

# Cerealier

No. 03/2022

A magazine from  
Lantmännen  
Research Foundation



DEVELOPMENT

**Scaling up lentils  
and lupins**

RESEARCH

**Wheat for  
saline soils**

FROM MY PERSPECTIVE

**New partnership  
for wholegrains**



THEME  
FOOD SUPPLY



**Helena Fredriksson**  
**Can we eat grass?**

**E**very season has its highlights, but if I have to choose, then autumn is my favourite. It's harvest time. And, even if this year has involved many challenges and crises, the harvest has brought relatively good results. It feels great.

**ONE OF THE CHALLENGES** discussed in this issue is how to safeguard food supplies. One step on the way could be the large-scale cultivation of lentils and sweet lupins in the Nordics. We also cover an exciting initiative from the Swedish University of Agricultural Sciences, where researchers are looking at whether proteins from grass and cover crops could potentially be used as raw materials for food. We have also interviewed Johanna Lethin, who recently presented her thesis on salt-tolerant wheat – a hot topic now that reports of extreme weather are increasingly common.

**“Get the most out of your food.”**

**YOU CAN ALSO READ** about the breakthrough in oat DNA mapping, and the opportunities this provides. In our series about the new oat variety, Active, we meet one of the farmers who has just brought in the harvest.

To round off, we have a suggestion from a recipe book that focuses on getting the most out of food. The basic idea is the smarter use of food, such as transforming yesterday's leftovers into new meals – a clever way of reducing food waste.

I wish all of you a pleasant read!

**Helena Fredriksson**

Lantmännen Research Foundation



PHOTO: GOLDEN RETRIEVER

# Food supply

*In this issue, we interview researchers about future foods.*

**Pages 7–15**

## Cerealier

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PHOTO: CHRISTIAN ANDERSSON



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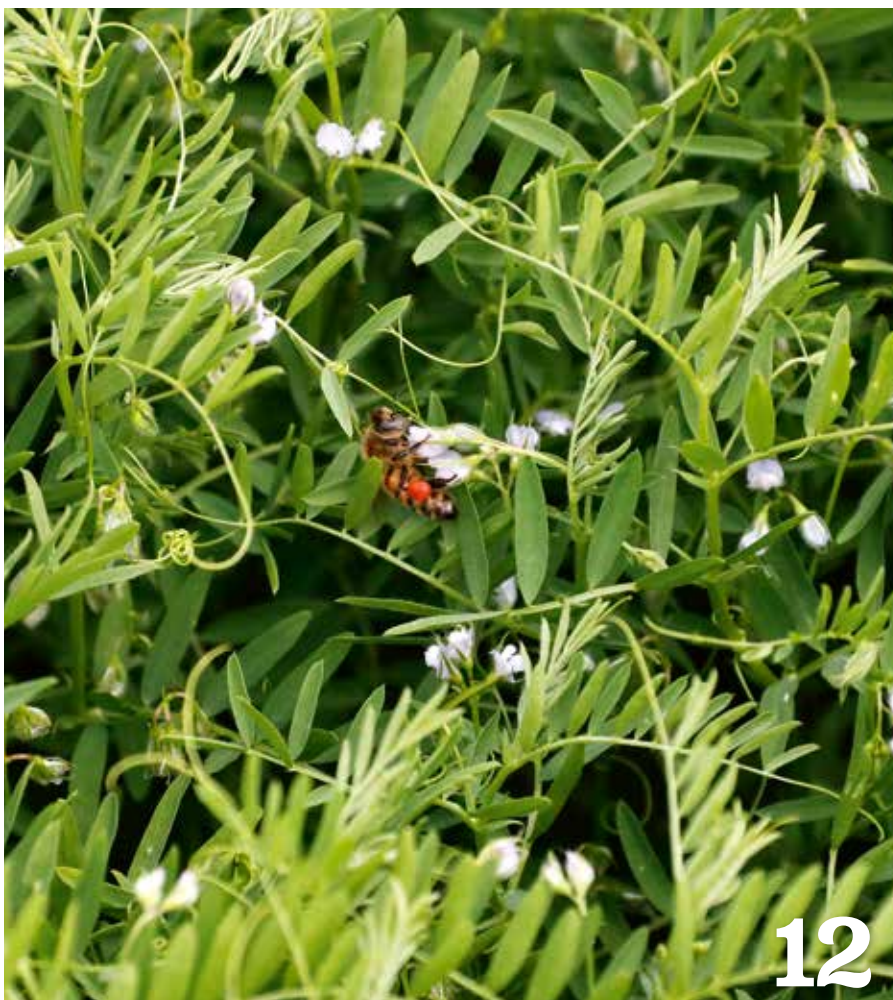


PHOTO: HANS JONSSON / CUMULUS INFORMATION

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**LANTMÄNNEN**  
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## Danish whole-grain advice



The Danish Veterinary and Food Administration has previously advised

that people should eat at least 75g of wholegrains per day, preferably more. This figure has been reconfirmed after an evaluation by the National Food Institute at DTU. They state that a daily intake of 300g to 400g of grains is suitable for adults, and at least half of this should be wholegrain products. ●

