase there were 1679 certified producers in 2013.

The area under organic cultivation grew from 1,000 hectares in 1988 to 128,690 in 2004 and 140,292 in 2009. To sum it up, the sector grew quickly between 1996 and 2004, since then the

numbers of operators and the total cultivated area are stagnating.

## Registered organic land

According to 2013 data grasslands make up the majority of registered organic land (50.3%), followed by arable crops (37.6%), perennial crops (4.1%), and vegetables (1.4%). Although more than half the organic area is grassland, organic animal husbandry is relatively insignificant compared to crop production. In 2010 less than 100

farms kept certified organic livestock, which is less than one tenth of the organic produces.

The percentage of organic land in Hungary is less than half of the European Union average and Hungary is one of the few European countries where the organic sector has not been expanding exponentially in the last decade. This is partly due to a lack of effective policy incentives, such as suitable subsidies or administrative

support, a lack of coordination of export marketing initiatives and of any broad awareness-raising campaign for domestic consumers. Better cooperation between stakeholders is required for the sector to move forward.

## Organic market and marketing

According to estimates the total value of organically certified food produced annually in Hungary is approximately € 25 million. Today, organic products have just a small share in the domestic market. About 85 % of total production is exported. Most of it leaves the country as raw materials or as low added-value produce. Most of the produce goes to the EU, principally Germany, Austria, the Netherlands and, outside of the EU, to Switzerland. At the same time, the majority of the (modest) organic assortments in Hungarian food stores are processed imports. Some estimates suggest that 90 % of domestic organic consumption is made up of imports.

There are two organic inspection and certification bodies in Hungary accredited by the National



*Potato field*



On farm meeting



Food Chain Safety Office. Both control body uses its own logo on packaged organic food items, and also the European Organic logo is mandatory to use.

Supermarket chains are playing an ever-increasing role as distributors of organic products and, as elsewhere, it can be assumed that they will play a major role in expanding the domestic market. However, only few domestic organic producers can currently meet the volumes, quality standards and the regularity of deliveries demanded by the supermarket chains.

Pilot projects for product development, quality assurance and cooperation in production are needed to

help domestic producers tap into this market. The formation of farmers' production and marketing groups, organic farmers' markets and local producer-consumer networks can also be important vehicles for distributing certified local organic products and expanding the domestic market.

#### Future trends

The future development of organic agriculture in Hungary depends a lot on the implementation of the EU's Common Agriculture Policy 2014-2020, and the figures of the measures which support certified organic farmers. There are promising pledges for the higher prioritization of the organic

sector in the country. The National Rural Development Strategy approved in 2013 aims to generate demand for high-quality, GMO-free, locally produced food. The document sets ambitious objectives for the future development of organic agriculture, it aims to have 350,000 hectares of certified organic land by 2020 which implies 260 % of increase compared with the current area. Also, the National Organic Action Plan was introduced in early 2014 by the Ministry of Rural Development. It consists of six action programs with concrete goals and necessary activities to be achieved continuously till 2020.

It is anticipated that

market demand for organic products will continue to steadily increase in Europe and slowly also the domestic market will grow in Hungary. Both trends will enhance the volume of organic agriculture in the country. The development of the sector could play a key role in maintaining Hungary's competitiveness on agricultural markets on the long run. This is increasingly recognised within current agricultural policy. Joint efforts by the Hungarian organic stakeholders are needed to ensure the realisation of the promising policy plans.



Organic Action Plan event

#### Key References

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# Organic agricultural research in Hungary – Current state and plans



By Dr. Dóra Drexler and Zoltán Dezsény,  
Hungarian Research Institute of Organic Agriculture (ÖMKi)

**Hungarian organic production needs a stronger practice-oriented research basis, there needs to be more dissemination work - underpinned by local scientific evidence - and efforts to increase consumer awareness in order to establish a stable and growing organic sector.**

Currently research and development activities related to organic farming in Hungary are strictly project based, and are subject to actual financial support opportunities. The projects are usually independently initiated by actors of the national R&D arena. A horizontal R&D concept is still missing. A state funded research program which would indicate direction, priorities and coherence for individual R&D projects through thematic project calls would help to overcome this challenge. This need for a system approach in the organic farming research sector was formulated in the National Organic Action Plan proclaimed in early 2014. This document appoints objectives and directions for the sector which match with the agricultural research policy efforts of the European Union (e.g. Horizon 2020, EIP-AGRI) considering organic farming a strategic industry.

There is a significant need for credible, practice-oriented research activities. Hungarian organic stakeholders express their interest in such applied research in order to increase the amount and availability of relevant information which can enhance their level of innovation. On the long run we believe that such demand-driven and at the same time

high standard professional research can develop the necessary knowledge base and standing of the Hungarian organic agriculture and food industry. Also, cooperation and a better communication between organic stakeholders (producers, traders, umbrella organisations, certifiers, and research institutions) are crucial for effective lobbying work and to increase the sector's volume and importance.

### Involved national institutions

Currently, most of the agricultural universities and state research centres are involved in some kind of organic agriculture research

projects. However, only two universities have dedicated independent departments to the organic field. These are the Corvinus University of Budapest and since 2013 the Szent István University of Gödöllő. The Department of Sustainable and Ecological Agricultural Systems at Corvinus University offers an Organic agricultural engineering MSc program and also an organic farming post graduate program. Both universities have organic model farms for experimental and educational purposes. The Agricultural Research Institute of the Hungarian Academy of Sciences at Martonvásár coordinates the biggest organic basic

research program in the country. This program, funded by the National Technological Platform, focuses on organic einkorn and emmer crop breeding for beer brewing. There is only one research institution where the focus is entirely on organic farming, the Hungarian Research Institute of Organic Agriculture (ÖMKi).

### New actor on the horizon

The Hungarian Research Institute of Organic Agriculture (ÖMKi) is a private non-profit research centre, founded by the Swiss Research Institute of Organic Agriculture (FiBL) in 2011. The aim of ÖMKi is to advance science and innova-





*Poly tunnels at Zsámbok*



*Wheat onfarm squares at an ÖMKi experiment*

tion in organic agriculture in Hungary with special emphasis on participatory research approaches. We closely cooperate with many stakeholders in the Hungarian organic movement, and initiate, coordinate and implement on-farm research projects, as well as training and extension services.

ÖMKi regularly organises workshops and vocational trainings for farmers and other stakeholders (often in partnership with other organisations). It has also established a popular PhD and Postdoctoral scholarship programme in order to foster the development of a new generation of Hungarian scientists, who will be deeply involved in researching organic agriculture and sustainable production methods.

Thus, ÖMKi is striving to support the development and competitiveness of Hungarian organic agriculture and food production in the long run. ÖMKi is acknowledged as consultancy centre and agricultural extension center by the state.

In October 2013, the institute realized the major event of the International Conference on Organic Agriculture Sciences in Hungary (ICOAS 2013). In the same year ÖMKi was awarded the title of external Department of Agrobiodiversity and Organic Agriculture of the University of Debrecen, which raises the

number of organic agriculture university departments to three. So far, Hungary has not been a partner in the CORE Organic ERA net. International cooperation is nevertheless also in the centre of our interest. We participate in European research projects (FP7, Leonardo, Horizon), and closely cooperate with FiBL institutes in several countries.

**On-farm network**

A prerequisite for successful practical research is situating the location and subject on a farm, under realistic conditions. The „on-farm” expression refers to this non-abstract research manner: the subject is not

studied on small plots or under strictly controlled conditions but on real farms, located around the country. The experimental design is fit into the existing framework of the farm and is developed in close cooperation with the farmers.

