NEWSLETTER

No 2, February 2015

Dear Readers,

The HealthyMinorCereals project has successfully continued over the next six month following the first issue of the Newsletter. In November 2014, our consortium held its second meeting in Budapest, Hungary to discuss project progress. During this meeting, we also held a half-day workshop focused on the market potential of minor cereals in Europe. Using the World Café approach we had a lively workshop session discussing the factors that may support or hinder the development of niche and larger markets for minor cereals.

In this Newsletter we will bring an update on project activities and progress. Also we feature an interview with a Czech farmer who has specialised in the production of minor cereal crops. Our partner FiBL has performed an extensive survey of minor cereal crops grown in Europe, their potential and perception by consumers. A selection of products made from minor cereals and already available in Europe is included in this Newsletter. Their final survey report will be available on our project website after being approved by the European Commission.

We wish you an enjoyable reading of our news.

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Project Coordinator

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(More information can be found at the project website: www.healthyminorcereals.eu)

Meeting of the consortium partners in Budapest

On 4-5 November 2014 the HealthyMinorCereals consortium met in Budapest, Hungary. Present were representatives of all 16 project partners and leaders of the project workpackages. In addition we welcomed the participation of our project officer, Mr. Béla Atzel, from the European Commission and a member of our External Advisory Board, Prof. Steve Quarrie, who contributed some very useful comments from an independent perspective.

A half-day workshop in the World Café format was organised during the Budapest meeting by our partner FiBL to discuss and identify the factors that may support or limit the wider production and consumption of minor cereals and the development of niche or larger markets.

All the discussions were really lively.

Interview

Mr. Čech and his wife run a family organic farm - about 150 ha of arable land and 25 ha of grasslands. Minor cereals are produced here on approximately 50-60 ha (spelt, rye and oats). In addition to crop production the farm specializes in horse rearing (breed of Hafling) and sheep rearing (Romney).

We asked Přemysl Čech, a Czech farmer from the foothills of Jeseníky, in the north-eastern part of the Czech Republic, about growing minor cereals and their potential in the future.

How did you start with the production of minor cereals? Since 1996 I have watched the events around organic farming and in the year 2000 I converted 20 ha of permanent grassland to organic farming and joined the Organic Farming Union. There I met Mr. Martin Hutař from PRO-BIO (*editors's note; SME partner in the HealthyMinorCereals project*) who inspired me to start with the production of minor cereals. In 2003 I bought new plots of land, and in 2007 converted the whole farm to organic production.

In your experience, what conditions are suitable for growing minor cereals? Our farm is situated in the foothills of Jeseníky (*editors's note; altitude 298 metres asl., 705 mm of annual precipitation*), we have heavy soils that are rather poor in nutrients and hard to cultivate. We farm so-called marginal lands and in my opinion, organic farming and cultivation of minor cereals seems to be a good opportunity for those farming in this region.

What are the biggest challenges in minor cereals production? The most critical is to employ suitable farming methods – good ploughing in autumn and thorough mechanical removal of weeds before sowing. Also, the sowing of spelt requires special attention as the presence of the hull on seeds may lead to sowing difficulties due to tube blockages, leading to less seeds being sown than needed. Hence it is important to perform regular checks for blockages during sowing. The recommended seeding rate is 200 – 220 kg/ha for spelt, 230 – 250 kg/ha for rye, and 200 – 220 kg/ha for oats. In oat production the most critical is the post-harvest treatment, i.e. drying and cleaning immediately after the harvest to prevent the loss of grain quality.

Where do you sell your production? I sell all of my production (cereals as well as buckwheat) to the company PRO-BIO. We have cooperated for a long time. The prices are relatively good.

What future do you see in producing minor cereals? At present, there is an increasing demand for minor cereals on the market. I expect that this demand will continue to grow and the price will stay up. An informed consumer buys these cereals for their high nutritional value – high levels of proteins, vitamins, minerals and essential fatty acids. The growing demand motivates new producers. Another reason why minor cereals are of interest to organic farmers is that they fit well into the crop rotation system of organic farms. Spelt is already the main cereal in organic farming in the Czech Republic, and rye - having a good competitiveness with weeds - can be used to stop or reduce weed propagation. Of course, good marketing of the product is also important. In this respect, I highly value the new marketing strategy of PRO-BIO and their project "Our Organic Farm". This project helps promote minor cereals as well as the local organic farmers who care for a healthy environment and the diversity of the local countryside and who offer high quality products.

What would you recommend to farmers who want to start producing minor cereals? The most important thing for growing minor cereals in organic farming is to learn 'how to do it right' and be patient. All the effort will be worthwhile, because minor cereals have a great potential and customers want to see them on the market.