Read more: [www.food.dtu.dk](http://www.food.dtu.dk)

## Updated food database



PHOTO: ISTOCK

The Swedish Food Agency has updated its “Search for nutrients” page in the Food Composition Database. The new version has added nutritional values in the groups for potatoes and grains, vegetarian products, gluten-free products and dishes commonly found in parts of the Middle East and Africa. Values for added and free sugars have also been added to the database this year. ●

Read more: [www.livsmedelsverket.se](http://www.livsmedelsverket.se)



## Highlighting the “rye factor”

Wholegrain rye bread has been shown to provide a lower insulin response after eating than other wholegrain products, without affecting blood sugar. This phenomenon has been called the “rye factor”.

In a new review, three

researchers from Chalmers University of Technology have summarised results from meal studies that included bread and other rye-based foods.

This compilation of results strengthens the hypothesis that rye has a positive effect

on insulin and glucose responses straight after a meal. Further research is necessary to clarify the underlying mechanisms. ●

Read more: <https://www.frontiersin.org/articles/10.3389/fnut.2022.868938/full>

## New European research on fermented foods

HealthFerm is a brand-new EU-funded research project, led by Professor Christophe Courtin from the KU Leuven, Belgium. 22 partners from ten countries will study the effects of fermentation on a range of plant-based foods. The interdisciplinary consortium will facilitate the transition from traditional to new plant-based foods that can contribute to better health. The project will run until 2027. ●

Read more: [www.healthferm.eu](http://www.healthferm.eu)





## Oats okay in a gluten-free diet

After mapping the genome of oats, researchers now know more about why people with coeliac disease do not become ill when they eat oats.

**D**etailed genetic analysis has strengthened the evidence that the composition of the protein in oats is different to that in wheat and barley, so people with coeliac disease can eat oats without an autoimmune reaction. Someone with coeliac disease cannot eat specific grain proteins.

“The results confirm that it is safe to include oats in a gluten-free diet, as long as any other grains are excluded,” says Manuel Spannagl, researcher at Helmholtz Zentrum, Germany.

THROUGH MAPPING the oats’ genome, the correct chromosomal location of the genes has been identified. This has been

difficult, not least because many copies have the same set of genes (see ‘In-depth information’).

Researchers liken this work to using building blocks: many similar pieces need to fit together in the right way. However, this new knowledge about the genome makes it possible to know which part is responsible for which characteristics, so it is easier to highlight

### IN-DEPTH INFORMATION

Oats are hexaploid, which means they have six sets of all seven chromosomes. In comparison, humans have diploid chromosome sets – we have two complete sets of chromosomes. Oats’ genome has over 800,000 genes, while the human genome has around 20,000 genes. In mapping the genome, researchers put together DNA fragments to make longer fragments that were finally assembled as chromosomes.

desirable characteristics when new oat varieties are bred.

“The work now presented in *Nature* provides a solid foundation for scientists and breeders when they develop oat varieties with higher yields, better climate tolerance, improved nutrient content and increased sustainability,” says Olof Olsson, professor at Lund University.

THE RESEARCHERS BELIEVE their work can increase understanding of oats’ beneficial properties and open doors to further development.

Much of the research was conducted at the ScanOats research centre at Lund University. Work was carried out in cooperation with the CropTailor company in Lund, and universities and institutions around the world. ●

Åsa Eckerrot

Read more: Kamal *et al.*, *Nature*, 2022

# 5.8

million tons is Lantmännen's forecast for this year's harvest of grains, oil seeds and legumes – somewhat higher than last year's figure of 5.6 million tons. ●

## New theses



↑ Anja Herneke



↑ Inger-Cecilia Mayer Labba

Researcher Anja Herneke has received her PhD from the Swedish University of Agricultural Sciences, with a thesis about protein nanofibrils as an ingredient for creating structure in foods.

Her study compared proteins from whey with plant-based proteins from legumes, grains, oil seeds and root vegetables. One result was that protein nanofibrils can be formed from mung beans, potentially creating meat-like structures in foodstuffs.

Inger-Cecilia Mayer Labba has earned her PhD from Chalmers for a thesis on the health effects of a green protein shift, with a focus on iron. ●



PHOTO: ISTOCK

↑ Regardless of culture, the test subjects found that vanilla, and second, peach, smelled best.

## Attractive scent is chemistry rather than culture

One widely-held belief among researchers is that scent preferences are due to culture.

However, a new study from Karolinska Institutet and the University of Oxford shows

that people from different cultures experience scents in the same way.

In the study, 235 people from different cultural backgrounds ranked ten scents.

The results clearly show

that the structure of the scent molecule determines whether or not the smell is pleasant. ●

Read more: <https://news.ki.se/people-around-the-world-like-the-same-kinds-of-smell>



ILLUSTRATION: LENE DUE JENSEN

## Farmers grow soya beans and lupins

In a new project at the Swedish University of Agricultural Sciences, 30 farmers will field trial soya beans and lupins for two years. The project will lead to cultivation guidelines and the aim is to increase cultivation of these protein crops, for food and for animal feed.

