Let's make grain great again

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The Landrace

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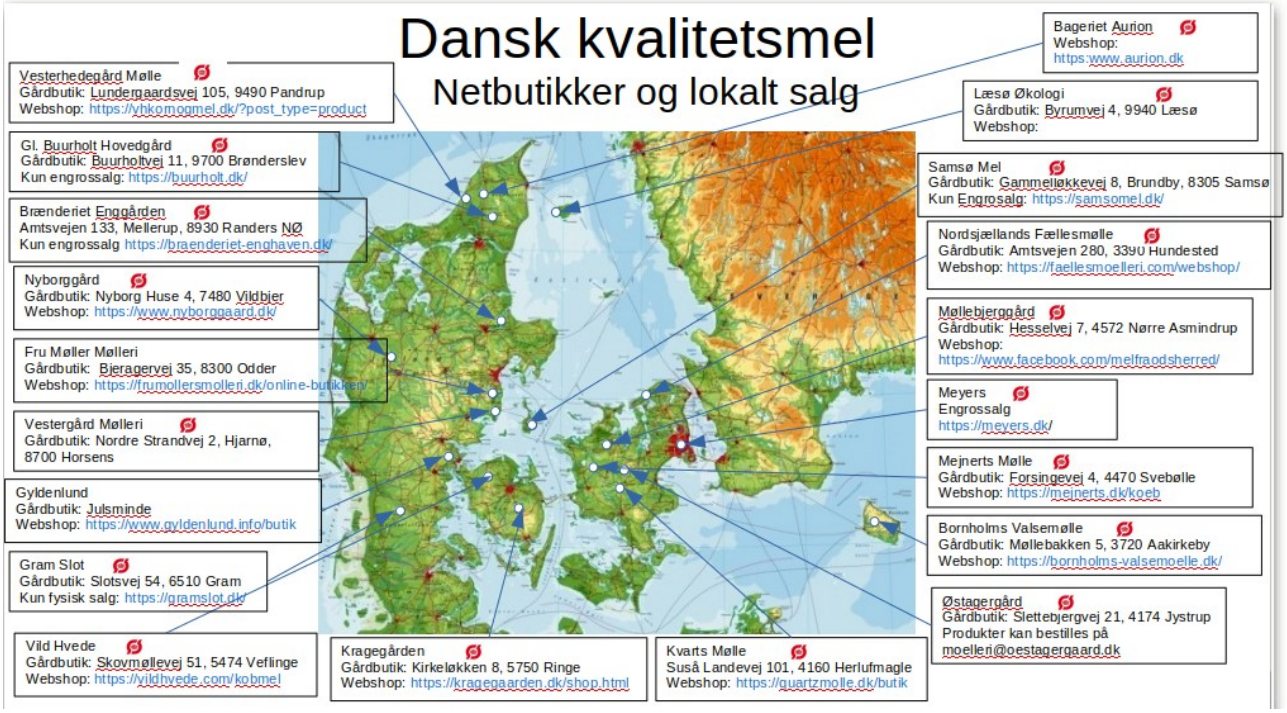
List of mills and webshops in DK

Landsorten works to procure seed that can provide the best quality of locally produced flour and other cereal products. The good flour and beer that is made from Landsorten's varieties, on the other hand, is not sold by Landsorten but by the mills, the breweries, restaurants and others who make food from the grain. However, we naturally receive inquiries from consumers and retailers who ask where they can buy products from Landsorten's varieties. We have therefore tried to compile a list of where you as consumers can buy locally produced quality flour in Denmark.