The most important on-farm research topics initiated and coordinated by ÖMKi in cooperation with the involved organic farmers and other concerned professionals are:

- Study of native perennial groundcover plant mixtures in vineyards to preserve soil structure, maintain nutrient levels of the soil and provide both shelter and food for

useful soil organisms while increasing biodiversity;

- Testing hulled grain and wheat varieties for organic production suitability, yield quality and quantity;
- Testing of soya varieties and agro-techniques with the aim to find the best adapted solutions for Hungarian organic soya production;
- Comparative study of different early potato varieties with and without row cover, comparison of different mid-early potato varieties for their suitability for organic production;
- Comparison of local/heirloom tomato varieties under organic management;
- Protection against the cherry-fruit fly with biological control methods in organic production;
- Alternative protection methods against varroa mite in organic beekeeping.

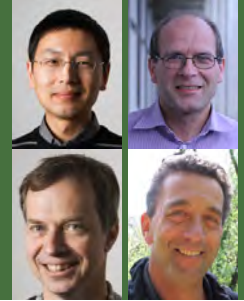
In the future interdisciplinary R&D activities are anticipated to grow in their scope and importance globally and in Hungary as well. System-oriented tools and innovative solutions are needed for organic producers to answer their production, management and marketing challenges.



*Young farmers training, Béla*



# Genetic variability of root and root hairs in spring wheat varieties



By: Yaosheng Wang, Kristian Thorup-Kristensen, Lars Stoumann Jensen and Jakob Magid, Department of Plant and Environmental Sciences, University of Copenhagen

Root systems are critical for water and nutrient uptake, determining crop growth and yield. This is especially true under reduced soil nutrient availability. In the Organic RDD project ROCO, we have investigated root growth vigor, root distribution and depth as well as root hair characteristics with spring wheat varieties. The results of our experiments show that there is a large variation of root and root hair traits among spring wheat varieties, which determines and is genetically related to crop growth and nutrient acquisition. Therefore, vigorous root growth and long and dense root hairs is a very important target for selecting and breeding future spring wheat varieties for organic agriculture.

Low nutrient availability is an important constraint on crop yield in low-input and organic agriculture. In Denmark the reduced use of

manures and crop residues in organic agriculture from conventional farms is challenging soil fertility management. Is it possible

to secure crop growth and yield with sufficient supply of nutrients from the soil with low input?

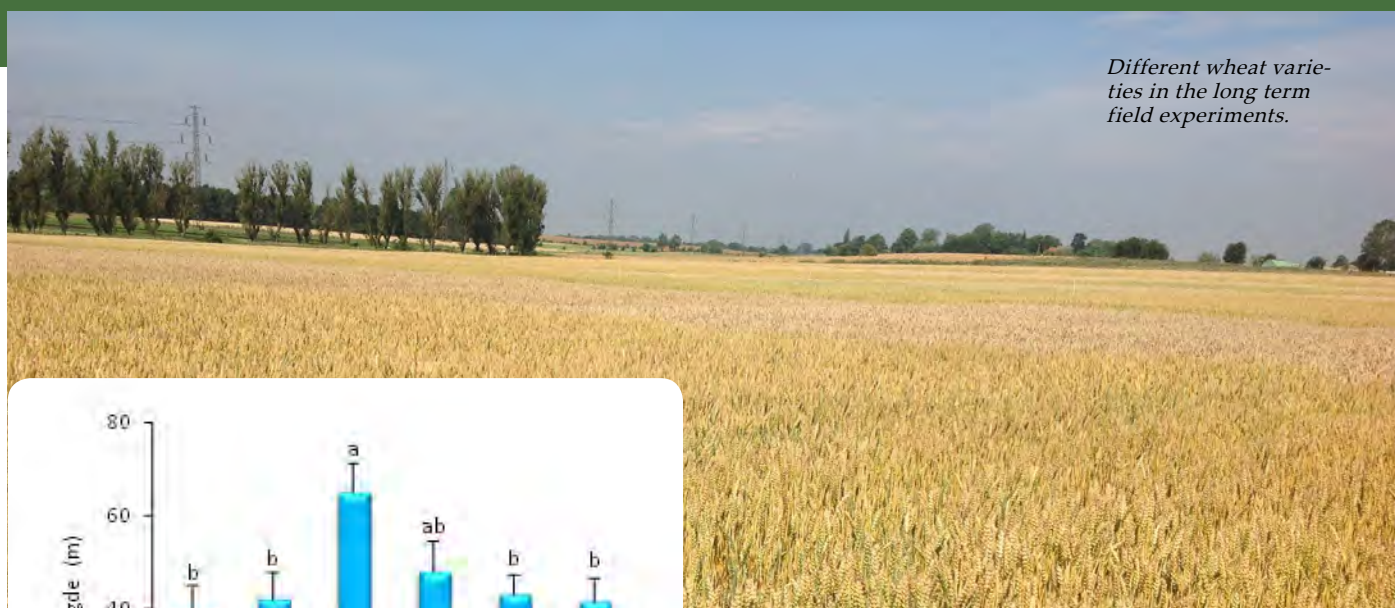
**Root and root hair as breeding goals for new cultivars for organic farming**

Plant root systems perform essential functions of water and nutrient uptake. In the Danish spring, wheat plants germinate and grow under rather cold condition and sometimes also dry condition. Here, the development of root systems is especially important for plant growth and nutrient uptake, which can determine the harvest later on.

Wheat varieties with strong early root growth may have a better uptake of water and nutrients from the soil. Therefore, the selection and breeding of wheat varieties with vigorous root systems may be an efficient strategy for nutrient acquisition and yield stability. However, many currently used crop varieties in organic agriculture are from the conventional breeding program with high input of fertilizers and pesticides.

Such varieties may lack important traits required under reduced nutrient conditions, leading to poor growth, reduced yield and nutrient acquisition. Simultaneously root growth and





*Different wheat varieties in the long term field experiments.*

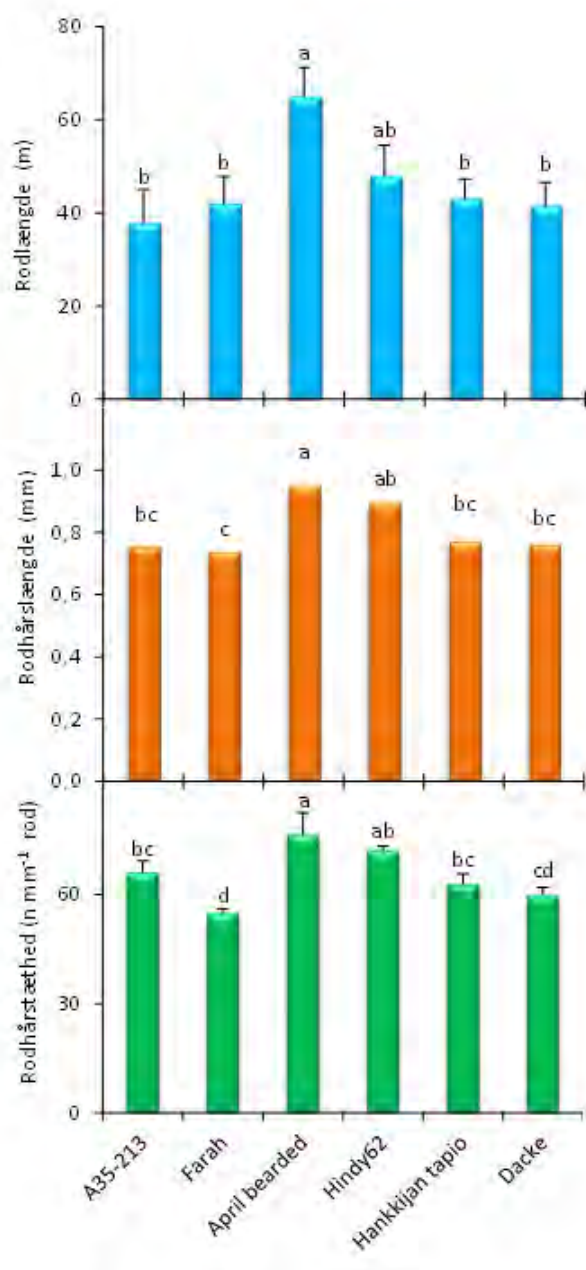


Figure 1. Root length, root hair length and density of spring wheat varieties. Values are means  $\pm$  standard error ( $n = 4$ ). Different letters indicate significant differences between varieties at  $P < 0.05$ .

function have rarely been used as selection criteria in modern breeding programs. As a part of the research project- Roots and Compost, - organic crop production under reduced nutrient availability (RoCo), we have studied the variations in root growth and root hair formation among spring wheat varieties in greenhouse and field experiments, which can be used directly by organic agriculture, and also to identify superior cultivars and critical root traits which can be used as breeding goals for new cultivars for organic farming.