There has been great interest in participation, particularly among organic farmers. ●

Read more: [www.slu.se](http://www.slu.se) (in Swedish only)

**THEME**

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# FOOD SUPPLY

*What will we eat in the future and how will we feed everyone? We have interviewed researchers and experts about how research and innovation can help solve future food requirements. ►*

Photo Golden Retriever





# Research for future foods

Our food supply is affected by numerous challenges in the world around us, but these can be tackled through research and development.

“Research can contribute to the understanding of external factors, help increase harvests and remove bottlenecks,” says Ulf Sonesson, research and business developer at RISE Research Institutes of Sweden.

Text Karin Janson Photo Golden Retriever

**T**he vulnerabilities of the food supply chain have become clear during the pandemic and the war in Ukraine. At the same time, climate change is affecting how and what we will be able to grow in the future. RISE has just launched a new research focus on future foods, which will use the entire group’s expertise.

“We have a new research focus on food security, in which we and public agencies are investigating how we can secure the provision of food and power. We are already conducting projects in agriculture and digitalisation, such as how artificial intelligence and image analysis can improve food quality. Our unit for food and agriculture has worked with these issues for a long time, but what’s new is the creation of a platform where the entire breadth of expertise can be used,” says Ulf Sonesson.

RESEARCH AND INNOVATION can contribute to food provision at several levels, he notes.

“Planning for an unknown future is difficult. Research can contribute systems

understanding, the levels at which the food system can be influenced and what we can do. Research can also help remove bottlenecks and create opportunities for increased harvests. With climate change in mind, there is a huge need for continued research into plant cultivation, both the development of new varieties and of new, more robust production systems.”

Climate change is creating problems in both the short and the long term. Average temperatures are rising, and precipitation will increase.

“We will get a warmer and wetter climate, generally speaking. This means crops will grow faster and there will be more pests. In Sweden, we will be able to get higher grain harvests, but these will need better plant protection. Meanwhile, extreme weather, such as droughts and torrential rain, is becoming more frequent, and can destroy harvests and lead to crises.

SYSTEM ANALYSES ARE one way to prepare for this unknown future.

“Most of us believe that the future will be pretty much like now, just slightly different. Scenario and system analyses can help us think bigger and in new ways. Facts and an understanding of external factors are fundamental, but psychology is also involved. It is easy to push things away and think they’ll never happen, although history shows us that many unbelievable things have actually happened.

“The future doesn’t just happen, it is created by many different players – all with different agendas. As a researcher, it is possible to influence this, which feels hopeful.” ●

FOTO: GICCI JONSON



Ulf Sonesson  
RISE Research  
Institutes of  
Sweden

“The future doesn’t just happen, it is created by many different players – all with different agendas.”



↑ Johanna Lethin develops new wheat varieties.

**Responsible**  
Suedana Lehtova  
Kati Oksanen  
Are responsible before using the equipment!  
Users of this do not the equipment!  
If broken with the equipment - ask responsible!  
Good luck!

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# Future wheat for saline soils

Researchers at the University of Gothenburg have developed a wheat that can be grown in soils with higher salt levels. In some cases, the studied wheat had a higher grain weight and better growth than comparable varieties.

Text Åsa Eckerrot

**A**rable land in places such as Asia and Australia has been seriously affected by climate change. Due to rising sea levels, coastal arable land (such as in Bangladesh) is frequently flooded, increasing the soil's salinity.

"Globally, around 2,000 hectares of arable land disappears every day," says Johanna Lethin, from the Department of Biological and Environmental Sciences, University of Gothenburg, who was awarded her PhD on salt-tolerant wheat this spring.

THE INDIGENOUS WHEAT in Bangladesh has some salt-tolerance, so a moderate increase to 2–4 deciSiemens per metre (dS/m) does not usually lead to greatly reduced harvests. However, coastal flooding can increase soil salinity to

more than 10 dS/m - a level where only salt-tolerant crops can grow. In other words, developing salt-tolerant wheat is important for the ability to feed a continually growing population.

IN A TEN-YEAR PROJECT, researchers in Gothenburg developed around 2,000 wheat lines from a Bangladeshi variety that is moderately salt-tolerant, BARI Gom-25, aiming to create a population with point mutations (see below). The original material was then used as a control when the researchers investigated how good the new lines were. From the 70 lines that germinated better than the control, half were chosen for continued studies in Australia, where there is a high level of expertise in this field.

"The Australian trials were conducted in controlled conditions in a gigantic greenhouse. Thanks to this, various wheat lines could be compared without interference from wind, temperature, uneven soil salinity or monsoon rains, which can happen when field trials are conducted outdoors," says Lethin.

One factor the researchers looked at was the level of salt in the leaves, and yield was compared with the control after

cultivation in saline soils in the same growing conditions. The study made important progress as the researchers were able to see how the lines used different mechanisms to deal with salt stress.

