Cerealier

No. 04/2025

A magazine from
Lantmännen
Research Foundation

#04

A Christmas gift for the prepper kit!

PLENTY

How to improve the food system

KNOWLEDGE CENTRE

Investigating threats to food security

PLATE

Recipes for sustainable meals

THEME

FOOD PREPAREDNESS

Helena Fredriksson
Preparing for leaner times

Interest in prepping has increased. Recently, in the lunch room, there was talk of stocking up on groceries, tinned food, coffee and even wine. There is definitely greater awareness of how to manage a potential crisis, both at an individual level and in society as a whole. However, we must avoid hoarding if there is to be enough food for everyone when it is needed. In this issue of *Cerealier,* which focuses on food preparedness, we report on various activities in this area, including some newly established research centres; these are funded by Formas and will focus on the preparedness and competitiveness of the Swedish food system.

WE VISITED Jeanette Purhagen, who conducts research on baking in Lund University's baking lab. Also, we previously covered Jaqueline Auer's work for her doctoral thesis, which shows how different food processes can improve the nutritional value of legumes. She has now completed her doctorate and this issue presents some of her research results. Our foundation is also involved in more farm-based research, where one example is developing future feed for dairy cows. Cecilia Lindahl tells us more about this on page 23.

We also want to inspire you with a recipe that fits the theme: a vegetarian cevapcici. This can be cooked on a gas stove when there is limited access to water and ingredients.

Happy reading!
Helena Fredriksson
Lantmännen Research Foundation

"There is definitely greater awareness of how to manage a potential crisis, both at an individual level and in society as a whole."

PHOTO: ISTOCK

Food preparedness

Combined efforts in research and the public sector.

Pages 6–13

Cerealier

Responsible publisher
Helena Fredriksson
helena.fredriksson@lantmannen.com

Editor-in-chief
Ingar Nilsson
ingarnilsson@hotmail.com

Scientific project manager
Karin Arkbåge

Editorial board
Karin Arkbåge
Helena Fredriksson
Lovisa Martin Marais
Ingar Nilsson
Camilla Telander Pulliam

Translation
Clare Barnes
Åre Translation

Art direction & layout
Alenäs Grafisk Form

Cover
Theme: Food preparedness
Photo: Golden Retriever (see images on pages 3 and 6).

Address
Lantmännens Forskningsstiftelse
Tidskriften Cerealier
Box 30 192
104 25 Stockholm
Sweden

Telephone
+46 (0)10-556 00 00

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Address Lantmännens Forskningsstiftelse
Tidskriften Cerealier
Box 30192, 104 25 Stockholm, Sweden

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LANTMÄNNEN
RESEARCH FOUNDATION

The *Luftprover* podcast will help researchers detect biological threats

Biological warfare is one of the areas on which the Formas-funded Food Defence Research Centre will work (see page 9). In a podcast from the Swedish Defence Research Agency, biologist Per Stenberg describes technology for identifying airborne organisms, which are then analysed to detect potential threats. ●

Listen (in Swedish): https://rapporterat.podbean.com/e/69-hur-ett-system-for-att-mata-radioaktivt-nedfall-blev-en-guldgruva-for-biologisk-forskning

14/1

2026 sees the launch of FullkornsFrämjandet's Wholegrain Day in Sweden. ●

A new Danish cookbook on rye bread leftovers

Cookbook author and entrepreneur Louise Bering was fed up with the last dry slices of rye bread never being used, so she began experimenting. The end result was 55 recipes based on leftover rye bread. These are gathered in her book *Rugbrød – brug dine rester* (Rye bread – use your leftovers), which contains recipes for pizza, snacks, cakes and bread. ●

ILLUSTRATION: LENE DUE JENSEN

New study on the impact of wholegrains on children's gut flora

Research into wholegrains' positive effects on physical health has mostly focused on adults, showing that the gut flora's composition can reduce the risk of diabetes and cardiovascular disease.

A recent study included just over 50 Danish children, aged 8 to 13, with high BMIs. For eight weeks, half of the children ate a diet rich in wholegrain products made from rye and oats, while the other half ate a diet with refined grain products. The study identified two distinct clusters of gut bacteria in the children, and these influenced the effects of the wholegrains.

