



Follow up

European workshop: Grain legumes for organic agriculture Towards better varieties in Faba bean, Lupine and Field Pea

In this document you can find a summary and some key statements from presentations and group discussions from the European workshop on grain legumes October 28th 2013. Presentations are uploaded on our webpage and you will find links in the text. A list with contact details and email addresses of participants is enclosed at the end of the document. Thank you all for your participation and contributions and for many interesting discussions. We will try to keep in touch and look into possibilities to finance an active network.

The workshop was an activity in the EcoProtein project, a four year project running from 2012 to 2015. The project aims to feed Danish organic farm animals with Danish organic protein feed. The Organic Farming section at the Knowledge Centre for Agriculture is the organizer of the project, project leader is Margrethe Askegaard. Also involved in the project is the Faculty of Science and Technology at Aarhus University and a number of private companies and organic farmers. The EcoProtein project is financed by GUDP.

Kind regards,

Tove Mariegaard Pedersen
Inger Bertelsen
Darran Andrew Thomsen
Margrethe Askegaard



Johanna Winkler, Saatzucht Gleisdorf, Austria: Faba bean breeding at Saatzucht Gleisdorf, Austria

- The acreage of faba bean in Austria is 6000 ha, 80 % of which is grown organically.
- Agronomic breeding goals at Saatzucht Gleisdorf are yield and yield stability, plant architecture, lodging resistance, suitable seed size (350 – 550) and adapted maturity.
- Quality breeding for increased protein content in seed and reduction of antinutritional factors. Gloria is a low tannin variety from Gleisdorf.
- Resistance breeding for chocolate spot, faba bean rust, viruses and root diseases. A lot of *Phoma medicaginis* make possible the selection and breeding for varieties with healthy roots.
- Six varieties are registered in Austria by Saatzucht Gleisdorf: Alexia, Julia, Gracia, Aurelia, Gloria - and Felicia registered as cover crop. The varieties Julia and Alexia have the most healthy roots and high yields but slow soil cover since this is not an important feature in conventional farming.

Finn Holmgaard Jensen (Olaf Sass), Norddeutsche Pflanzenzucht Hans-Georg Lembke KG: Breeding of Grain legumes at NPZ with a focus on winter Faba beans

- NPZ does breeding for conventional farming, and there are no selection parameters specifically for organic farming. Cooperation with RAGT/FR since 2009.
- Spring bean are developed through a network in Germany, France and UK and winter beans in Germany and UK.
- Breeding goals in winter bean (UK): Grain yield, short plant type, good standing power, white hilum, winter hardiness. Because there is no winter damage, winter hardiness has the lowest priority in UK. Winter hardiness is selected for on German locations.
- UK and France are the main European countries growing faba bean.
- NPZ has seven spring and three winter varieties – winter varieties are Husky, Nordica and Hiverna.
- Hiverna is still the most winter hardy. New winter hardy varieties are under development. Most winter damage occurs during late winter or early spring.
- Rolling of winter beans possibly helps the overwintering.
- Winter beans have the highest yield potential compared to spring beans, in dry summers they are superior.
- Compared to winter wheat, winter barley and winter rape seed the yield potential has hardly increased, because of too little marked share, hence not enough breeding activity.

Uwe Brede, Bäuerliche Ökosaatzucht e. G.: From the breeding, over the field, to the animals.

Uwe Brede started farming after organic principles 1987 and runs 180 ha and has 15.000 organic laying hens. As a member of Bioland, special requirements for feeding have to be fulfilled. Bioland requires 100% organic feed, 50% from own farm. Pealed faba bean has become 17 % of his poultry feed. Uwe Brede started breeding because of the lack of local organic protein. Soybean availability reduces the desire for legume breeding in the conventional system; organic farming is still dependent on conventional breeding.