#### Genetic variations of root and root hairs among spring wheat cultivars

We screened 23 spring wheat varieties, which are currently cultivated or older cultivars from gene banks based on variations in root growth and root hair formation as well as biomass growth. We compared the current and the old varieties, and identified whether some important root traits has been lost for new varieties. The selected spring wheat varieties we are currently studying include A35-213, Farah, April Bearded, Hindy62, Hankkijan Tapio,

Dacke, Taifun, Thasos and Økilde.

In our study, we have found significant differences in root length, root hair length and density among varieties (Fig. 1). April Bearded developed the largest root length, followed by Hindy62. The roots of April Bearded and Hindy62 were covered with the longest and densest root hairs, whereas Farah had the lowest length and density of root hairs.

#### Root and root hairs determine crop growth and nutrient uptake

The uptake of macro- and micronutrients (e.g., N, P, K and Ca) differed significantly between spring wheat varieties (Fig. 2). April Bearded absorbed the highest amount, A35-213, Farah, Hindy62 and Hankkijan Tapio were intermediate, and the lowest was Dacke. We calculated linear correlation coefficients to examine the relation between root and root hair growth and nutrient uptake. We found that there were significant linear correlation between root and root hair traits and nutrient uptake, and also between root hair length and density and biomass

Based on cultivation of spring wheat varieties in green house, six varieties were selected for soil cultivation.

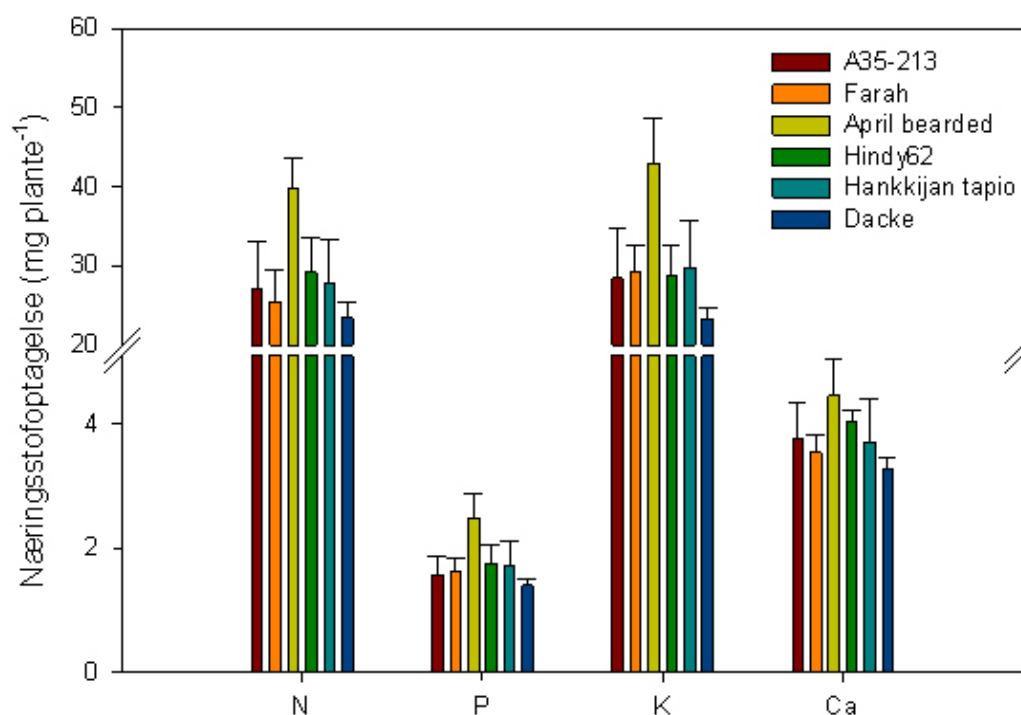


Figure 2. The uptake of N, P, K and Ca of spring wheat varieties under reduced soil nutrient availability.

production for spring wheat varieties. This clearly indicates that root vigor growth and root hairs of spring wheat plants are very important for capture of nutrients during early growth stages, which enhance nutrient uptake and biomass growth.

Based on the root growth and root hairs, we estimated the soil volume explored by root systems. April Bearded and Hindy62 explored larger volume of soil than other varieties. This indicates that root exploration is a major limiting factor for nutrient uptake for young plants.

Therefore, vigorous root and long and dense root hairs is a very important target for selecting and breeding future spring wheat varieties for organic agriculture.

#### More information

Read more about the Organic RDD project RoCo at: <http://www.icrofs.dk/danskforskning>



Organic RDD is financed by the Ministry of Food, Agriculture and Fisheries and coordinated by ICROFS.

# Design of multi-species grass-clover fields for cattle feeding



By Karen Søgaard and Jørgen Eriksen, Department of Agroecology, Aarhus University

**Forbs established in mixture with grass-clover are exposed to a strong competition. Some may survive, while others need help.**

**If the sward is to be truly multi-species, it is necessary to take the competitiveness of the forb into account when designing the field.**



In this article we outline a very simple design for a cutting regime based on several years' experience with forbs in the sward, especially in the projects EcoServe and Orggrass. The word 'forb' will here be synonymous for non-traditional forb species in grasslands.

## Forbs

The forbs may be split in three categories. 1) Strong forbs, which can compete with grass-clover (chicory,

ribwort plantain and caraway), 2) weak forbs, which only occur sporadically in grass-clover and therefore necessitate less competition, if they are to be productive quantitatively and 3) very weak forbs not suitable in mixtures. Among the latter is chervil and melilot. We have previously discussed species competition in :

[http://www.icrofs.dk/pdf/icrofsnyt/2013\\_3.pdf](http://www.icrofs.dk/pdf/icrofsnyt/2013_3.pdf)

There are many reasons for establishing multi-species mixtures including appetite, animal health,

product quality and nature value. We will not go into these aspects, but instead focus on field design and its effect on feed quality and yield.