Children who had high levels of *Faecaliumbacterium* in their gut flora prior to the study responded positively to the wholegrain diet, and their body fat decreased during the test period. In the second cluster, where the children had high levels of *Clostridium* in their gut flora, wholegrain intake led to higher levels of good HDL cholesterol. ●

Read more: Madsen et al. "Gut microbial clusters in children show different cardiometabolic responses to wholegrains – a post hoc analysis of a randomized wholegrain trial in children". *Food and Function*. 2025.

Policy proposal for a path to sustainable diets

What influences our food choices, and what will make us choose foods that are good for our health? Interdisciplinary research platform SLU Future Food has presented a series of recommendations in a policy brief, Kostråd i praktiken (Dietary Guidelines in Practice), which they believe could encourage more people to follow the official dietary guidelines. Among other things, it highlights that advice must be rooted in food culture, that making the right choices should be easy, that knowledge is needed, and that healthy and sustainable food must be affordable. ●

Read more (in Swedish): SLU Future Food. Policy brief. Kostråd i praktiken. Version 1. May 2025.

PHOTO: ISTOCK

PHOTO: ISTOCK

Seminar examined plant-based proteins

Plant-based proteins will play a prominent role in the food systems of the future. But what do we know about how they affect our health, and how can foods that are produced using plant-based proteins be made tastier and more attractive to consumers?

This and many other topics related to plant-based proteins were discussed during a seminar at the Royal Swedish Academy of Sciences on 25 November. It was co-hosted by PAN Sweden, a research centre that collects evidence-based knowledge about plant-based proteins. The seminar was recorded and can be viewed on the academy's website. ●

Watch the seminar: www.kva.se/evenemang/plant-based-proteins-for-a-healthy-and-sustainable-diet/

Calls

ILLUSTRATION: LENE DUE JENSEN

Formas research council has two calls aimed at the food sector. It is seeking projects for the programme called Co-created Innovations for a Competitive Food Sector and Sustainable Transitions. In this, companies and researchers collaborate and use research as a basis for developing new foods, such as through new processing methods or the use of residual flows or new concepts that promote healthy food choices.

Formas has also announced grants for research that supports a food-system transition to meet future challenges. Their focus is on projects that can develop sustainable and attractive products, and processes that can increase the refining of Swedish raw materials. ●

Read more: https://formas.se/

New thesis

On 21 November, doctoral student Ansung Kim presented her thesis at Örebro University's Campus Grythyttan. One aspect of her study was how taste and cultural identity influence people's attitudes towards plant-based alternatives to meat. ●

Thesis: Ansung Kim. *Seeds of change for plant-based food consumption: Products, restaurants and everyday life.* Örebro University, School of Hospitality, Culinary Arts and Meal Science. 2025.

Rich gut flora may provide more stable blood pressure

According to a new study from Uppsala University, gut bacteria may play a crucial role in stabilising blood pressure.

The researchers used material from the Swedish Heart Lung Foundation's SCAPIS research initiative and analysed data from stool samples and blood pressure measurements from more than 6,400 men aged 50–64.

The results showed that people with a rich gut flora had more stable blood pressure than that of people with a less varied flora. The researchers will continue to investigate how the gut flora's composition could affect the risk of cardiovascular disease. ●

Read more: Lin et al. "The association between the gut microbiome and 24-h blood pressure measurements in the SCAPIS study". *Communications medicine.* 2025.

THEME

FOOD PREPAREDNESS

Work has begun to improve Sweden's food security, and this issue highlights some current initiatives. The Swedish Board of Agriculture has been tasked with building up emergency grain reserves in Sweden, while the Formas research council is funding five centres that will develop solutions for improving Sweden's food systems, preparedness and competitiveness. A crisis can mean limitations on resources, requiring cooks who can supply the public sector with food every day, providing meals that where ingredients are utilised as much as possible and that are filling and delicious.

Photo Golden Retriever

Emergency grain reserves for

secure food supplies

The uncertain security situation is placing new demands on Sweden. Emergency grain reserves are being established for the first time in decades to ensure that Swedes can access sufficient food in the event of a crisis or, in the worst case, war.