- Through Bäuerliche Ökosaatzucht e.G. he has become an organic plant breeder for faba beans and a seed producer.
- Uwe Brede wants more organic breeding, especially for weed competition. The variety Bilbo (former Lochow -Petkus) is now owned by Bäuerliche Ökosaatzucht e. G.
- Local breeding gives better adapted varieties.
- Bäuerliche Ökosaatzucht e. G. use bumblebees in pollination cages in their breeding programmes, the bumblebees are effective pollinators.
- Tannin varieties may be healthier in regard to root diseases.
- Limitations: varying yields due to leaf and root diseases and pests, strong weed proportion can make harvesting difficult, import feed is available, antinutritives.
- Needs: Breeding of winter varieties, development of methods for fast detection of diseases and pests, recrossing of coloured flowering varieties and treatment of seeds for feed.



Ann-Charlotte Wallenhammar, Swedish University of Agricultural sciences, Sweden: **Sustainable cultivation of pulses**

- In Sweden faba beans are grown on 18.000 ha, but there are no Swedish breeding activities.
- Demand for early maturing varieties because of a short growing season.
- Faba bean have become important because many soils are infested with *Aphanomyces euteiches* (root rot) in southern Sweden, making pea growing impossible. This also affects pea growing for human consumption. The industry supports research and development.
- A new aggressive root rot pathogen infecting both faba bean and pea called *Phytophthora pisi* was discovered during soil tests for *A. euteiches*. Big difference in the susceptibility of the faba bean varieties from disease index 3-48 for *P. pisi*. Not in all of Sweden yet! - Development of molecular diagnosis and soil test is very important.
- Experiments with Intercropping showed no effect on disease index for chocolate spot, nor root diseases. Quite some development is being done on molecular diagnostic tools like qPCR for *Botrytis Faba*.
- Development of soil assessments for suitability to cultivation.

Inger Bertelsen, Knowledge Centre for Agriculture, Denmark:

Grain legumes for organic agriculture

Introduction to organic Faba bean and Lupine cultivation in Denmark

- Organic trials with faba bean - varieties, sowing depth, harvest time.
Trials 2013:
 - No yield difference in varieties with and without tannine.
 - Highest protein content registered in Columbo.
 - Alternative sowing depth (down to 13 cm) did not affect yield negatively.
- Organic trials with lupine - varieties, sowing time, sowing depth, irrigation.
Trials 2013:
 - Yields in branched lupines higher than varieties with no branches.
 - Mixed cropping with spring wheat have increased yields and led to lower water content.
 - Early sowing led to higher yields.
 - Sowing depth did not affect yield negatively.
 - 5,5 hkg pr. ha higher yields with irrigation before and during flowering compared to no irrigation.
- Some results from organic trials can be found on www.sortinfo.dk (choose English language and organic trials)

Udo Prins, Louis Bolk Institute, The Netherlands:

Lupines – a healthy alternative for farmer and consumer

- Topics were lupine cropping mainly in pure stand and lupines for human consumption and as functional ingredients in food industry. Project goal is to increase Dutch production of lupines instead of importing lupines from Australia.
- Lupines for human consumption require an alkaloid level lower than 0,02 %.
- No advantage in mixed cropping for Dutch conditions in trials so far.
- Clay soils produce higher yields in Holland especially in a dry august. Some Dutch clay soils are suitable for lupine cultivation because they are not too alkaline. Breeding of lupines with higher tolerance for calcareous soils is an option and may increase the lupine acreage.
- Disease susceptible varieties benefits from early sowing.
- Potassium deficiency results in elevated alkaloid levels, for some varieties more prominent.
- Lupines mobilize phosphorus.
- Conventional trials with fungicide treatments are useful for the identification of susceptible varieties.
- Dutch trials show high yields.