## Design

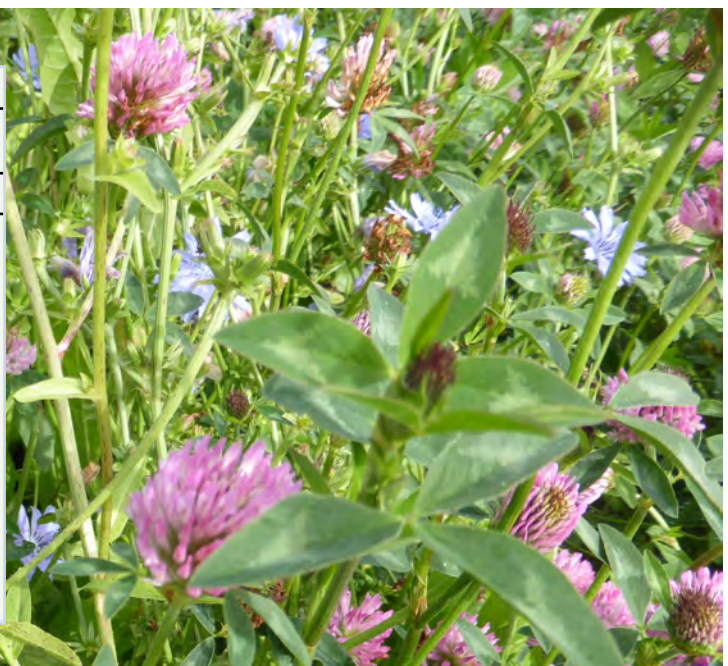
In Table 1 are presented suggestions for three seed mixtures, which can be used under cutting regime. Mixture 1 is intended for the main part of the field and contains a huge amount of grass, different types of perennial ryegrass and festulolium, plus red and

white clover. Additionally, it contains a small amount of lucerne for greater legume diversity, as well as three strong forbs. Yield in this mixture is expected to be at least at the level of a mixture without lucerne and forbs and often slightly higher.

Mixture 2 is a high yielding mixture, where red clover and lucerne will supply with nitrogen from fixation. There is a high proportion of strong forbs and some weak forbs. Grass and white clover are not

Table 1. Suggestions for different seed mixtures.

	1	2	3
	Main mixture	Legumes + forbs	Only forbs
	Seed weight (%)		
Grass	64		
White clover	6		
Red clover	7	1.5	
Lucerne	3	1.5	
Chicory	8	9	4
Ribwort plantain	4	5	2
Caraway	8	9	4
Birdsfoot trefoil		20	25
Field scarbious		20	25
Salad burnet		17	20
Yarrow		17	20



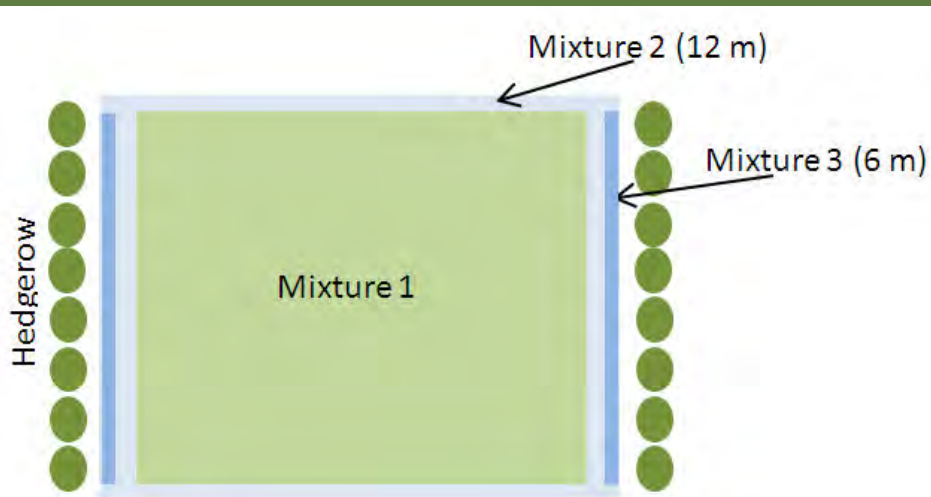


Figure 1. Example of a field design for a cutting regime. In this design (10 ha) mixture 1, 2 and 3 covers 82, 15 and 3% of the area.

included in the mixture to restrict competition. Yield in this mixture is expected in the first couple of years to be close to mixture 1, after which a yield decline is expected. Mixture 3 is without red clover and lucerne, and there is a limited amount of strong forbs. The expected outcome is higher diversity and lower yield. This mixture is targeted only a small part of the field. A very simple design is shown in Figure 1. The field of 10 hectares is primarily sown with mixture 1, but close to the margins mixture 2 is sown in a 12 m width.

Further, there is a 6 m stripe along the hedgerows with mixture 3. When ensiling in one silo and mixing before feeding the feed composition will be homogeneous. Other uses such as ensiling in bales or grazing may require other designs. The advantages of this simple design are the simplicity when sowing, and many species close to the surrounding habitats, providing better opportunities for foraging wild fauna.

#### Feed quality

The ordinary grassland species vary greatly in quality,

and the same is the case for the forbs. Clover is known to decrease less in digestibility of organic matter and energy content during growth than grass. This is a particular advantage when working with different cutting time. In Table 2 the digestibility of organic matter in mid-May is shown together with the subsequent decrease per week. Grass, lucerne, birdsfoot trefoil and salad burnet all exhibit relatively large reductions in digestibility over time. At the opposite end is caraway and dandelion with very little change in digestibility.

Species composition affects the herbage quality, but at standard harvest time some forbs have a higher digestibility than grass, while only caraway and chicory is at the level of white clover. The huge species difference is also the case for the other quality parameters such as crude protein and NDF content. Thus, when mixing in forbs the feed quality can either be improved or worsened.

#### Yield

From our experience a standard yield is 10.000 feed units (FU)/ha in





*Table 2. Digestibility of organic matter (% of organic matter) in early spring and the subsequent decrease per week (% of organic matter/week) measured over four weeks.*

	IVOMD	Decrease/week
Grass	85.6	-3.1
White clover	87.7	-1.2
Red clover	79.3	-1.5
Lucerne	84.3	-3.5
Birdsfoot trefoil	87.4	-5.0
Chicory	89.3	-2.0
Ribwort plantain	86.1	-2.4
Caraway	90.1	-0.4
Dandelion	82.2	0.3
Salad burnet	82.0	-3.2

grass-clover, at least the same yield in mixture 1, approximately 9.000 FU in mixture 2 and 6.000 FU in mixture 3. The mixtures 1, 2 and 3 in the design in Figure 1 covers 82, 15 and 3%, respectively, of the area and for this composition the overall yield is 9800 FU/ha. However, mixture 2 and 3 are located in the edge of the field and near hedgerows, where the yield level usually is lower than in the rest of the field.

### Challenges

During the latest years we have gathered much knowledge on forbs about growth and herbage quality, and there is now more evidence of positive effects. However, much knowledge is still lacking before we are able to design fields for different purposes. For example, if specific effects of the forbs are desired, as feed resources for pollinators and birds, or effects on composition of milk fatty acids, the species mixture should target these effects. In addition, for grazing the forbs have to be more homogeneously distributed. When harvesting, the sward is totally changed for the wild fauna. For much of the fauna the field will be a desert. Different cutting strategies with different cutting time give the oppor-

tunity to maintain foraging possibilities within short distance. We have worked on this aspect and shown that there is a potential, but it needs further development. Planning the botanical composition is a challenge. It is difficult to manage the species content as it is not the same in the field as in the seed mixture. If a specific composition is desired, it can be solved by growing the forbs in monoculture or in a number of mixtures, which are then mixed prior to feeding.

### More information

Read more about the Organic RDD project EcoServe and FØJO III project Org-grass at: <http://www.icrofs.dk/Sider/Forskning>



Organic RDD and FØJO III was financed by the Ministry of Food, Agriculture and Fisheries and coordinated by ICROFS.

# Focus on robustness in organic broiler production



By Liselotte R. Norup, Ricarda M. Engberg, Sanna Steinfeldt, Klaus Horsted and Helle R. Juul-Madsen, Institute for Animal Science, Aarhus University, Foulum, Denmark

**The natural power of resistance is important to consider in organic production systems in the future to fulfill the demands of the market and to improve the productivity in general. However, as the development of a robust immune system requires energy, it is reasonable to assume that this happens on the expense of other functions such as growth and reproduction. In the Organic RDD project "SUMMER", broilers of different breeds with different growth potential were used in order to test gut health and their immunological response capacity. The immunological investigations revealed differences in base-line immune functions between breeds. The results indicate that the development of a more robust immune system is related to a lower growth rate.**

**H**ealth, welfare and integrity are concepts related to the quality of life of an individual. To enhance the quality of life of an animal in organic production systems in the future, it is essential to take these 3 concepts into account. The quality of life or robustness of an animal can be defined as "the ability – under normal physiological circumstances – to fast recovery after having been subjected to different environment stressors where survival, reproduction and productivity are the main measures for robustness.