Text Ylva Carlsson

Sweden's emergency stockpiles were phased out in the mid-1990s, but are now making a comeback. In October, the government decided to start procurement processes, which will be handled by the Swedish Board of Agriculture.

First are the four northernmost counties, which produce the least amount of grain in Sweden. They are entirely dependent on transports from southern Sweden to meet their needs, while the area is also important for Sweden's and NATO's defences.

THIS YEAR'S TOTAL GRAIN harvest is expected to be approximately six million tons, which is an increase of almost 20 per cent from last year.

"This shows that conditions remain good, especially in the southern areas of the country. We have long been net exporters of grain," says Saranda Daka, contingency officer at the Swedish Board of Agriculture.

The procurement process for northern Sweden has begun; it is aimed at farmers, traders and other stakeholders who wish to store grain on behalf of the state. Suppliers must be able to sell at least 1,000 tons of wheat to the Swedish Board of Agriculture, and be able to store it and sell it onward.

In the event of a heightened state of alert, the Swedish Food Agency calculates that 3,000 calories per person per day must be assured. Half of these should come from cereals. The remaining calories must come from other food production that Sweden can maintain in the event of serious societal disruption or war.

"The stockpiles must only be used in the event of a shortage that cannot be managed via the market or by other means. They help ensure the ability to maintain Sweden's total defence and that we have enough food," says Daka.

How long the grain reserves should last has not been decided. Building up stockpiles throughout Sweden is expected to take 5–10 years to avoid disrupting the market.

FINLAND HAS BEEN a great source of inspiration, according to Daka. Unlike in Sweden, Finnish emergency stockpiles never disappeared. Earlier this year, Finland also decided to establish 300 emergency shops that will sell food in the event of a power outage. This summer, the Swedish municipalities of Gullspång and Töreboda, among others, launched trials of emergency shops.

Since 1 April, also to help secure Sweden's food supply, companies in the blue and green economies have also been able to apply for investment support from the Swedish Board of Agriculture for building up more robust primary production. So far, over 700 applications have been received.●

PHOTO: JORDBRUKSVERKET

"This shows that conditions remain good, especially in the southern areas of the country."

Saranda Daka
Contingency Officer at the Swedish Board of Agriculture

↖ At FOI, a method is being developed to detect airborne organisms that could threaten Sweden's food production.

Biological warfare threatens our food preparedness

Sweden's emergency food reserves have been empty for over 20 years. The Swedish food strategy focuses on greater domestic production to achieve a more robust food chain in a crisis. However, even if cultivation increases, sophisticated attacks on both biology and economics could threaten our food supply.

Text **Ingar Nilsson**

Camilla Eriksson is a researcher at the Swedish Defence Research Agency (FOI). She leads one of five centres that have received funding from Formas for improving Sweden's food security. The knowledge centre that will be built under her leadership has a clear focus on external threats.

"The research will focus on how we can detect attacks involving biological and chemical substances, which can have major economic consequences. We will also examine how we can deal with information campaigns that exaggerate and lie with the aim of destabilising Sweden's food supply."

AS ONE ELEMENT of this, biologist Per Stenberg at FOI in Umeå will develop a method for the rapid detection of airborne organisms that could threaten our food production. Read more on page 4.

Camilla Eriksson has worked in the field of food preparedness for many years. Prior to working on these issues at FOI, where she started in 2018, she was employed at the Swedish University of Agricultural Sciences, where she also conducted research on what is required for us to cope in times of crisis or war.

PHOTO: MÅRTEN SVENSSON / LANTMÄNNEN

PHOTO: LINDA BJÖRKVALL KÖLING

"Research at the centre will focus on how we can detect attacks involving biological and chemical substances ..."

Camilla Eriksson Researcher Swedish Defence Research Agency (FOI)

"Typically, the concept of self-sufficiency has been used in relation to the balance between domestic food production and import volumes. However, in total defence planning, also considering our dependence on input goods such as fuel, seeds and commercial fertiliser has always been important."

ERIKSSON BELIEVES THAT a more accurate model is one in which domestic food production is converted into calories. She points out that the food sector should really function the same way in a crisis as it does in peacetime, meaning that food production is mainly managed by private companies, whatever the situation.