Figur 1: Local mills, farm shops and webshops in Denmark. Please inform us on updates

Upcoming events

Open field day 20th June

Landsorten's annual open field day will be held again this year at Agrologica, Houvej 55 in Mariager on 20th June from 12.00 to 16.00. Everyone is welcome and participation is free. We start with a bite of bread baked from interesting cereals, so we ask for registration to: johan@landsorten.dk or on the Facebook-event. This year there is a bit of everything to look at. In addition to the usual around 2000 different varieties of grain, which include spring wheat selecting for low attack of gout flies, durum wheat with good overwintering and pasta quality, and spelt with good baking quality, then there is now also propagation of beans, lentils, chickpeas and much more that Landsorten expect to offer in the program in the future.

The day will mainly be in Danish

International open field day 5th July 2023

At the open field day 20th June, there will be a lot native talking, so if you do not speak Danish, you may consider to visit on 5th July instead, as we will have an open field day for international participants. The international project DIVERSILIENCE financed by CoreOrganic Co-fund will have a project meeting the day before with organic researchers and breeders coming from all over Europe including Italy, Bulgaria, Slovania, Romania and Scandinavia, but the field visit the 5th July will be open for all. Please announce you participation to borgen@agrologica.dk.

Nordic Heritage Cereal Conference 2023

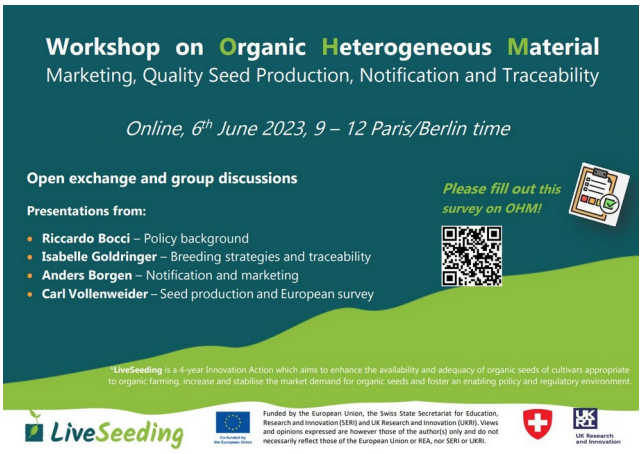
The annual Nordic Heritage Cereal Conference will this year be held at Järna in Sweden on 26-28th June. The seminar will be bilingual.

It will be an orgy in exciting posts about grains. The annual Nordic Heritage Cereal Conference has been going on since 2008, and is a fantastic opportunity to network in the grain industry. There usually comes a wonderful mix of both farmers, millers, bakers, researchers and all sorts of others who are involved in one way or another in working with organic grain and especially with old grain varieties.

See you!

Online workshop on Organic Heterogenous Material

on marketing, quality seed production, notification and traceablity with contributions from the leading European innovators within the area.



XXII International Workshop on Bunt and Smut Diseases

For the common bunt geeks, this event is of course the event of the year, where scientists from all over the world meet to discuss the latest news about smut and bunt diseases. It will be held this year in Austria in the city of Tulln on 13-15th June.
See more here

Hard wheat and soft wheat

There is often a lot of confusion when grain geeks talk about hard and soft wheat and gluten. It's a bit of a mess with those designations.

If you cut kernels with a knife, you will see that some kernels are white inside like compressed flour, while others are more amber-like with a crystalline and almost transparent structure (Figure 1). There are intermediate forms where some of the core is floury while other parts are ambery, but as a general rule it is either or. You can also see the difference on the outside of the kernel, where the soft mealy kernels have a lighter cream-like surface and with a rounded surface, while the hard amber-like kernels are darker and more angular. The difference between the two types is due to the structure of the cell walls, and is determined by both the genetics of the plant and the protein content of the kernel.

Kernels with a high protein content become harder, while kernels with a low protein content become soft, but there is a difference between the different varieties in relation to when the protein content causes the kernel to switch from a polymorphic structure to a crystalline structure. When grain is grown in a humid climate, the yields are higher and the protein content correspondingly lower than in a dry climate. The same cereal variety can therefore have hard kernels when grown in a dry climate but softer kernels in a more humid climate.