## Natural power of resistance

To increase an animal's robustness it is necessary to reduce disease incidence. To reduce the disease incidence it is necessary to have a well-functioning immune system that is able to respond to infections. The ability of animals to deal with an infection – the animal's natural power of resistance – depends on the animal's genetic potential, its experience, time of exposure, its physiological stage and ability to adapt. Hence, the natural power of resistance is important to consider in organic production systems

in the future to fulfill the demands of the market and to improve the productivity in general. However, as the development of a robust immune system requires energy, it is reasonable to assume that this happens on the expense of other functions such as growth and reproduction.

## The Experiment

In the project "SUMMER", broilers of three different breeds with different growth potential were used:

SU51 (a Sussex breed from Sasso in France) having a low growth potential,

T851 (a grey-black breed from Sasso in France) having a low growth potential,

JA757 (a white breed from Hubbard, France) having a higher growth potential.

The JA757 is the most commonly used breed in the Danish organic broiler production.

These three breeds were subjected to two different feeding strategies:

1. Standard organic feed with access to whole wheat (HP).
2. On farm produced feed

based on three local grown protein sources (peas, rapeseed and lupine) and with access to whole wheat, whole oats and limestone (LP).

Feeds, whole wheat, whole oats and limestone were fed from different silos (choice feeding). All chickens had access to outdoor areas with different grasses and herbs from the beginning of the experiment when the chickens were 4 weeks old. During the first 4 weeks of life, all chickens were reared under the same conditions.

## Different growth potentials

The HP feeding strategy clearly revealed the different growth potentials of the breeds, as the SU51 had a weight of 2049g whereas the JA757 reached a weight of 4282g at 84 days of age. When applying the LP feeding strategy, the weight differences were less significant. These two breeds were tested for microbiological gut health and their immunological response capacity.

## Microbial gut health

The numbers of selected dominating bacterial strains in excreta samples together with the pH value of the samples were measured at

the start of the experiment and after 2 and 8 weeks. Both breed and feeding strategy had an influence on the excreta pH and on the gut microbiota.

## pH of excreta samples

At the start of the experiment, before the chickens were distributed to the different feeding strategies, a lower pH and a higher number of bacteria were measured in the excreta samples from the chickens with the highest growth (JA757). This reflects a larger microbial activity and fermentation in the gut of these chickens, and this may be explained by the larger uptake of feed which serves as a substrate for a higher microbial

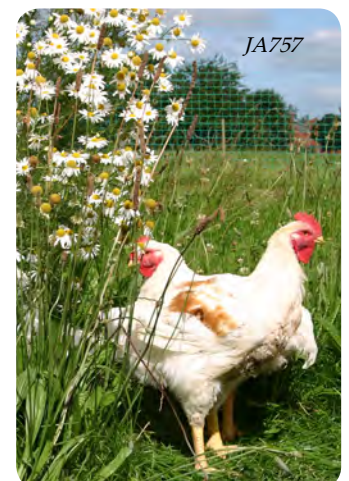
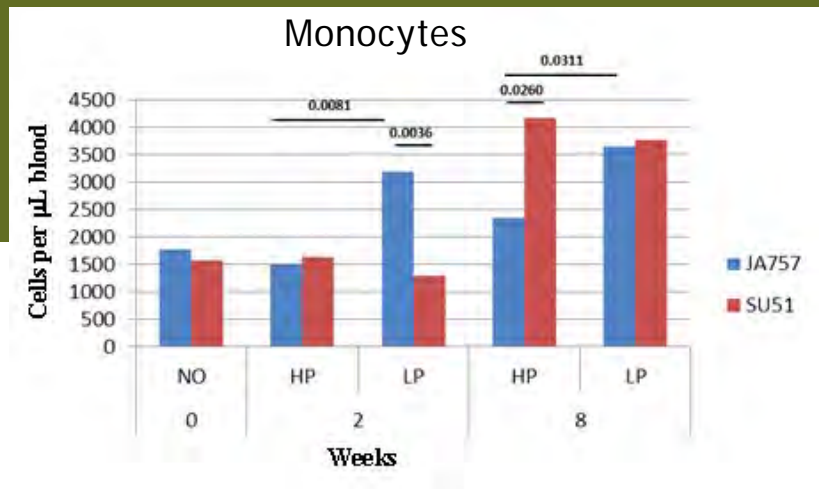


Figure 1a: The concentration of monocytes in blood from the two breeds 0 to 8 weeks after onset of the experiment.



growth in the gut. The high microbial activity results in a higher concentration of organic acids in the faeces (low pH) especially lactic acid which is excreted to a significant extent and thus may be considered as energy loss for the chickens.

### Microbial composition of the excreta samples

A significant influence of the feeding strategy on dominant gut bacteria was seen in the later samplings (weeks 2 and 8) especially on the number of *Enterococcus faecium* which was significantly increased in chickens fed HP compared to chickens fed LP. *Enterococci* are bacteria fermenting a number of sugars rather than proteins and the explanation for the higher number of these bacteria may be found in the differences in the amount and the composition of carbohydrates in the feeds used.

After 2 weeks, the number of lactose-negative enterobacteria was higher in the excreta from the fast growing JA757 chickens. Furthermore, the excreta from HP-fed chickens contained a lower number of these bacteria than the excreta from LP-fed chickens. Lactose-negative enterobac-

teria are gram-negative bacteria that are unable to ferment lactose. This group of bacteria contains potentially pathogenic bacteria such as *Salmonella*, *Shigella* and *Pseudomonas*. They are all very sensitive to acids, and their growth may be suppressed by the higher number of lactic acid producing enterococci.

### The fast growing chickens are "wasting" energy

Considering the present results, it is difficult to deduce whether the composition of the gut microbiota is of any significance or reflects any degree of robustness. However, it is clear that basic differences are found between fast and slower growing chickens. Slow growing chickens harbor fewer bacteria in their gut, which leads to reduced competition for easily digested nutrients, and this is beneficial for the chickens. The fast growing chickens are "wasting" energy in the form of e.g. lactic acid derived from microbial fermentation, which is excreted to the environment with the manure.

### Immunological response capacity

The content of white blood cells and immunoglobulins in the blood together with the ability to respond to an artificial infection was measured at the start of the experiment and 2 and 8 weeks later. Furthermore, the amount of natural antibodies towards an antigen

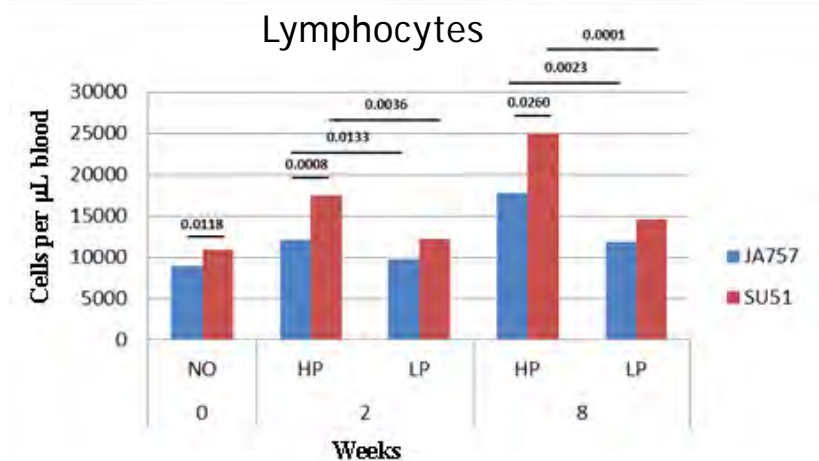


Figure 1b: The concentration of lymphocytes in blood from the two breeds 0 to 8 weeks after onset of the experiment.

unknown for the chicken; Keyhole Limpet Hemocyanine (KLH) was measured at the start of the experiment and after 2 weeks.