"The state can intervene if necessary, and there is pricing and rationing legislation that regulates access to food and ensures there is enough for everyone. This is important, because otherwise hoarding can be a problem," says Eriksson, referring to the empty shelves during the pandemic, which once held toilet paper and other goods.

SWEDEN'S FOOD PREPAREDNESS is improving, she believes. Emergency stockpiles will be rebuilt, with grain and input goods. There is increased cultivation of protein-rich legumes, with more varieties being developed.

"This is a positive development that should be encouraged, but we should consider biological warfare's effects on infectious disease control when we start growing more legumes," Eriksson concludes. "So that we breed resistant varieties." ●

Read more (in Swedish): www.foi.se/en/foi/about-foi/international-defence-research/cooperation-projects/ongoing-cooperation-projects/food-defence-research-centre.html

KNOWLEDGE CENTRE

The Food Defence Research Centre is led by FOI in collaboration with the Swedish University of Agricultural Sciences, the National Veterinary Institute, the Swedish Food Agency and the Swedish Board of Agriculture. A state-run research council, Formas, is contributing SEK 60 million in funding over four years.

The work will be organised into different tracks, each focusing on a specific type of warfare: chemical, biological, economic or information. The researchers will develop methods for detecting and managing threats, and the centre will also formulate advice and provide knowledge support to decision-makers and the food industry.

Increased knowledge about meals makes us better equipped

One task for the new PLATE research centre is looking at how a meal can contribute to food preparedness. The aim is to increase knowledge about how meals can enhance preparedness, sustainability and competitiveness.

Text **Ylva Carlsson**

The food service sector faces two major challenges: the sustainable transition and better food preparedness. At PLATE, interdisciplinary collaboration between academia and the public sector, business and civil society aims to identify opportunities and solutions.

Meal services are societally important, which means that many of those who are normally responsible for meals will retain that responsibility in a crisis.

"We combine research with practice, and hope to help meal providers develop their own organisations so they can meet future challenges," says Anna-Karin Quetel, PLATE's director.

PLATE'S VISION IS to create a resilient, sustainable and competitive Swedish food service sector that ensures wellbeing for all. The transition is being studied from various perspectives, including the food that is put on plates and the distribution chains.

"We can already see that both traditional knowledge and innovations are needed. One really clever example we've worked with this year is hydrothermally treated barley, served like bulgur," says Quetel.

> **"One really clever example we've worked with this year is hydrothermally treated barley, served like bulgur."**
>
> **Anna-Karin Quetel** Director PLATE

PLATE published its first report this summer. It includes principles for how meals can be designed and prepared to support a sustainable food service system. Meals must be based on readily available foods that are easy to store and handle safely.

WITHIN PLATE, PROJECTS are being planned to explore how cultural festivals – and sporting events – can serve as test beds for sustainable and resilient food systems.

Around 40 ideas for projects have been prioritised, and Quetel expects that around ten will be implemented each year. One example is TV4/Köket.se, which is one of Sweden's largest recipe databases. It is participating in PLATE to get help analysing their recipes, so they can progress in their transition towards both sustainability and preparedness.

Quetel also highlights Region Gävleborg, which will be working with in-depth testing of meals' aromas and tastes in collaboration with a number of folk high schools. The aim is to create sensory frameworks for sustainable, delicious meals that everyone can enjoy.

There are already many examples of synergies between the sustainable transition and improving preparedness in the food system, Quetel points out. One important area is sustainable production methods in primary production.

"There, we are seeing reductions in food waste, while land can be used in a smarter way. Plus, we are reducing our dependence on imports by producing fossil-free fuels locally and reducing the use of plant protection products." ●

Read more at www.plateresearch.org

PLATE

A research centre that explores and strengthens the sustainability, competitiveness and preparedness of the food service sector. PLATE is coordinated by the Stockholm Resilience Centre at Stockholm University, in close collaboration with researchers at the Swedish University of Agricultural Sciences, the Beijer Institute and KTH Royal Institute of Technology. Partners are the municipalities of Boden and Uppsala, the City of Stockholm, Region Gävleborg, the Swedish Food Agency, Max hamburgare, Martin & Servera, TV4/Köket.se, WWF, Reformaten, Axfoundation, Eldrimner and LiveGreen.