"Six lines were very interesting, but one of them distinguished itself through better growth, higher grain weight and a much lower salt concentration in the leaves," she says.

THE RESEARCHERS HOPE that the new salt-tolerant wheat can eventually be distributed to countries that have problems with saline soils, where problems are expected to increase due to climate change.

In southern Sweden, like other places in the world where rising sea levels is a growing problem, Lethin believes that a salt-tolerant wheat could be developed with adaptations to local conditions.

"If our salt-tolerant wheat was crossed with a Swedish wheat, for example, a salt-tolerant wheat could be developed and grown in the south of Sweden." ●

Reference: Mutagenesis in wheat: An approach to make saline green! Lethin, University of Gothenburg 2022.

Salinity (dS/m)	Growth response	Harvest impact
< 0.75	None	None
0–2	Small	None
2–4	Moderate	Limited harvest of some sensitive plants
4–8	Strong	Limited harvest of many plants
8–16	Very strong	Only tolerant crops provide satisfactory harvests
Over 16	Extreme	Only very tolerant crops provide satisfactory harvests

## SALT-TOLERANT WHEAT

Researchers have used point mutation to identify the genes that govern the plant's salt tolerance.

The technique means that point mutations are made in the seeds' genome, instead of adding external genes, such as in GMO.

One advantage of this technique is that it is possible to create a population with great genetic variation, from which new varieties can be developed. They could be salt-tolerant or have other valuable characteristics, such as high protein levels.

*Lentils and sweet lupins are examples of protein crops that are now in small-scale cultivation in Sweden. A research project is now investigating how this can be scaled up.*

*There is great demand for Swedish-grown protein crops, says Johanna Olsson, senior project manager at RISE Research Institutes of Sweden.*

Text **Karin Janson**

## Scaling up cultivation of lentils and lupins

**T**he project is called “From plot to commerce”, and researchers, farmers and food producers are working together to identify and remove obstacles and thus enable more cultivation of Swedish protein crops.

“We need to find new methods, for growing and for sorting, drying and dehulling. Our end products will be dry lentils and lupins,” says Johanna Olsson.

**OBSTACLES TO SCALING UP** could include access to adequate amounts of seed, difficulties in getting plant protection approved, and the need for technology and equipment for the different stages, such as efficient drying.

“Increased knowledge about growing protein crops at farm level, improved cultivation techniques and making inputs available would facilitate scaled-up cultivation,” says Olsson.

**FIELD TRIALS** OF eight lentil varieties and four sweet lupin varieties are being conducted this year and next year in Skåne and Öland, to see which varieties are best suited for cultivation in Sweden.

“Lentils appear to do well on lime-rich soil and soil with a moderate clay content, but not on ones with high clay content. We have not yet tested lupin on different soils, but we believe it likes drier, less clay-rich soils. The trials will tell us,” says Margaretha Månsson, project manager with Lantmännen R&D.

↑ Sweet lupins are already grown in Sweden, but on a small scale.





PHOTO: HANS JONSSON / CUMULUS INFORMATION

Plant protection against weeds will be tested for one lentil variety. Once the crops are harvested, practical drying trials will be conducted in RISE's mobile lab drier. All trials will be repeated and evaluated over two years.

"When it comes to drying, we need to know things such as optimal temperatures and how the crops should be handled," says Olsson.

ALONGSIDE THESE TRIALS, workshops are being held, at which the project group will develop cultivation advice for farmers. Field walks and seminars will also be organised to disseminate information about the results.

"If more farmers are to grow lentils and lupins, we need more stable harvests and increased yields.



FOTO: HANS JONSSON

↑ Johanna Olsson, project manager, RISE

This means we need to produce varieties that suit our climate, and to have a good infrastructure throughout the value chain," concludes Olsson. ●

Reference: <https://www.ri.se/en/what-we-do/projects/from-plot-to-commercial-production-upscaling-of-swedish-protein-crop>

## ABOUT THE PROJECT

**From plot to commerce** – scaling up Swedish protein crops started in 2022 and will run for three years. RISE leads the project, with Lantmännen and Kalmar Ölands trädgårdsprodukter as partners. Stiftelsen JTI is funding the project.



• Eva Johansson, Swedish University of Agricultural Sciences, sees great potential in the extraction of green protein.

# Green leaves may become protein-rich foodstuffs

The protein in side streams from vegetable cultivation and cover crops can potentially be used in foodstuffs, but extracting it is difficult. The GreenLeaFood project is now investigating various methods for doing this.

Text Karin Janson

All green plants contain RuBisCo, a high-value protein that is attracting increasing attention. Humans cannot use RuBisCo straight from leaves and grasses, but if it could be extracted from green biomass, it could be used in food.

“The protein develops different characteristics depending on how it is extracted, including the ability to froth or gel. So it could be used in meat analogues, for example,” says Eva Johansson, professor of agronomy at the Swedish University of Agricultural Sciences and project leader for GreenLeaFood.