### The concentration of white blood cells

White blood cells in chickens mainly consist of three types of cells. These are the monocytes, the lymphocytes and the heterophils, which all take part in the immunological response.

*Monocytes* are the scavengers of the body which incorporate and destroy foreign microorganisms.

*Lymphocytes* are separated into T and B lymphocytes. When T lymphocytes are alerted and identify the smaller parts of the foreign microorganisms on the surface of the macrophages, they will either kill the infected macrophage (cytotoxic T lymphocyte) or they will provide help to the B lymphocytes to initiate the production of antibodies

*The heterophils* are also a

group of scavengers. When tissues are damaged, the heterophils flow to the tissues and ingest the remains of the destroyed tissue and bacteria.

### Monocytes

Genetically, the two breeds did not differ in the number of blood monocytes at the beginning of the experiment (Fig. 1a). However, the feeding strategies HP and LP resulted in a significant difference in the concentration of blood monocytes at weeks 2 and 8, but only for the breed with the highest growth potential JA757, as chickens fed with the LP diet had a significantly higher number of blood monocytes per µL of blood than those fed the HP diet.

At week 8 of the experiment, the high number of monocytes was equal to the number of monocytes found at both feeding strategies in the chickens with low growth potential SU51.





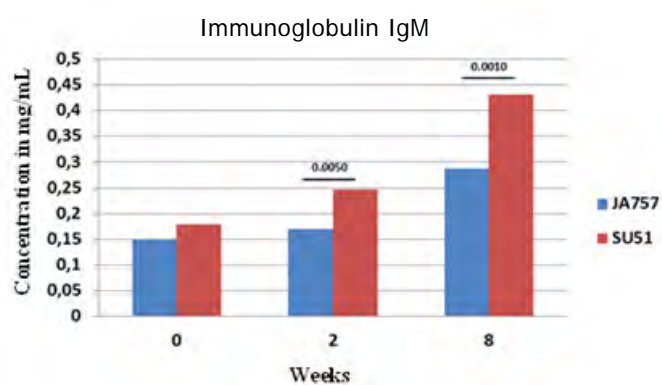


Figure 2a: The concentration of IgM antibodies in blood from the two breeds 0 to 8 weeks after onset of the experiment.

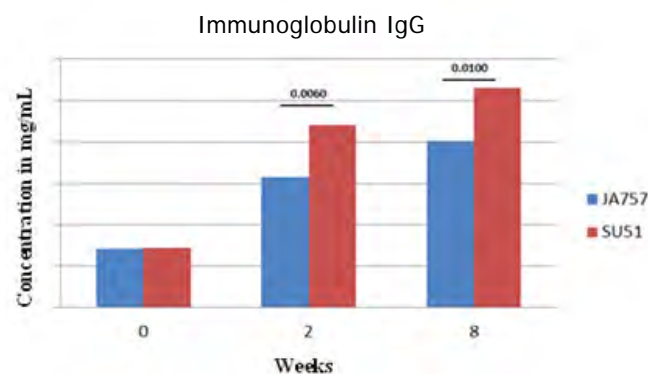


Figure 2b: The concentration of IgG antibodies in blood from the two breeds 0 to 8 weeks after onset of the experiment.

## Lymphocytes

Looking at the number of lymphocytes (Fig. 1b), the picture was quite different. The number of lymphocytes differed between the two breeds from the start, and continued to differ throughout the experiment. In the HP group, SU51 chickens had significantly higher numbers of lymphocytes per  $\mu\text{L}$  blood than JA757 chickens, whereas this was only seen as a tendency in the LP groups. However, the feeding strategies significantly influenced lymphocyte numbers in that chickens fed the HP diet had a higher blood lymphocytes number

than the chickens fed the LP diet.

Furthermore we tested the ability of monocytes and heterophils to ingest and kill foreign particles like bacteria. This process is called phagocytosis. At week 2 of the experiment this ability was elevated in both breeds and for both feeding strategies compared to week 0 and week 8 (data not shown). This indicates that the animals have responded immunologically to the new environment.

## Immunoglobulin concentrations

We measured the concentration of two subtypes of

immunoglobulins in the blood – IgG and IgM (Fig. 2a, b). None of these differed between the two breeds at week 0. However, after 2 and 8 weeks a significant difference between the two breeds was observed. A higher concentration of both types of immunoglobulins was found in the slow growing breed SU51 as compared to JA757. The feeding strategy had no influence on blood immunoglobulin concentrations.

## Natural antibodies

In addition to specific antibodies, animals are producing “natural antibodies”. These antibodies are present in the blood even though the body has not been exposed to an infection beforehand.

The production of natural antibodies somewhat depends on the bacteria present in the gut. The antibodies are usually directed towards molecular patterns found at the surface of microorganisms in general. They are able to lyse microorganisms, and as such they are able to react in advance of production of specific antibodies during an infection.

Natural antibodies are an important connection between the innate and the acquired immune system, as they are thought to be regulators or precursors for the production of specific antibodies. Furthermore, a high level of natural antibodies directed against KLH in chickens is connected to a decreased mortality in layers, which is the reason for using this as a measure for robustness.

Natural antibodies of the

IgG type differed between the two breeds at day 0 of the experiment (Fig. 3a, b). As the animals grew older, the concentration of natural antibodies of both the IgG and the IgM subtype grew larger. No significant influence of the feeding strategies was seen on the level of natural antibodies. As described for the immunoglobulin concentration, we also found significant differences between the two breeds considering both the IgG and the IgM types of natural antibodies, where the slow growing breed had the highest concentration.

## Low growth rate – improved immune system

In summary, the immunological investigations revealed differences in base-line immune functions between breeds, as the blood of the breed with the lowest growth potential SU51 contained a higher number of monocytes, lymphocytes and antibodies especially when fed the HP diet. This is consistent with the hypothesis that the development of a more robust immune system is related to a lower growth rate.

## More information

Read more about the Organic RDD project SUMMER at: [http://www.icrofs.org/Pages/Research/organicrdd\\_summer.html](http://www.icrofs.org/Pages/Research/organicrdd_summer.html)

Organic RDD is financed by the Ministry of Food, Agriculture and Fisheries and coordinated by ICROFS.

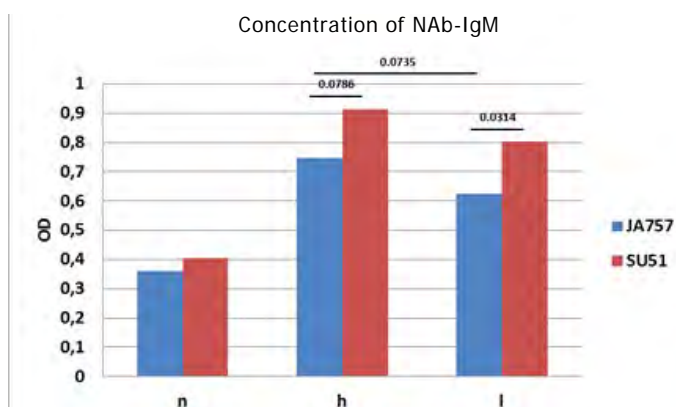


Figure 3a: The concentration of natural IgM antibodies in blood from the two breeds 0 to 8 weeks after onset of the experiment.