Formas is providing SEK 60 million of funding for four years. The work will focus on the restaurant and food service sector in both the private and public sectors, gastronomy and chef expertise.

PHOTO: BILDBYRÅN / SU

↗ Anna-Karin Quetel is the director of PLATE, a centre where work includes enhancing preparedness in the food service sector.

The PLENTY centre will take a holistic approach to the optimal use of resources in the food system. The vision is to create a circular system that makes efficient use of waste and side streams and reduces Sweden's dependence on imported foods. Text **Ingar Nilsson**

Mapping uncovers

Commitment and cooperation with a range of different industries and research institutions are required if the centre's ambitious vision is to be realised. Therefore, PLENTY has brought together partners from the entire chain: academia, innovation hubs, the food industry, primary producers, processing companies and recycling companies.

"The project's starting point was to specify what's necessary for us to make the transition to a circular food system," says Francisco Vilaplana, professor at KTH Royal Institute of Technology in Stockholm, and director of KTH Food and PLENTY.

THE PROJECT IS DIVIDED into four different work packages: WP1 Technology, WP2 Systems, WP3 Society, and WP4 Innovation Management.

"We will investigate how we can improve various processes, such as by developing technology to make better use of municipal food waste and side streams from food production. The aim is to develop healthy food products from side streams and other food ingredients," he continues.

MICHAEL MARTIN IS an adjunct professor at KTH Royal Institute of Technology and IVL Swedish Environmental Research Institute. He conducts research on sustainable food systems and is responsible for the 'systems' work package, which focuses on a systems perspective.

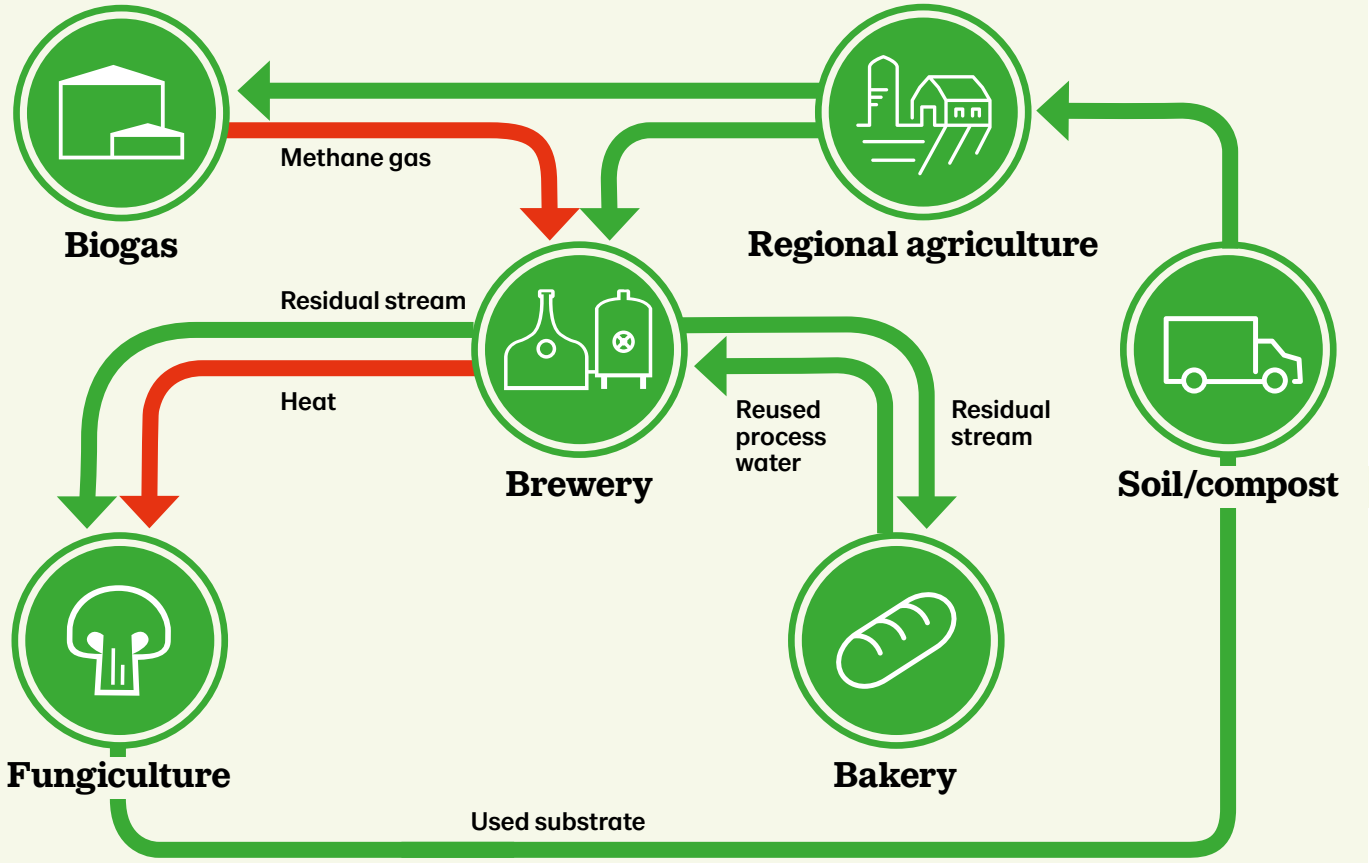
"In the first step, we will map and validate side streams from agricultural production and food production. The statistics we currently have only concern waste, so we need to take a closer look at what the figures include and the quality and form of the waste," he explains.