Reports from workpackages

The following text brings reports from WPs that are well underway and achieved first important results. Progress from other WPs will be reported in the next issue.

WP1: First ‚X-Ray Insights' into Genetic Resources

Looking with markers at genetic resources is like x-raying: suddenly you see structures you had not seen before, lying under the surface and enabling you to draw some conclusions and to do the right things. This had been the case for oat genotypes analysed in HealthyMinorCereals (262 genotypes from 27 countries, ‚x-rayed' with 42 SSR markers by the group at the CRI in Prague).

So what has this analysis found so far?

First, it is clear that just looking at the "phenotypic" visible characteristics like dark *vs.* light kernels or husked vs. naked kernels, doesn't tell you a lot about how genetically similar or dissimilar the genotypes are. The actual genetic relationships may be very different from what you expect from the physical appearance, but science is more interesting, when expectations are not met…

So, is there a structure within this broad collection of oat genotypes? Is it possible to identify specific groups that are genetically distinct from the rest? The answer is yes, three groups were identified, a large group and two smaller groups. One of the smaller groups features oat genotypes from the US/Canadian gene pool, and the other has genotypes from a distinct Czech/Austrian gene pool. This interesting result can help oat breeders in the future in choosing genotypes for crossing with maximal genetic diversity,

rather than just relying on phenotypic characteristics, and so obtain improved oat varieties.

In genotyping, before we can obtain our results, there is the tedious work of DNA isolation and marker analysis – and that's what is going on at the moment for rye and spelt genetic resources and wheat wild relatives. Our results in the near future will reveal further new interesting structures currently hidden from view.

WP2: Phenotyping to determine potential for developing new varieties

Phenotyping of spelt wheat

The spelt wheat diversity panel was grown in 2014 at four locations, i.e. Darmstadt, Germany; Hombrechtikon, Switzerland; Raasdorf, Austria; and Jogeva, Estonia.

Unfortunately, heavy yellow rust (*Puccinia striiformis*) infection appeared at the three Central European locations. The high aggressiveness of this infection prevented the scoring of other leaf diseases in the highly susceptible genotypes, and data for powdery mildew, leaf rust and leaf blotch diseases were recorded only for the yellow rust resistant genotypes. Therefore, the trials will be extended for another season in 2015. Besides the genetic resources, breeding lines by the project partner, SME Getreidezüchtung Peter Kunz are included.

Diversity of spelt wheat lines with respect to maturity and plant height: late and tall types on the left and center background; short, early and yellow rust susceptible variety on the right foreground

Extreme dwarf and late maturing type of spelt wheat in the center row

Early (i.e. before heading) and heavy yellow rust infection of a spelt wheat breeding line surrounded by (at this time still) resistant lines.

Spelt wheat diversity at time of yellow ripening (Raasdorf, Austria)

Manual harvest of spelt in order to prevent mixtures of genotypes (Raasdorf, Austria)

Sowing of spelt wheat in mid-October 2014 in Austria using a Hege pneumatic single seed sowing machine

Phenotyping of oats

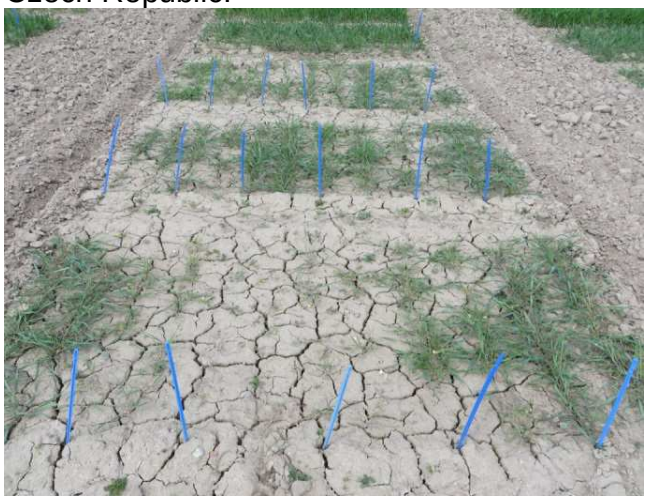
The oat diversity panel was grown in 2014 in Krukanice, Czech Republic and Jogeva, Estonia. A broad variability was observed with respect to grain yield (200-1500 g/m²), thousand grain weight (25-51 g) and test weight (39-65 kg/hL). At the moment selection is carried out to reduce the diversity panel to about 100 genotypes which will be sown in spring 2015 for further evaluation trials.

Manual harvest of the oat diversity panel in August 2014 at Selgen breeding station Krukanice, Czech Republic

Oat phenotyping in Estonia in 2014

Phenotyping of rye

Poor seed germination and losses due to winter damage in Estonia hindered the multiplication of all originally received genetic resources. Therefore, some commercial rye varieties were organized from European rye breeders to include them in the rye diversity panel. In fall 2014 evaluation trials were sown in Jogeva, Estonia and Prague, Czech Republic.