Ulrich Quendt, Darzau Getreidezüchtungsforschung: Organic Winter Pea breeding in Northern Germany

- Advantage of winter pea: Higher yield than spring pea, tolerant to dry and harsh conditions, tolerant to late sowing. Disadvantages are potential winter damage, lodging, weed pressure, weak competition ability to cereals in mixed cropping, disease pressure due to long growing season.
- Winter peas can be between 50 cm and 200 cm tall, mixed cropping to increase harvest ability.
- Selection criteria, organic winter peas: soil borne and seed borne diseases, winter hardiness (long snow cover and bare frost), intercropping, seed density, high ground cover, competition ability, resistance to pea diseases, high grain and protein yield.
- Overwintering in triticale better than in pure stands.
- Yields are higher in mixture with triticale opposed to rye. Rye is very competitive in autumn.
- Overwintering may depend on nutrient level, micro climate and not only weather conditions.
- Leaf type and growing period affect protein content.
- Purple flowering is more resistant to artificial infection with Phythium. There seems to be a possibility to find resistance to Phoma medicaginis.
- There seems to be different pea diseases in different countries.

Herwart Böhm, Johann Heinrich von Thünen-Institut, Germany: Requirements of varieties and cultivation of grain legumes for animal feedstuff production in Organic Farming

- The production area of grain legumes in Germany is reduced drastically during the last decade most pronounced for pea and lupine. An increasing part of this area is grown with organic grain legumes (6000 ha organic faba bean)
- An interest for soybean cultivation is emerging.
- The yields of faba bean on a national scale for both organic and conventional farming systems are slightly declining.
- Intercropped pea with barley and faba bean with oats increases the yield stability of the crop to even exceed that of oats and spring barley in pure stands. Intercropping with lupines did not give the same increase in yield stability. White lupine and faba bean in pure stand are the most unstable yielding. Intercropped pea with barley and faba bean with oats were the only combination which achieved a RYT-value (Relative Yield Total) above one three years in row.
- There is variation of amino acid quality between the different species of grain legumes. Even small increases in e.g. the methionine content can increase the feed value. NIRS (Near InfraRed Spectroscopy) for lysine and methionine have been developed, which enable a quick determination of the amino acid quality directly after harvest. Could also be interesting for breeders.
- Some results from winter pea intercropping with rape seed and triticale were presented. Both rape seed and triticale increase yield stability by preventing lodging of the peas.
- Winter peas have an important advantage over spring peas, because the flowering is earlier and attack by aphid's are therefore much less severe. Intercropping with triticale further reduces the number of aphids per shoot, at least in years with significant levels of aphids.
- Important requirements for organic grain legumes are winter forms, early plant development for weed competition, high yield stability, resistance to diseases and pests, high feed values and precise and easy methods to determine the feed quality.

Waltraud Hein, Ifz Raumberg Gumpenstein Austria: Organic grain legumes in Austria, results from variety trials

- In 2012 organic faba bean have overtaken field pea in growing area, the area of faba bean being almost tripled over three years to 5.299 ha. Lupines area is only 48 ha.
- Since 2006 there have been organic variety trails for faba bean, field peas, sweet lupins, seed vetches and soya beans at Lambach. Trial results for faba bean, lupine and field pea from 2010 - 2012 can be found in the presentation.
- Extensive experiments with intercropping of winter legumes and cereals from harvest year 2011 with high yields and some variation. Good matches are: winter pea and winter triticale, winter faba bean and winter wheat.
- Faba bean Hiverna in pure stand yields almost the same raw protein yield as in mixed cropping, but the pure stand yields a lot less when the total grain yields are compared.
- Important issues to consider in mixed cropping: Same time of ripeness, comparable heights, suitable percentage of each partner.
- Pure winter pea: very long, lodging resulting in harvest problems.
- Austria has growing regions suitable for faba bean (humid regions) and field peas (dry regions) depending on rainfall. Growing of lupines seems to be quite difficult and requires fields with no weeds.

Group discussions:

How do we move forward the cultivation and development of Faba bean, Lupine and Field pea for organic agriculture? Limitations, needs and possibilities.