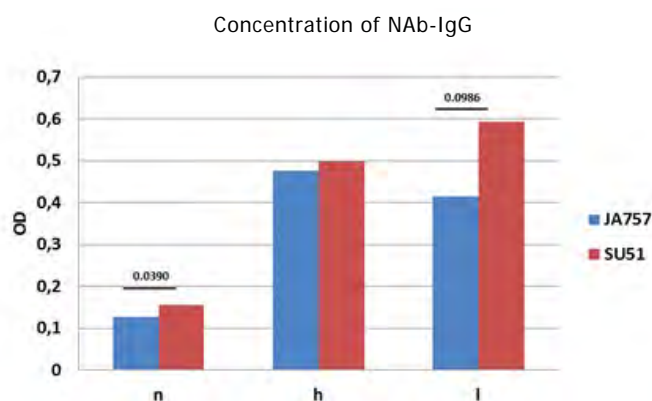


Figure 3b: The concentration of natural IgG antibodies in blood from the two breeds 0 to 8 weeks after onset of the experiment.

# How to eliminate the requirement for castration in organic pig production



By Bent Borg Jensen, Department of Animal Science, Aarhus University, Denmark

**Is feeding with grain only the last four days before slaughtering and slaughtering of the pigs at a lower slaughter weight the solution to the boar taint problem in organic pig farming? In the organic RDD project No-Cast a demonstration experiment are currently running at an organic pig producer, with the goal to investigate, if it is possible to solve the boar taint problem by these methods.**

Currently, surgical castration of male piglets is a common practice in the pig production in many countries to prevent boar taint. However, due to animal welfare concerns there is an increased desire to stop surgical castration at least in the European countries. The European Commission and representatives of European pig farmers, meat industry, retailers, scientists, veterinarians and animal welfare NGOs have recently committed themselves to voluntarily end surgical castration of pigs in the European Union by January 1, 2018.

Production of entire male pigs will have several advances:

- it will improved animal welfare
- it will reduced piglet mortality
- it will improve feed utilization and meat production
- and it will lower the environmental load due to the improved feed conversion ratio

Al together this will increase the production economy and the marketing potential for organic pigs. Therefore, realistic alternatives to surgical castration are needed.

## Boar taint

Boar taint is an offensive odour and flavour released upon heating and eating meat from some pubertal or sexually mature male pigs and is disliked by many consumers. It is mainly caused by accumulation of *skatole* and *androstenone* in fat.

## Skatole

The main source of *skatole* (3-methylindole) is the bacterial breakdown in the large intestine of the amino acid, tryptophan, originating from dietary protein and cell debris. Approximately 70 % of the skatole produced in the large intestine of male pigs is absorbed into the portal

vein. Via the portal vein, skatole is transported to the liver where more than half of the amount absorbed is degraded. Skatole that fails to undergo hepatic degradation accumulates in peripheral tissues, mainly in adipose tissue, due to its lipophilic characteristics, and may cause boar taint.

## Androstenone

*Androstenone* is produced in the Leydig cells of the testis with cholesterol as a precursor (76). From the testis androstenone enters the bloodstream, where it either enters the salivary gland, acting as a pheromone, or the liver, where it is metabolized. Like skatole, the even more lipophilic non-metabolized androstenone accumulates in adipose tissues.

## New feeding and management methods will be developed

The objective of the Organic RDD-project No-cast is to develop an optimum feeding and management praxis that eliminate the requirement for castration of male pigs in organic pig production.

The results from the studies show that it is possible to reduce the skatole production in the gut and as such the deposition of skatole in fat, by feeding pigs with





easily fermentable carbohydrates that is not digested in the small intestine, the last days before slaughtering.

#### **Inulin**

The most promising carbohydrate seems to be inulin either as purified inulin or as the inulin rich feed components Chicory root or Jerusalem artichoke. Addition of these feed components to a diet the last 7 days before slaughter at concentrations so the amount of inulin is above 50g/kg reduces the skatole content in back fat to 1/3 of the control diet.

#### **Potato starch**

Also raw potato starch has been shown to reduce skatole in back fat, however it has to be added to the diet at high concentrations (>200g/kg diet), and in contrast to inulin that can stand heating and pelleting, raw potato starch has to be added to the diet before the pelleting process. Likely because the high temperature during the pelleting process gelatinize the starch resulting in increased digestibility of starch in the small intestine.

#### **Reduction of protein**

Although not as well documented results has also shown that a reduction of the protein intake by feeding grain only 4 days before slaughter may reduce the skatole problem of boar taint.

No effect was found on androstenone in fat by any of the above mentioned feeding strategies. However it was shown that the androstenone content in back fat can be reduced by slaughtering the pigs at a lower slaughter weight. Slaughter weight had no effect on the skatole concentration in back fat.

#### **Cost-benefit analysis**

Cost-benefit analysis carried out with results from the conventional male pig production has shown that using a sorting procedure based on both skatole (< 0.25 ppm) and androstenone (<1.0 ppm), a reduction in the slaughter weight to a carcass weight of 75 kg versus the normal carcass weight at 83 kg combined with feeding with pure grain or chicory root the last 4 days before slaughter will

increase the meat price by DDK 0.48 and 0.67, respectively.

The cost-benefit analyses did not include organic farming due to lack of several parameter estimates. However, based on results from the present and previous Danish research projects, organic farms might face larger problems with boar taint than conventional production, and methods to reduce the risk of boar taint may, therefore, be even more necessary in organic production.

#### **Grain feeding and lower slaughter weight – promising methods**

The grain feeding method is easy to implement in organic pig production as organic wheat and barley are already available. Reduced slaughter weight is expected to have the same effects in organic as in conventional production. The organic pig production might, have better possibilities to market meat from smaller pigs as this consumer group is supposed to be more open to alternative products and

willing to pay a little more for specialized products.

#### **No-cast demonstration experiment**

In reign of No-cast a demonstration experiment are currently running at an organic pig producer, with the goal to investigate, if it is possible to solve the boar taint problem in organic pig production, by feeding grain only the last 4 days before slaughter and slaughtering the pigs at a lower slaughter

#### **More information**

Read more about the Organic RDD project NoCast at: [http://www.icrofs.dk/Sider/Forskning/organic-crdd\\_nocast.html](http://www.icrofs.dk/Sider/Forskning/organic-crdd_nocast.html)



Organic RDD is financed by the Ministry of Food, Agriculture and Fisheries and coordinated by ICROFS.

# Productivity and Growth in Organic Value Chains (ProGrOV)

## - Write-shop at the 4th Project Training and Project Meeting 14-19 September 2014



By Esther Waweru, Assistant International coordinator, ICROFS

**'How does research on development of organic value chains link to and contribute to peoples' food sovereignty? Do the findings contribute to the development of the local food system and/or farmers' control over food and their own livelihoods? How do the findings and results contribute to the development of the local as well as the global food system?**

**These were some of the questions discussed and reflected upon during the 4th ProGrOV training workshop.**

**This year the workshop aimed at assisting the students not only in scientific research but also looking at their research from the development and livelihoods perspective, at both local and global level.**

The 4th ProGrOV training and project workshop was held in Kampala Uganda. It was dubbed a 'write-shop' as the main focus this time was scientific write-up from the PhD and MSc studies, as well as how to synthesise results and knowledge from the studies in a form that can be used for dissemination at farmer, extension and policy level.

The project will at the end provide lessons learnt and give recommendati-

ons on how research can support the development of organic value chains. Such recommendations will be given on the basis of the experiences learnt though implementation of the individual research projects, and also based on knowledge and experiences shared with stakeholders across the value chains as well as between all project partners.