Loss of two rye accessions due to poor seed germination and winter damage in Estonia

WP3: Evaluation of biotic stresses on minor cereals

In 2015, WP3 has commenced the evaluation of resistance of minor cereals genotypes to crop diseases, namely to rusts in spelt wheat (*stem rust, leaf rust, yellow rust) and for oats (crown rust),* and to common bunt *(Tilletia tritici and T. laevis)* in spelt.

Left: A typical example of stem rust (*Puccinia graminis*)

Below: Yellow rust (*Puccinia striiformis*)

Why is resistance to crop diseases so important? The healthy condition of crop plants has a significant influence on the harvest yield as well as quality. An epidemic of crop disease can result where there is increased risk of heavy occurrence of the pathogen in several subsequent years.

At present, resistance to rusts in cereals in Europe is an urgent concern, especially in connection with changes in the structure of population of cereal rusts. Leaf rust (*Puccinia triticina*) appears in Europe to a varying extent each year. Recently, most attention has been given to yellow rust (*Puccinia striiformis*). In 2014 it was possible to observe an extraordinarily early and heavy occurrence of yellow rust in wheat in Western Europe, and this wave also hit the Czech Republic, Austria, Hungary and Switzerland. The newly occurring rust strains show a good capability for adaptation to higher temperatures. Most affected were wheat fields with early sowing and under higher doses of nitrogen fertilisers. Mild winters contribute to the disease development as well. Vulnerability to yellow rust is mainly found in wheat and triticale, as well as spelt wheat. It is possible to register large differences between varieties**.**

Also, increasing attention has been paid for some time to stem rust (*Puccinia graminis*) in connection with the spread of the *Ug99* strain, which endangers vast areas of wheat and spelt cultivation. A mutation in one pathogen locus was sufficient to destroy resistance of a large number of wheat varieties grown in South Africa and later also in Asia. However, minor cereals and wild relatives of wheat are an important source of resistance to the *UG99* strain, as well as to other stem rust strains. In the past, also rye has provided a source of genetic resistance to rusts.

Common bunt (also known as “smuts”) is also addressed in HealthyMinorCereals. A bunt infection may affect the quality of foodstuffs. Spores of bunt growing on the harvested grains produce trimethylamine, whose odour makes the crop unusable for the foodstuff industry and unsuitable even for feeding animals. The food industry has effective systems to detect and avoid contaminated batches, so the main negative impacts are for livestock fed bunt-contaminated feed. In severe cases of contamination of fodder cereals with bunt spores, health problems in livestock have been reported, including respiration allergies and digestion disorders, also disorders of growth, development and especially reproduction. In the course of the first half of the 20th century, the occurrences of bunt contamination from the *Tilletia* genus dropped thanks to application of disinfectants. The importance of resistance to bunt, however, currently rises with the use of growing technologies where seed treatment with disinfectants is not used (organic farming).

At present it is necessary to extend the range of information with new data regarding resistance to rusts and bunts for minor cereals. The results obtained during evaluation of the resistance of varieties will be used directly in the farming practice, especially during the growing of spelt wheat. Materials with a high level of resistance can serve also as a source of resistance in cultivation.

In WP3, resistance to rusts will be evaluated in experiments with artificial infection, when currently appearing strains will be used for infection. Responses to the range of crop disease strains tested in WP3 will be monitored and recorded also in experiments with the natural infection.

In autumn 2014, to evaluate resistance to bunts a mixture of teliospores of *T. tritici* and *T. laevis* originating from three different locations was applied to spelt, einkorn and emmer at CRI.

WP6: Optimising processing strategies

Samples of commercial varieties of emmer, einkorn, spelt, rye and oat received from project partners were processed according to standard milling technologies and supplied to a laboratory for qualitative and quantitative analysis to determine the nutritional value of their protein content and also to get evidence of the lack of any anti-nutritive substances. Based on the laboratory results, the samples have shown a great potential for human nutrition in terms of amino acid ratios. This result will allow us to choose the most appropriate processing technologies for enriching the protein fraction of bred varieties. The analysis of anti-nutritive compounds is currently ongoing.

Within the next months the scientific staff of ILU e.V. together with the industrial partners - Reiner Stolzenberger Bakery (Germany) and Grupa BGK (Poland) will develop a concerted strategy for optimisation of certain standard processing technologies of minor cereals, which will be adjusted based on their physiological and technological properties. ILU e.V. will develop the methodologies for baking and extrusion technological steps, whilst the industrial partners will perform production trials under real manufacturing conditions according to strict HACCP and GMP conditions. The outcomes obtained from the processing of common varieties will be later translated into processing protocols for the bred varieties obtained from partners involved in the overall breeding strategy.