THE PROJECT USES green biomass from side streams, such as beet greens and grass cuttings or ley, as well as intermediate and cover crops. The by-products left from extraction could be utilised for biogas.

“Intermediate and cover crops are mainly grown to bind nitrogen, and then ploughed in to help improve the soil. If these crops could be used in food

**“If these crops could be used in food instead, the farmer could get more out of each cultivated field.”**

Eva Johansson  
Professor SLU och  
projektledare GreenLeaFood

instead, the farmer could get more out of each cultivated field.”

In theory, this could also have environmental benefits. A researcher who carries out lifecycle and economic analyses is part of GreenLeaFood.

“We believe in the ideas, but they are still at the research stage. There are many pitfalls in terms of energy consumption, so lifecycle analyses are important,” says Johansson.

AS WELL AS PROTEIN, other components such as dietary fibre, colourings and phenols can be extracted from green biomass. Phenols are organic compounds that have many areas of use, such as in the beauty industry. In the food industry, phenols can be used in meat to increase shelf life and retain the meat’s natural colour.

After being harvested, the green biomass is cut in a machine in the university’s plant protein factory in Alnarp. The protein is then extracted. The first

attempts to extract RuBisCo started in the spring.

“We have obtained small amounts, but not enough. One challenge is not destroying the protein during the extraction process. It is water soluble, but is bonded in the leaves’ membranes and structures, so we are investigating different extraction methods, such as heat, enzymes or pH treatment,” says Johansson.

It remains to be seen whether protein extraction from green biomass is possible and financially feasible for farmers, but Johansson sees great potential.

“RuBisCo is everywhere, and green biomass is a good resource to extract it from. Eventually, it could replace soya protein, if we succeed in extracting it.” ●

Read more: A Danish study has investigated the extraction of proteins from green biomass. Möller *et al.*, *Journal of Agricultural and Food Chemistry*, 2021.

## GREENLEAFOOD

The project is funded by Formas and runs 2021–2025. The Swedish University of Agricultural Sciences is the project owner, with participants from Lantmännen, Oriflame, Gasum and Nordic Beet.

The aim is to obtain components that can be included in healthy new foods that are environmentally sustainable. The green biomass is processed in the protein factory on the university’s Alnarp campus.

ACTIVE PART 3:

# Active cultivated this summer

*This year in Cerealier, we are following the development of Active, a new Swedish oat variety. Over the summer, it was grown on three farms in southern Sweden.*

Text **Karin Janson**

**T**his growing season, a total of 40 hectares of Active were cultivated. At the time of writing, the analysis of the harvest was not complete.

“We’re waiting for the results to tell us whether the seed quality was high enough. Germination rates need to be adequate and the oats should be free from the inclusion of other varieties and common wild oats. Nor should there be any diseases,” says Maria Norén, market manager seed at Lantmännen.

The harvest will be divided up, with most of it becoming seed, but some will be used in industrial testing.

“If everything looks good, we will make a plan for allocating the harvest, growing in the next stage and testing the oats in various products,” says Norén.

ONE OF THE three farmers who have grown Active this year is Lennart Andersson from Grimeton, Halland. He grew 12.5 hectares of Active. This summer was damp and fairly cool.

“Halland normally has lots of rain and oats thrive in this climate. There’ve been no diseases either, and generally I think

that oats are more tolerant of disease than barley or wheat. In other words, the harvest was good.

“Growing a new variety is like normal cultivation from seed, but with some extra monitoring. We have grown special varieties previously with good results, which I think is why we were involved. We also have drying and storage on the farm, which was a requirement.”

HE BELIEVES IN Active as a future variety.

“It’s positive that Lantmännen is investing in developing new varieties that we can try – particularly, like with Active, when there is a health trend behind it. The younger generation have new demands, so we have to keep up.” ●

## ACTIVE

Active is a new variety of oats, developed by Lantmännen and CropTailor. It has higher levels of beta-glucan fibre and more protein than other oat varieties. Active is also the first oat variety in the world to be produced using genomic selection, a new method that is having a real breakthrough within plant breeding.



PHOTO: LANTMÄNNEN







FOTO: LANTMÄNNEN



PHOTO: TORBJÖRN ESPING



PHOTO: STAFFAN ERLANDSON / LANTMÄNNEN

↑ Lennart Andersson has grown Active.

↶ Oat harvest.

← Maria Norén, market manager seed, Lantmännen.



*In July, the International Association for Cereal Science and Technology (ICC), organised a conference on the theme “Future Challenges for Cereal Science and Technology”. Two of the presentations are summarised here.* **Text Sanna Remholt**

ICC CONFERENCE 2022

# Focus on gluten and weather

## FRED BROUNS

Professor of Food Innovation and Health  
Maastricht University,  
Netherlands



## STEFANO D'AMICO

Senior researcher  
in animal feed and health  
AGES (Institute of Animal  
Nutrition and Feed) Austria



**F**red Brouns highlighted the link between gluten intake and weight gain, an issue that is current for both researchers and consumers.