The word durum comes from Latin and means hard, and most varieties of durum wheat have very hard kernels.

If you talk to people from Italy, France and other countries from the Latin language, they immediately think of durum wheat if you say hard wheat, while soft wheat in those countries means bread wheat.

In America, the climate in the Midwest is drier than on the East Coast, where there is more rainfall. Therefore, the protein content is generally higher in grains from the Midwest, and the baking quality is therefore better and the kernels are harder. These areas specialize in bread wheat production, while on the East Coast, other types of grain are grown more cake flour. In America including Canada, hard wheat means bread wheat intended for bread baking, and all varieties are very specifically classified as either high protein hard wheat or low protein soft wheat. It is considered two completely different crops, and the varieties must be approved for either one or the other. In America, you cannot get a wheat variety approved at all if it is not either hard with a high protein content or soft with a low protein content, because there is no class for varieties with a soft kernel and a high protein content.
Many Europeans have difficulty understanding this.

Figur 2: Kernels of hard wheat (left) and soft wheat (right). Please not the colour difference also of the cut kernels

When you grind a hard kernel, it breaks down into small flour particles, but because the kernels in hard wheat are so hard, the kernels split and the starch grains breaks at the fracture surfaces. When

the starch grains are broken, the dough tends to be sticky, which is a bad feature in many bread recipes. The problem is greater in stone-ground flour than in roller mills, because the kernels on a roller mill are almost squeezed between two rollers, and therefore keep the starch grains more intact. In America, therefore, more than 100 years ago, they switched to grinding flour on steel rollers, because the bread grain in America is so hard, while in Europe they continued to use stone mills in many mills right up to our time. This is connected to the fact that European grain and especially Northern European grain has softer kernels, and therefore, all else being equal, gives a less sticky dough.

In Europe, grain quality is viewed a little differently. In Europe, the focus is not so much on the hardiness of the kernels, but to a greater extent on the protein and gluten content, regardless of whether it is found in a hard or in a soft kernel, because even though the kernels become harder when they have a high protein content, there are big differences between the varieties. Spelt and Øland wheat, for example, often have a very high protein and gluten content, but often have very soft kernels.

When you use the terms hard and soft wheat, it is important that you know whether the person you are talking to has an American understanding of the words or a French/Italian understanding.

To make the confusion complete, we also talk about soft and hard gluten, but this is something completely different, because it has nothing to do with the hardness of the kernel itself, but is a term for the properties of the gluten.

Gluten consists of a mixture of the proteins that cannot be dissolved in water. There are two different proteins in grains that are not water soluble, namely gliadin and glutenin. It is different from cereal to cereal which proteins they contain, and both gliadin and glutenin can again be divided depending on the molecular size of the individual proteins. Some cereals contain some huge glutenin molecules, and the more of these there are, the more firm the dough will be. It's like an exercise band at the physiotherapist, where some are looser than others. Spelt and many old cereals often have only a few of the high-molecular weight glutenins, and therefore have a soft gluten, while in modern cereals, you specifically go for a high content of the high-molecular weight glutetenins, which give a hard, firm gluten.

You can measure the softness of gluten in different ways. One method is on a Glutomat, where you first wash the gluten out of the dough by washing away everything that is water-soluble, and then centrifuge the gluten through a sieve. If a large percentage of gluten is left in the sieve after centrifugation, then it gets a high gluten index, up to 100%, while if there is only a small part of gluten left in the sieve, then it has a low gluten index. Many spelt varieties have a low gluten index of 40-50%, where Øland wheat is slightly higher at 50-70%, while modern wheat is often over 90%. Mariagertoba is often around 95%, and einkorn is always extremely low at around 20-30%.