Thus following this approach, the project had invited Ugandan stakehol-

ders for a workshop whose agenda focused on making ProGrOV research results beneficial for the development of the organic sector in Uganda.

### **There is a need for information**

The ProGrOV research projects in Uganda addresses integration of livestock (dairy cattle) with crops (pineapples) and the export of these high value products. Thus the stakeholders present represented the various

actors in the organic value chain within these areas as well as representatives from the ministry of agriculture in Uganda.

Through the various presentations, we learnt that currently Uganda's policy on organic agriculture has had tremendous progress and an implementation plan was drafted in November 2013. However as much as the policy level is taking shape, the local market still has some loopholes. A presentation from one

### **About ProGrOV**

ProGrOV is a research, development and capacity strengthening project funded by the Danish Ministry of Foreign Affairs. This 5-year project commenced in 2011 and takes place in Uganda, Kenya and Tanzania. This year the annual project training workshop and project meeting was held in Nairobi, Kenya at the Oak Place Hotel. The main items on the agenda included

- Training for students and monitoring the progress of the studies
- Stakeholders workshop - feedback and interaction with different organisations and stakeholders from the organic sector,
- Field trip - visit to organic farmers.



*Group picture with stakeholders*



of the local supermarkets (Uchumi) pointed out they do sell organic produce (mainly fruits and vegetables) however they lack shelves allocated for these organic produce and they are mixed up together with the conventional products.

They also mentioned that within their contracts with the suppliers they would have a 'return policy' meaning produce not sold would be returned to the farmers and they would incur losses.

An interview with one of the stakeholders representing Namulonge Horticultural Farmers Association, clearly voiced out that the organic farmers have had to struggle with the traders when it came to selling and marketing their produce. The farmers in this association have opted not to sell their produce to the big markets (supermarkets) but rather have small farmer market days where they would organize and sell their produce themselves. This is mainly due to delays in payment and the low rates the traders offered.

Having their own market has been successful and it is mainly because of the loyal consumers who, through word of mouth have promoted their produce and this created more opportunities to sell these harvest within different areas of Kampala. However they still endure some disadvantages such as not being certified-factor that would help them attract bigger markets, storage facilities and transportation of their produce to the centers which are all very costly.

Given the above, it is clear that there is a challenge in connecting organic producers and the consumers within this market. It was strongly expressed by the stakeholders that access to information would empower the different actors to be more involved and also better positioned within the chain in relation to the market.

#### **Organic value chain research-a development perspective**

Having feed-back from stakeholders has proved important for the students to understand the needs

of the stakeholders and for the students to be able to convey the results from their research in a way that is useful and understandable to the end-users. In order to convey messages from research it may also be important to understand what role one research plays and may contribute to the development of local and global food systems. Just as the previous years the project workshop includes a PhD course – this time addressing 'High value chain development in relation to global food systems, food sovereignty and global social change'.

The training looked at how the ProGrOV project is related to these topics and what contributions it would give to these fields.

*Food sovereignty:* with its definition as 'the right of peoples to healthy and culturally appropriate food produced through ecologically sustainable methods and their right to define their own food and agriculture systems', the concept of food sovereignty can

be seen to be linked to the ProGrOV project as some of its principles are inter-related to those of organic agriculture. The principle of fairness is one that satisfies this argument in that it emphasizes that those involved in organic agriculture should conduct human relationships in a manner that ensures fairness at all levels and to all parties.

Within ProGrOV, the project emphasizes on the importance of a working value chain and how each responsible party has an important role to play for there to be any value addition with these products.

Through discussions with the students it was seen that with organic agriculture, sustainable production can be acquired as it also encompasses the protection of the natural resources, a principle that food sovereignty holds. This is due to the minimal use of inputs and biodiversity which promotes a better ecosystem ensuring that the natural resources are enriched and reserved.

*Farmers' livelihoods:* It is generally accepted that organic agriculture will have positive impacts on the environment, health etc. But how does conversion to organic production influence livelihoods of actors' (including farmers) in the organic value chain? In the context of ProGrOV this question is important and is addressed from two levels: Policy: Justification for governments and development agents to support organic value chains.

*Field/farm:* To inform farmers (and other actors) on potentials and challenges in converting to organic. Thus ProGrOV as a research and capacity building project not only needs to provide reliable data on: Agro-ecology and Agricultural Productivity on innovation, inputs, yields, production costs ; Value Chain and Agribusiness Development on demand for organic (global & domestic), access to markets, transaction costs, incomes, it also needs to identify the factors that enhance or constrain peoples' capacity to earn their livelihoods that is the capacity to make a living in an economically, ecological-

ly and socially sustainable manner.

*Global food system:* There are very different trade profiles within different countries and more so with the East African countries. However these countries have experienced an increase in the demand of high value products both in local and global markets.

The importance of the shift from traditional to a non-traditional products for exports is that it decreases vulnerability from dependence on commodities in that the shift to high value exports implies more diversified export portfolios and the high value products fetch a higher price in comparison to the traditional tropical export thus creating opportunities for rural income mobility and poverty reduction among smallholder producers in developing countries.

The ProGrOV approach mainly takes a micro approach i.e. focuses on farmers, consumers, unit of analysis: transactions, governance and the implications of governance choices.



What we learn from the findings in ProGrOV is that there is still a missing link i.e. missing markets, credit implementations which are essential to have a fully functioning value chain that can suffice the global and local organic food systems.

knowledge in this field. However it is high time that the research results are synthesised to messages that would directly benefit the end users.

As it was addressed by the stakeholders, research in organic agriculture is quite essential as it does help the actors within the value chain to gaining more



### More information

The gathering included 37 project participants – students and their supervisors from Sokoine University of Agriculture 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.

The annual workshop and project meeting is an essential event for all the participants as this is where all the participants meet and share their work, findings and challenges and review progress.

Read more about ProGrOV: <http://www.icrofs.org/Pages/Research/progr-ov.html>

Conferences

**Organic World Congress, held in Istanbul, Turkey, 13 - 15 October 2014**

The congress is gathering the global Organic Movement every three years. 2000 people from all continents debate issues, inspire each other, learn altogether and take strategic decisions.

The 2014 conference will have 3 themed tracks, The Main Track, The Scientific Track, and The Practitioners' Track as well as a series of Workshops.

Read more at: <http://www.owc2014.org/>



**Conference on insects - a new driver in the bioeconomy**

On Thursday, 13 November the Danish Technological Institute and inSPIRE Innovation Community will host a conference on insects. This 1-day conference will focus on the current opportunities and barriers of insect production, and display their potential within various segments of the food and feed sectors.

One of the speakers will be Lotte Bjerrum, who's the project leader of the ORGANIC RDD-project BioConVal. She will present new research on the conversion of chicken manure by fly larvae. Read more: <http://www.inspirefood.dtu.dk/Kalender/Arrangement?id=116a1a7e-2c65-4e9f-a5cf-df3e1200783a>



Conferences

**International conference, 1-2 November 2014, California**

Join Speakers from 12 OECD countries in discussions on current knowledge and potential of organic food systems to enhance ecosystem services!

The conference will bring leaders in research on organic food systems from around the world

together to assess the current state of knowledge about innovations that enhance both sustainable food production and ecosystem services.

Read more: [http://www.icrofs.org/Pages/News\\_and\\_events/2014 Innovations in organic food systems.html](http://www.icrofs.org/Pages/News_and_events/2014%20Innovations%20in%20organic%20food%20systems.html)



Conferences

**Scientific Seminar on Organic Food, 5-7 November, 2014 in Mikkeli, Finland.**

Join the 2nd Scientific Seminar on Organic Food 2014 – open, critical and collaborative approaches! The seminar will take place from November 5 to 7 2014 in Mikkeli, Finland.

Read more: <http://luomuinstituutti.fi/en/organic-food-2014/>