Two different mechanisms for gluten's possible effect on weight gain have been discussed scientifically: either an appetite boosting effect, which can lead to increased food intake, or that gluten reduces basal energy expenditure.

**BROUNS BELIEVES** that for gluten to have a lasting metabolic effect in the body, a continual supply is necessary to maintain a stable concentration in the blood. When the number of absorbed gluten peptides in the blood after a meal have been examined, the amount is often found to be small, and the peptides have a short half-life. Nor is

there any proof that gluten peptides boost the appetite via receptors in the gut; instead, the peptides seem to promote a feeling of satiety.

Fred Brouns also summarised a study that investigated the effect of gluten on body weight, where the subjects' daily food intake initially included mixed proteins and, in a later stage, only wheat protein (gluten). Despite the relatively long period of 50 days with wheat protein as the only protein source, no effect could be seen on body weight.

**NOR DO THE RESULTS** of large cohort studies from around the world show any correlation between gluten intake and daily energy intake, body weight or BMI. The conclusion of the session was thus that there is very poor scientific evidence that gluten intake stimulates an increase in weight. ●

**T**he climate's effect on wheat components was discussed by Stefano D'Amico. The influence of climate change and extreme weather on agriculture often entails reduced grain yields. But other parameters, such as changed levels and compositions of macronutrients, primarily protein and carbohydrates, can result from changed weather. This may lead to changes in baking characteristics.

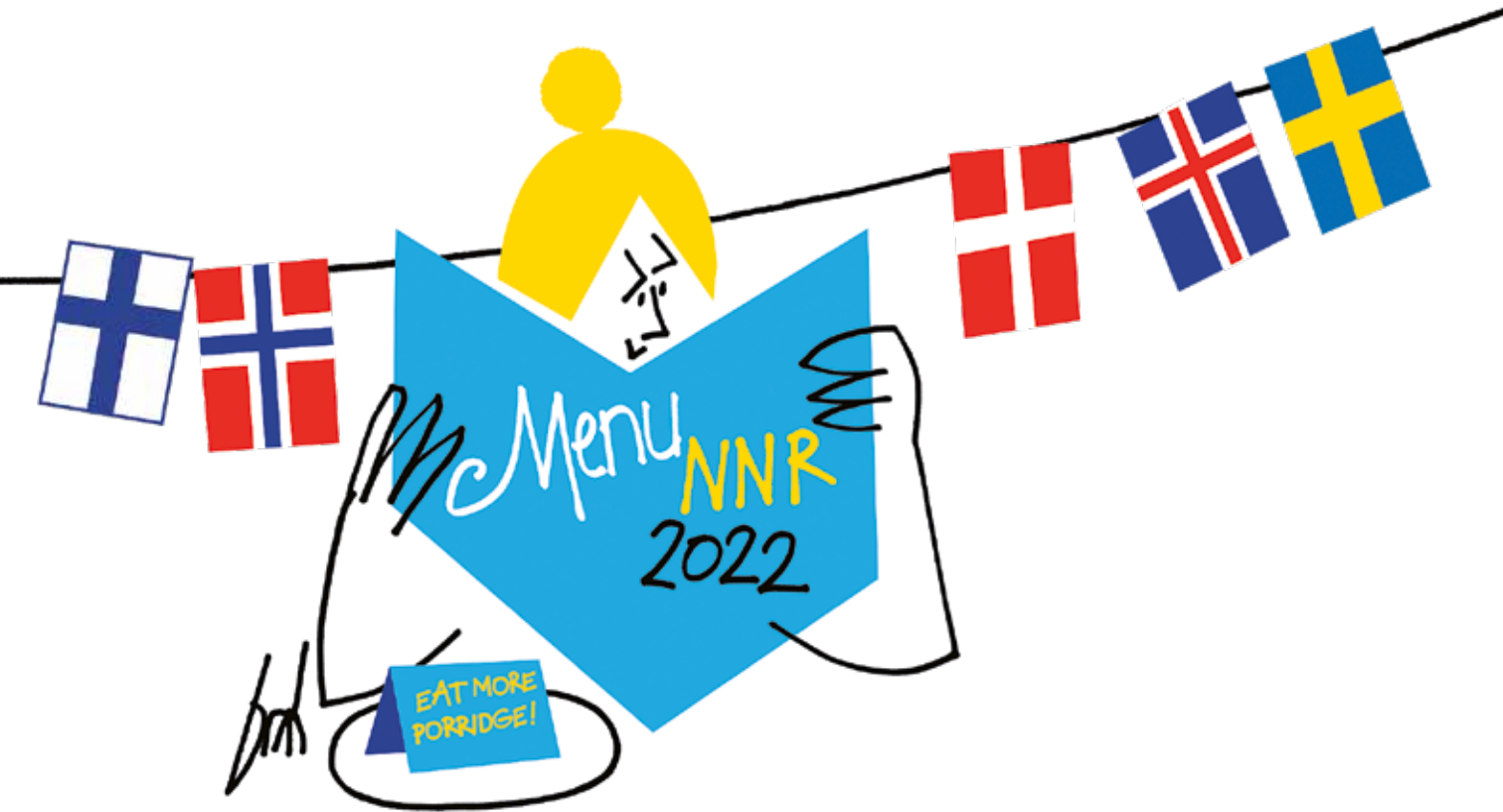
The researchers at AGES have investigated how factors such as fertilisers and varying weather conditions affect the composition of wheat.