It is not necessarily good to have a very high gluten index. It depends on the bread recipe and the purpose. If you are going to bake a free-standing bread, then the gluten index must be relatively high, because a soft gluten cannot keep its shape during rising. A spelt bread, and especially a einkorn bread, tends to flatten during rising, so it rises in width instead of rising in height. If you bake in a tin, the bread can only rise upwards, and then it may not matter som much whether the gluten is hard or soft. Therefore, there are completely different standards for baking quality in England compared to the continent, because in England the standards are set so that most flour is used for tin baked toast bread. In Germany, on the other hand, bread wheat cannot be approved if the gluten structure is soft.

A dough with a tight gluten is therefore good at keeping its shape, but on the other hand, more energy is needed to make it rise. A very tight gluten will therefore give a lower bread volume. You

then compensate for this by after raising bread and buns. A dough with soft a gluten, on the other hand, cannot be after raised in the same way, because then the bread will be flat.

When you fertilize the grain field, the protein content increases, but the gluten quality may also change a bit, although the distribution between gliadin and glutenin is primarily genetically determined by the variety.

If you add large amounts of nitrogen fertilizer and especially if it is added late in the season, it is the gliadin content in particular that increases, and this can result in a somewhat lower gluten index. Sulfur also affects the glutenin index, because sulfur bonds in the proteins help ensure the elasticity of the dough, and wheat grown with a sulfur deficiency generally has a higher gluten index.

World sensation: Mobile unit for single seed protein sorting

In the old days, when you had to measure the protein content in wheat, you did a Kjeldahl analysis, where you measured the nitrogen content in a laboratory. Most of the nitrogen in grain is bound in protein, so there is a very good correlation between nitrogen content and protein content. Nowadays, most measurements are made by directing a light of near-ultraviolet light (Near Infrared Transmission, NIT) through the grain. When the light passes through the grain, it is refracted as if in a prism, and a rainbow spectrum emerges on the other side. Different substances refract light in different ways, so depending on how the light is refracted, you can measure which ingredients the grain has. This is smart. It is literally a lightning fast method, and the grain is not destroyed during the analysis. When the farmer sells his grain at the whole sale, they'll take an analysis of the grain to measure the water, protein and starch content, and the farmer can then get a settlement corresponding the content. But it can get even smarter.

BoMill is a Swedish company that specializes in analyzing single seed with NIT. This means that the protein content in each individual kernelæ is analysed, and it turns out that there are large differences from kernel kernel to kernel.

The flowers in the middle of the top half of the spike bloom very first and the flowers at the bottom of the spike bloom a little later. But all kernels in the spike are harvested at the same time. Therefore, the kernels in the middle of the spike have a longer kernel filling period than the kernels at the top and especially the kernels at the bottom of the axis, and can therefore manage to embed more starch. The protein content is therefore highest in the kernels at the top and bottom of the axis. There are also differences in the protein content from plant to plant, depending on how much water, light and nutrition has been available to the individual plant, and on whether it is the plant's main tiller or whether it is an ear from a side shoot.

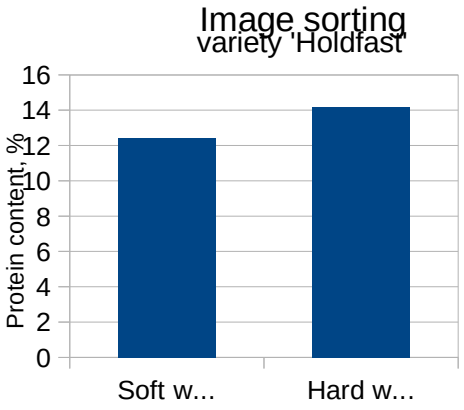
Figur 3: The first inspection of the sensatinoal new equipment of a mobile factory with single seed sorting with NIT analysis with a capacity of 4 tonnes per hour

When you have a batch of grain with, for example, 10% protein, it thus consists of millions of kernels, which on average have 10% protein, but with large differences from kernel to kernel. This means that by measuring the protein content of each individual kernel, you can sort them according to the protein content, and thus divide them into different fractions with high or low protein content.