PHOTO: KTH

"In the first step, we will map and validate side streams from agricultural production and food production"

Francisco Vilaplana Professor, KTH, Director of KTH Food and PLENTY

Resource and energy flows



hidden resources

He and doctoral student Joar Stephansson, from the Swedish University of Agricultural Sciences, will carry out the initial mapping and assessment. After this, research methods from industrial symbiosis (where companies collaborate and utilise each other's residual products instead of creating new ones) will be used to analyse material flows, geographical information and the quality of residual streams.

"We will identify how water and by-products can be used in the most efficient way. By first conducting regional trials, we can then scale up the technology to the national level," says Martin.

THE WORK PACKAGE that focuses on societal aspects includes mapping consumer attitudes to new products that are based on side streams and farmers' attitudes to using fertilisers made from residual products.

PLENTY

Is a research-based, interdisciplinary centre that works collaboratively to find solutions for reducing food waste, maximising circular food flows and increasing food preparedness. Five universities are involved, including KTH Royal Institute of Technology, Örebro University and the Swedish University of Agricultural Sciences. In addition, there are 20 industrial partners. Formas is contributing a total of SEK 60 million to the centre's funding over five years.

"The work package on innovation will examine the profitability of new products,

laws and regulations governing foodstuffs, as well as new business models and financial ecosystems that support a new food system," says Vilaplana.

He explains how the work packages complement each other. The survey opens up opportunities, and new technology can visualise how new products are developed. The partners receive the research results and develop them, creating new products and processes.

"When the project period ends, the centre's biggest impact will be thanks to our large network of people and businesses who believe in a circular food system," he concludes. ●

Read more: www.kth.se/en/2.104736/plenty-a-centre-for-symbiotic-and-circular-food-provisioning-1.1399253

Is it possible to cook for an entire school without electricity, with limited access to water and ingredients, and without using animal protein? Four teams took on the challenge in the Årets beredskapskock (Emergency Chef of the Year) competition. Text **Ingar Nilsson**

Chefs prepare food for troubled times

During this September's emergency preparedness week, the Swedish Chefs Association invited chefs from public kitchens and fine dining restaurants to the FFCR trade fair in Malmö. Eight contestants, two chefs in each team, were tasked with preparing dishes that could be served in a crisis. They had two hours in which to do so.

"How the food tastes is important, but the judges assess everything that could matter in a crisis," says Ralf Pedersen, chair of the association. "The chefs will have points deducted if they generate a lot of waste, and the same applies if they use too many ingredients. Ideally, they should also have time to bake bread."