**THE STUDY EVALUATED** how weather affected protein composition and the level of fructans (dietary fibre) in wheat. Samples from wheat harvested in 2016 and 2017, from nine areas of Austria,

were analysed. The wheat came from both organic and conventional production, and was a variety with naturally good baking characteristics and a high level of protein. Weather conditions differed between 2016 and 2017, as 2017 was more extreme, with a cold winter and a hot and dry summer.

**NITROGEN FERTILISER** was the parameter that had a significant effect, with higher yields and protein levels. Periods of more extreme weather (2017 harvest) resulted in lower yields, lower fructan levels and higher levels of protein, but it was difficult to express certainty about these results as the study only covered two growing seasons.

In general, weather conditions had only a moderate effect on protein composition and fructan levels, which surprised the researchers. ●



# Information about the upcoming nutrition recommendations

The updated Nordic Nutrition Recommendations, NNR2022, will be published next June. The committee chair, Rune Blomhoff, presented information at a webinar about how work is progressing.

**Text Karin Janson**

**Illustration Lene Due Jensen**

“It is important that we have a democratic and transparent process. Over 400 researchers and experts are participating and the choice of subjects is based on an open call,” Rune Blomhoff explained.

AS A BASIS FOR THE WORK on the new recommendations, 76 existing high quality systematic reviews\* are being used, as are nine new high quality systematic reviews

produced by the committee, and seven background articles. All chapters are undergoing peer review. New chapters are published on the internet and are open for comments for eight weeks.

“We encourage researchers and other stakeholders to provide feedback and share their knowledge,” said Blomhoff.

THE FINAL REPORT, which will be published in June 2023, will include chapters on nutrients such as fat, carbohydrates, protein, vitamins and minerals. It will also include 17 chapters on food groups and areas (see list below). Sustainability will be more comprehensively integrated in the new Nordic nutrition recommendations.

“We will integrate sustainability in every chapter where it is relevant. By sustainability, we

**“We will integrate sustainability in every chapter where it is relevant.”**

**Rune Blomhoff**  
Committee chair

primarily mean environmental and climate aspects,” Blomhoff stated. ●

\***Systematic review:** A review of research literature, using specific methodology to compile all available research in a defined field.

Follow the work at:  
[www.helsedirektoratet.no](http://www.helsedirektoratet.no)

## FOOD GROUPS

Drinks (coffee, tea, sugared and with sweeteners). Cereals (grains). Vegetables, fruits and berries. Potatoes. Fruit juice. Legumes. Nuts. Fish, fish products and shellfish. Meat and meat products. Milk and dairy products. Eggs. Fats and oils. Sweets and baked goods. Dietary patterns. Meal patterns. Ultra-processed foods. Breastfeeding.

RECIPE

# Apple crumble with muesli

*Make the most of autumn apples with this muesli-topped apple crumble. Tart apples work best, and whipped cream or custard are a great accompaniment. The recipe comes from the book *Var rädd om maten*.*

## Apple crumble

Servings: 12 Time: 40 minutes

6 apples  
150 g butter  
300 ml muesli,  
bought or homemade  
150 ml wheat flour  
200 ml sugar  
50 ml golden syrup

To serve:  
Whipped cream with vanilla

### INSTRUCTIONS

1. Heat the oven to 175°C. Peel, core and slice the apples. Arrange in a greased ovenproof dish.
2. Melt the butter. Stir in the muesli, wheat flour, sugar and syrup. Cover the apples with the muesli mixture and bake in the oven for about 30 minutes.
3. Serve with custard or gently whipped cream. ●



# FROM MY PERSPECTIVE

*A Swedish wholegrain partnership, “Fullkornsfrämjandet”, is taking shape. Hopefully it will have the same good effects on dietary habits as in Denmark, writes Anette Jansson, from the Swedish Heart-Lung Foundation.*

## “Now we’re working to increase wholegrain consumption!”

**D**enmark has had a wholegrain partnership since 2008, which has led to more than doubled consumption of wholegrains - from 35 to 80 grams per day. Product development has also taken off, with around 850 new wholegrain products in the same period.

Dietary habits rank highly among the lifestyle habits that have the greatest effect on health, and, among dietary factors, a low intake of wholegrains is one of the most central.

**WHOLEGRAINS BRING** several health benefits, reducing the risk of type 2 diabetes, cardiovascular disease and bowel cancer. They have fibre and other components, such as plant sterols, which reduce the uptake of cholesterol in the gut, thus lowering levels of harmful LDL-cholesterol in the blood and contributing to a reduced risk of cardiovascular disease.