WP8: Enhance the market prominence for minor cereals

Our partner FiBL has performed an extensive survey of minor cereal crops grown in Europe, their potential and perception by consumers. Their report states that Europe is currently self-sufficient in cereal crops as a result of the intensive production of common wheat. Rye, oats, spelt, emmer, and einkorn are produced in much lower quantities although they have interesting nutritional and health properties.

Data on minor cereal products collected reveal an interestingly high number of diverse products on the market. Below we would like to present you a few examples from Hungary.

Products from einkorn and emmer

Einkorn and emmer bakery products by Piszkei Öko Ltd.

Einkorn beer by Körös-Maros Biofarm Ltd.

Einkorn grains by Naturgold Ltd.

Products from spelt

Spelt crackers by Mogyi Ltd.

Spelt breakfast flakes by Biopont Ltd.

Buttery Spelt "Pogácsa" (whole wheat spelt flour, sour cream, butter, yeast, sesameseeds, himalaya salt) by Ballagó Attila

Wafers with almonds (malt syrup*, whole wheat spelt flour*, coconut oil, almond, carob*, water, soya lecithin, sodium bicarbonate) by Ballagó Attila

Rolls with pumpkin seeds (wholewheat spelt flour*, water, palmoil*, pumpkin seeds*, yeast, seasalt) by Piszkei Öko Ltd.

Wholewheat spelt flour bread by Piszkei Öko Ltd.

Pasta

Products from oats

Chocolate-oat cookies by Biopont Ltd.

Coconut-oat cookies by Biopont Ltd.

Products made from rye

Teabiscuits with rye by Ballagó Attila

Rye pasta

Project communication, cooperation and publicity

Contacts with the Healthgrain Forum Association were further pursued. The HealthyMinorCereals project was presented at their meeting in Copenhagen on 10-11 November 2014.

Stolzenberger's Bakery attended between 23-24th of September the „BetaGlucan Barley" symposium organised by ILU e.V. in Nuthetal Germany (about 50 participants). Mr. Stolzeberger's presentation focused on the quality of bakery products manufactured from minor cereal grains highlighting the advantages of minor cereal products' consumption. His talk was followed by practical presentation of several products baked from oat flour from the Stuttgart region.

In Estonia, several field days were organised during summer 2014 where the HealthyMinorCereals project and varieties of minor cereals were presented: field day of organic farmers in Avinurme (3 July; 40 visitors), field day of organic farmers at ETKI (8 July; 35 visitors), and farmers field days at ETKI (10 July; *ca.* 400 visitors).

Future events:

On 9-10 June 2015, the HealthyMinorCereals project will be presented at the field days „Naše pole" in Nabočany, Czech Republic. Look for the stands and field plots of the Crop Research Institute and BRO-BIO Ltd, where all five minor cereal crops studied in the project will be on display and consultancy offered.

The HealthyMinorCereals project and its first results will be presented at the 20th International Scientific Conference »Healthy grain for a healthy diet« that will take place on 22-23 April 2015, in Potsdam, Germany. Bernadette Oehen of FiBL will present a talk entitled Market potential for minor cereals (spelt, oat, rye) in Europe – see the conference programme.

Partners in the HealthyMinorCereals project

The project consortium includes nine academic centres (six research institutes and four universities) and seven SMEs located in 10 European or Associated countries.

1: Crop Research Institute (CRI), Czech Republic, Coordinator

2: PRO-BIO Trading Company Ltd. (PROBIO), Czech Republic

3: Selgen a. s. (SEL), Czech Republic

4: University of Newcastle upon Tyne (UNEW), United Kingdom

5: Gilchesters Organics Ltd. (GIL), United Kingdom

6: Sabanci University, Faculty of Engineering and Natural Sciences (SU), Turkey

7: Research Institute of Organic Agriculture (FiBL), Switzerland

8: Getreidezüchtung Peter Kunz (GZPK), Switzerland

9: Volakakis Nikolaos (GEO), Greece

10: Estonian Crop Research Institute (ETKI), Estonia

11: University of Natural Resources and Life Sciences (BOKU), Austria

12: Institut für Lebensmittel-und Umweltforschung e.V. (ILU), Germany

13: Stolzenberger's Bakery (SB), Germany

14: University of Kassel, Section of Organic Breeding and Agro-Biodiversity (UNI KASSEL), Germany

15: Grupa BGK Spółka z o.o. (BGK), Poland

16: Hungarian Research Institute of Organic Agriculture (ÖMKi), Hungary

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The HealthyMinorCereals project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 613609.