FABA BEAN

Limitations

- Sowing problems with big seeded varieties
- Lack of organic testing of breeding material
- Limited number of breeders, in limited climatic conditions
- Lack of volume in the crop

Needs

- Drought resistance/tolerance
- Tannin in leaves and not in seeds/knowledge about tannin in plant and tannin in seed.
- Soil tests for soil borne diseases
- More knowledge to farmers about management
- Breeding for more winter hardiness
- Treatments against aphids
- Knowledge of correlation between tannins/vicine and aphids susceptibility and disease susceptibility
- Weed competition
- Disease resistance
- Early ripening
- Stable yields (addressed to both breeders, farmers and advisers or genetics/management)

Possibilities

- Human consumption
- New products: Faba cheese, Faba fish fodder
- Breeding for resistance, marker assisted selection
- Intercropping (keeps disease pressure low, more stable yields)
- Improve the feeding programs and advisory services (research)
- European grown protein instead of imported soy
- Promotion
- New collaboration (breeders, farmers, internationally) of breeders to test also early breeding material
- Better exchange of information



LUPINE

Limitations

- Unstable yields
- Low yields
- Non-branching type: Low weed competition
- Branching type: Late ripening

Needs

- Longterm testing crop rotation
- More suited varieties for humid north
- Knowledge of diseases
- Less susceptible varieties for drought during flowering and pod filling
- Explanation to small yields – research

Possibilities

- Communication and network
- Participatory breeding
- Iris
- Intercropping of lupines and grain
- Research of yields etc.



FIELD PEA

Limitations

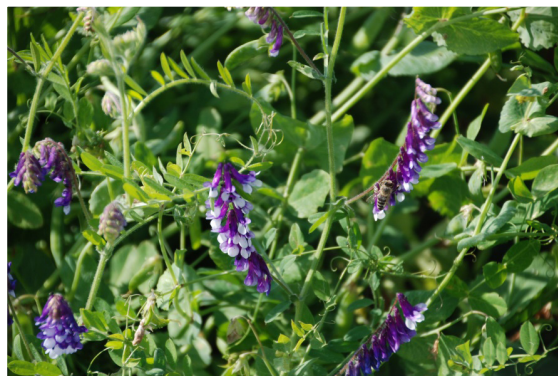
- Yield stability
- Weeds
- Root diseases
- Price in some countries
- Wild life
- Pigeons

Needs

- More trials and information on varieties
- Certified seed equal healthy seed
- Varieties for food and feed (quality)
- Soil tests
- More protein

Possibilities

- New and better canopy type (easy harvest)
- Biofumigation for “disinfection” of soil
- Protein quality
- Seed coating



Conclusive remarks:

Udo Prins pointed out that peas have been grown for many years, resulting in problems with soil borne diseases. Some pathogens are the same in pea and faba bean, and problems can be predicted for faba bean. Faba bean may well face similar problems with soil borne diseases as it has been experienced with pea. Therefore it is important to have alteration in the cultivation of grain legumes. It is important to not place all bets in one species of grain legume, in order to spread the risk of diseases.

Christian Petersen commented to this, that it is important to be very clear in the recommendation for the farmers. It is difficult to wait 6 years if you have grown a successful crop one year. Christian also stated the importance of research in disease complexes.

Livija Zarina brought to the attention a conference held in May by the Legume Society <http://lsc1.nsseme.com/?opt=home>. The legume society is worldwide and deals with all types of legumes.

It is a common problem to share knowledge and information. Especially concerning these crops, that are grown to a limited extent, it is even more important to exchange knowledge. It might be that there are differences in diseases from one country to another, but there might well be many similarities as well and important experiences to be learned.

Inger Bertelsen introduced the outline of an international conference in 2015 under the auspices of the EcoProtein project. This conference will also focus on these grain legumes, but the subject may have a different angle than this current workshop.

Results on faba bean and field pea from the European COBRA project will be disseminated through the project website: <http://www.cobra-div.eu/>



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