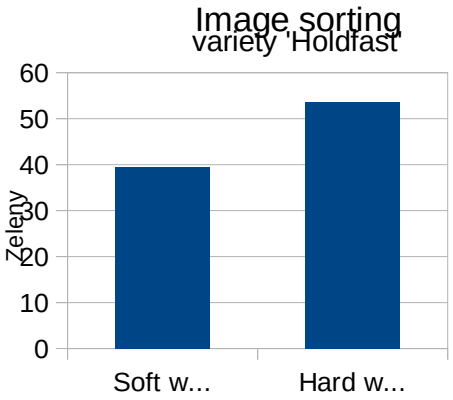
A batch of wheat with 10% protein does not bake quite optimally, and many bakers would like to go up to 11% to give a better baking quality. By removing the 25% of the kernels, with the lowest protein content, you can increase the average protein content in the rest. BoMill has therefore made a machine which can do it on an industrial scale. It works just like in a standard color sorter, but it uses Near-Infrared light instead of visible light.

Gl.Buurholt Hovedgård is one of the partners in the BOOST-project, that has been mentioned several times here in this newsletter, and they are the first in Denmark to invest in equipment that can sort with this new technology. The plant will have a capacity of 4 tonnes/h and will be established on a truck which can drive from farm to farm and from mill to mill and improve baking quality and seed quality with the new revolutionary sorting technology.

Agrologica has of course always been decades ahead of its time, and already in 2010-12 I started working with this and other technologies for grain sorting to improve baking quality.



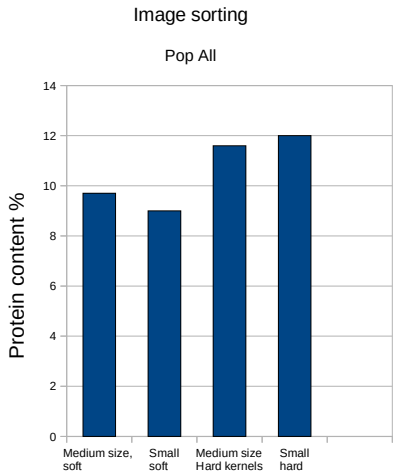
Figur 4: Effect on protein content of wheat sorted according to visual sign of seed hardiness. Trials from the COBRA project 2012



Figur 5: Baking quality expressed by NIR estimation of zenely of hard and soft wheat sorten by image sorting. Trials from the COBRA project 2012

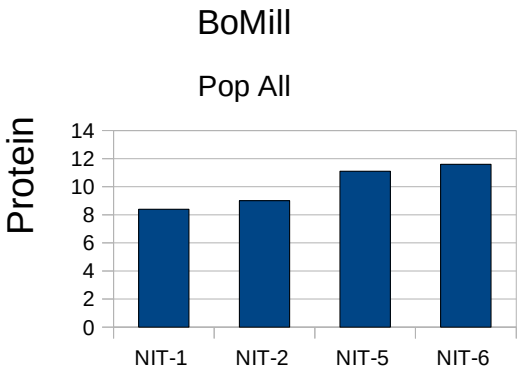
It is possible see with the naked eye whether a kernel is hard or soft, so by setting an image sorter according to this color difference, it is possible to sort the kernels according to kernel hardness and thus protein content. In the trial with the old white wheat variety 'Holdfast', it was possible to sort to a difference of around 2 percentage points in the visibly hard kernels compared to the visibly soft kernels (Figure 4). A color sorter can have an excellent capacity, and 2 percentage points in difference in the protein content is really something with an impact in the baking quality.

By combining size and color, it is possible to improve the protein content even more (Figure 6).