THE COMPETITION KITCHEN had only a gas stove and five litres of water, which set limits on inventiveness. This was particularly evident among the restaurant chefs.

"We are used to being able to use unlimited quantities of whatever ingredients we want, without thinking about the cost, so this is a difficult competition for us," admitted Alex Mendez.

The other teams, all of whom work in the public sector, did not seem as unaccustomed to cooking with limited resources. Two teams came from Trelleborg Municipality, which is not coincidental – the municipality's schools seem well prepared for a crisis.

"We've been working on this for the past four years," says Torbjörn Larsson, head chef at Söderslätt upper secondary school, "and we are ready to prepare food at any time. Our meals are always adapted to the season, we have plant-based protein in the pantry as a supplement, and we always have 100 litres of water in containers in our kitchens."

ALL SCHOOL KITCHENS in Trelleborg Municipality have a month's worth of food stored, and there is a municipal plan for how to transport food if a school is forced to close.

At the end of the competition, the team from Söderslätt had a narrow win, ahead of the team from the restaurant. ●

The recipe for the winning dish is on page 16.

"Our meals are always adapted to the season, we have plant-based protein in the pantry as a supplement, and we always have 100 litres of water in containers in our kitchens."

Torbjörn Larsson Head Chef Söderslätt upper secondary school

MUNICIPALITIES' RESPONSIBILITIES FOR EMERGENCY PREPAREDNESS

Every day, more than three million meals are served in Swedish healthcare, schools and social care, so municipalities have a great responsibility to plan for disruptions to meal services. The Swedish Food Agency has compiled a contingency manual that can be used to develop contingency plans for such an event.

(in Swedish): www.livsmedelsverket.se/om-oss/publikationer/handbocker-och-verktyg/bered-skapshandbok-for-offentliga-maltider/

PHOTO: ANDERS TEGNÉR

↑ Alex Mendez, from the restaurant team, selects ingredients.

←← Anneli Svärd and Anna Engström from Skurup Municipality cook on a gas-heated frying pan.

← The competition entries are carried out to the waiting jury.

PHOTO: ANDERS TEGNÉR

RECIPE

A dish to prepare

The tasty winner of 2025's Emergency Chef of the Year.

Recipe
Jannica Eriksson & Carl Larsson

Pea and faba bean protein cevapcici

Serves: 4
Preparation time: approx. 1 hour

200 g dehydrated plant-based mince
120 g potatoes
120 g yellow onion
1 garlic clove
2 small eggs
½ tbsp wheat flour
1 tbsp roughly chopped flat-leaf parsley
1 tsp chili paste
1 tbsp paprika paste

INSTRUCTIONS

1. Peel and boil the potatoes. Save the water once the potatoes are cooked.
2. Soak the plant-based mince in the potato water for 15 minutes.
3. Peel the onion and garlic, then grate them into a bowl.
4. Add the chopped parsley and mashed potatoes to the onion mixture.
5. Drain off the soaking water and add the plant-based mince.
6. Add the eggs and flour and combine to a smooth consistency.
7. Test fry some. Add salt, pepper and more flour if necessary.
8. Shape the mixture into patties and fry in oil.
9. Serve with pita bread, coleslaw and aioli.

Legumes are increasingly being used in plant-based foods. However, if they are to be a nutritionally complete option, one area that needs improvement is the products' mineral availability. In a new thesis, researcher Jaqueline Auer presents findings that may indicate ways forward for certain legume-based foods. Text **Ingar Nilsson**

Structure and processing method can determine

bioavailability in legumes

The phytate in plants is what blocks the availability of iron and zinc, although a plant's structure also affects its nutritional value.

"The structure affects the availability of the bean protein. Certain polysaccharides and fibres found in the plant affect how the protein is broken down," says Auer. "Protein quality is also important. Soya beans and yellow peas have a similar amino acid profile, while faba beans have a different one."

IN HER RESEARCH, Auer has investigated how different processing methods can help release the nutrients from soya beans, faba beans, yellow peas and grey peas.

"I found that the phytate in both faba beans and grey peas was minimised when producing fermented tempeh. This processing method allows the nutrients in the plants to be released and absorbed by the body," she says.