Naturally, since wholegrains are good for the heart, the Swedish Heart-Lung Foundation is committed to increasing their consumption in Sweden. Grain products are the source of dietary wholegrains and also one of the most climate-smart foods you can eat.

We do not eat very many wholegrains in Sweden. The recommendation from the Swedish Food Agency is 70 to 90 grams per day, but only one in ten people eat this much according to the latest dietary survey, “Riksmaten 2011”.

However, the range of wholegrain products has expanded in recent years, and wholegrains can now be found and consumed in many ways. To further promote variety in wholegrain products and increase intake, work is now ongoing to create a wholegrains partnership in Sweden, “Fullkornsfrämjandet”, like the one in Denmark. The partnership will include the Swedish Heart-Lung Foundation and other participants from academia and the public and private sectors.

**THE SWEDISH** Heart-Lung Foundation is looking forward to working on a continued increase in wholegrain consumption in Sweden, alongside the other contributors who initiated work on “Fullkornsfrämjandet”. This will be good for both health and the environment.



**Anette Jansson**

“...since wholegrains are good for the heart, the Swedish Heart-Lung Foundation is committed to increasing their consumption in Sweden.”



FOTO: PRIVAT

**Anette Jansson**  
The Swedish Heart-Lung Foundation

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PHOTO: ELIN KARLSSON, SLU

↑ The researchers will study new types of pen systems.

## Future pens help pigs find their place

A new project, partly funded by the Lantmännen Research Foundation, is studying innovative pen systems for slaughter pigs.

Text Kerstin Sigfridson, Lantmännen R&D

**P**ens for slaughter pigs have, in principle, looked the same since the 1960s. Developing and modernising how slaughter pigs are raised is important for sustainable Swedish pig production. One way is to keep pigs in larger groups of 100 to 400 pigs, rather than the normal 12 to 14 pigs in a pen. The main benefit is that the pigs will have a larger area to move around in.

**THE RESEARCHERS** in the project “Innovative pen systems for large groups of slaughter pigs – success factors and pitfalls” are Rebecka Westin, Jenny

Yngvesson and Elin Karlsson from the Swedish University of Agricultural Sciences, and Carl-Johan Ehlörsson, livestock vet at Gård & Djurhälsan.

The aim is to increase knowledge of pigs in large groups and to contribute to producing new guidelines on how best to design and build new pens. The research group also wants to find out the best design for a feeding system and the optimal group size for pigs.

**THE PROJECT WILL START** with an inventory of alternative pen systems in Sweden and Denmark. These are often solutions developed by creative pig farmers. The inventory will be a type of reference for the potential that exists.

In a second phase of the project, researchers will look in more detail at around ten farms that have a new type of pen system, with auto-sorting scales. In these, the pigs are in large groups with

access to different areas for feeding, resting, activity and manure. Using new technology, the pigs are weighed as they move to the feeding area. Depending on their weight, they are directed through gates to the feed station that is most suitable for them.

The research group will collect production data from the farms, evaluate the animals’ health and investigate how their behaviour is affected by living in larger groups.

“We want to try to evaluate which group size works best. The pigs have to be happy,” says Elin Karlsson, one of the researchers.

**THERE ARE MANY FACTORS** that need investigating with these new types of pen systems, including hygiene, health, production efficiency, how the pigs are managed and how to train them to go through the gates. The project will be presented in the summer of 2023. ●

## NEWS FROM LANTMÄNNEN RESEARCH FOUNDATION



PHOTO: ANDERS LILJEGREN / LANTMÄNNEN

## Recently completed projects



### Pea protein as meat

Conditions for concentrating

protein from yellow peas have been studied in the lab by researcher from Chalmers University of Technology. In addition to yield trials, the functional properties of the proteins have been studied, as has how the proteins function as ingredients in meat analogues. The results will be published in a scientific journal this autumn. ●



### Increased wheat quality

When wheat is grown, nitrogen

fertiliser is applied at specific times to control the amount of protein in the grain. Researchers at the Swedish University of Agricultural Sciences have investigated how the amounts of fertiliser can be adjusted to requirements in later stages of development. The results will be used in recommendations for farms. ●



### Starch for 3D printing

Researchers at KTH Royal Institute of Technology have evaluated whether wheat starch can be used as a fossil-free alternative to plastic as a raw material for 3D printing. The studies showed that it is possible to produce threads of starch and use them for 3D printing. More development work is needed before the product can be commercialised. ●

## About the research foundation

Lantmännen Research Foundation supports research in the entire chain, from field to fork. It grants up to SEK 25 million to research annually, focusing on three areas:

- Agriculture and machinery
- Bioenergy and green materials
- Food and health

The goals of this research funding include increased agricultural production with minimised

environmental impact, and establishing how agriculture can contribute to the development of a biobased society. In the area of food, we want to increase knowledge of grains and legumes as a natural element of sustainable future food.

The foundation holds an open call every autumn, starting in September. See: [www.lantmannen.com/researchfoundation](http://www.lantmannen.com/researchfoundation) Applications are assessed on their newsworthiness, scientific

quality and business potential. Decisions are announced in December. ●

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