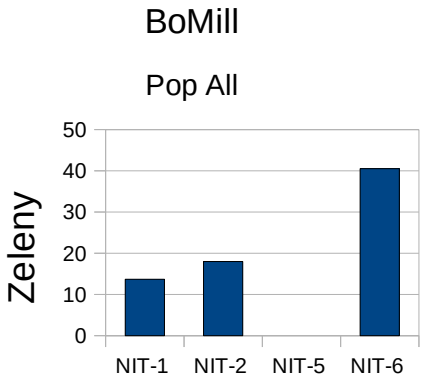


Figur 6: Combined sorting of seed size image sorting. Effect on protein content. Trials in the COBRA project 2012

When BoMill developed their NIT sorters, I naturally became curious and included this technology in the trials. In the experiments, the grain was sorted into 6 fractions. In one of the experiments, the 10% kernels with the lowest protein content had 8.4% protein, while the 10% with the highest protein content had 11.6% (Figure 8). The baking quality expressed by zeleny clearly reflected the differences in protein content (Figure 7). Another trial spread from 9.5% in the lowest fraction to 11.4% in the highest (data not presented).



Figur 8: Effect of NIT sorting on protein content in wheat sortet into 6 fractions. Trials from the COBRA project 2012



Figur 7: Effect of NIT sorting on zeleny of wheat sortet into 6 fractions. Trials from the COBRA project 2012

Now it might sound as if Gl.Buurholt's new equipment from BoMill is not very much better than known technologies such as image sorting with visual light, but it is not! It is far from always possible to see differences in protein content as between hard and soft kernels. As a general rule, you can't see the difference, and you won't be able to color sort according to the difference with visible light either. NIT sorting, on the other hand, sorts directly on the protein content, even if the difference is not visible. Therefore, I am absolutely certain that the new equipment will be able to improve the baking quality in almost all seed lots, and of course mostly in seed lots with a low protein content.

When a plant gets sick, it goes beyond the sugar content and changes the protein composition. The NIT equipment can therefore also be used in many cases to sort out kernels that are infected by fusarium fungi, which develop mycotoxins. Mycotoxins are actually quite a problem in grain, and the new equipment can rescue some batches infected with fusarium and reduce consumer exposure to mycotoxins.

The protein content is a problem for the baking quality, especially in organic grain grown at a low level of fertilizer, but regardless of the cultivation system and fertilizer, the Hagsberg Falling Number is always a parameter that can tease and destroy the baking quality. The falling number decreases when the starch is broken down into sugar at the beginning of germination, and precisely starch is one of the things that the NIT equipment is good at measuring, so it has been shown that in many cases you can improve the falling number by sorting the grain with the new equipment.

As you can see, I am quite excited about the new technology. I really think that it has the potential to produce some fantastic flour, and fulfill the ambition to make world-class local organic flour. I think it is this extra tool that has been missing from the ecological toolbox.

Figur 9: Quality improvement with Gl.Buurholt's novel mobile seed sorting equipment from BoMill .

Does NIT-sorting replace plant breeding?

As a plant breeder, I mainly work on developing cereal varieties with good baking quality, so will I now be unemployed when Gl.Buurholt can just take a pile of skod grains and sort it into the good baking quality? No not at all!

The two paths to good baking quality do not compete with each other. They complement each other. With good varieties of grain, there is less grain that is discarded with the NIT sorting facility, and of course it makes a difference whether you discard 10% or 50% in order to achieve the optimal baking quality.

The more protein you can get with both good varieties and sorting, the less fertilizer it is necessary to apply to the field to achieve sufficient protein content. In organic farming, we will have to use all the technologies available in order to grow the grain in an environmentally friendly way. Many are experimenting with phasing out manure and especially conventional fertiliser, while others are experimenting with reduced soil tillage in order to bet on solely supplying the plants with the soil's own nutrient cycle. The experiments are well-intentioned and will certainly lead to something good, but we have to admit that it often leads to a protein content in baking wheat that is not good enough. Therefore, both good varieties and new sorting technology are important tools to ensure both the environment and baking quality.

Please find previous issues of the newsletter at: https://www.agrologica.dk/publications