PROTEIN AVAILABILITY also increased in tofu-like products, probably due to their soft texture and lower dietary fibre content. Gels made from pea protein concentrate showed that the gel's higher fibre content and strong network prevented the protein from breaking down. The ratio of dietary fibre to carbohydrates probably affects the release of nutrients in the product. ●

↓**Nutrient bioavailability in legumes is determined by the structure of the plant and how it is processed.**

Thesis: Jaqueline Auer. Beyond the Label: the effect of processing on the structure and digestibility of plant-derived foods. SLU. 2025.

PHOTO: PRIVATE

"This processing method allows the nutrients in the plants to be released and absorbed by the body."

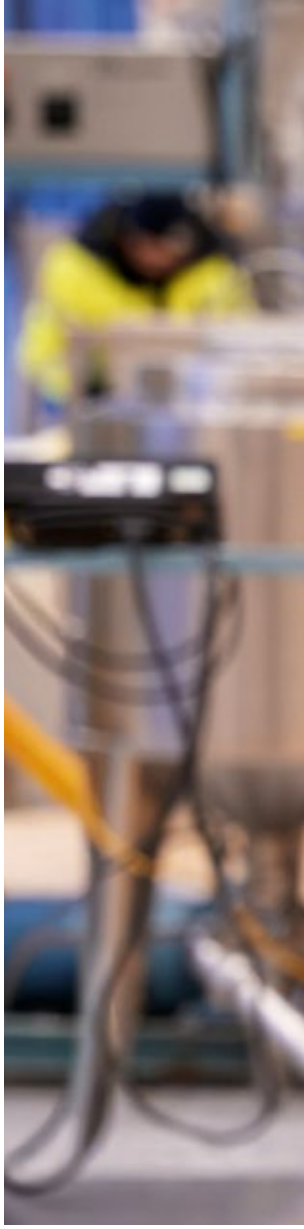
Jaqueline Auer Researcher

PHOTO: ISTOCK

Legumes become delicious bread in the baking lab

At the Division of Food and Pharma at Lund University's Faculty of Engineering, researcher Jeanette Purhagen is investigating how peas and beans can be turned into new protein-rich products. This has resulted in baked goods made from various combinations of legumes and cereals; they have good baking properties and a delicious taste.

Text **Ingar Nilsson**



↗ Jeanette Purhagen is a senior lecturer at the Division of Food and Pharma, Lund University. She is also the deputy director of FORCE.

There are baking trays of bread in the baking lab's test kitchen, all made using a unique blend of flour from legumes and cultivated grains.

"The products with approximately 30 per cent legume flour are the best quality," says Jeanette Purhagen, picking up a scone that includes brown bean flour.

IN A RECENTLY completed research project, conducted in collaboration with the Swedish University of Agricultural Sciences, among others, Purhagen has investigated how different crop combinations can be used for baking, and which deliver the best results. Legumes add a different type of fibre and protein composition to the product, which improves the overall protein quality and nutritional composition, she explains.

She is assisted by Peter Jensen, a colleague and an experienced baker.

"I can measure the dough with a texture analyser when we test how much legume flour to add, but I trust Peter's professional judgement when he feels the dough has the right consistency," she says.

IN SWEDEN, we are good at growing cereals, so it is important that we also investigate how we can further refine them, according to Purhagen.

She works closely with industry to ensure that processes can be scaled up and that the results come to use once the research projects are complete. Conversely, she receives protein-rich and fibre-rich residual streams from producers of oat milk, for example.

"The trend is towards a more circular economy, which means that producers are trying to reduce their residual streams. These will be valued more highly if they can still be classified as foodstuffs and reused in new food products," she says.

PHOTO: HILDE SKAR OLSEN

For example, master's students at the division have had mentors from the food industry when they have developed new products from residual streams. Projects have included using hemp, wheat bran and leftovers from fruit and vegetable shops to make products such as spreadable hemp topping with hemp biscuits, crispy cinnamon sticks, tempeh chips and ice cream based on a mixture of vegetables and fruit. Some of these products will be further developed in start-ups.

LOOKING AHEAD, much of Purhagen's research will focus on food preparedness at the new FORCE preparedness centre. For example, she plans to develop a crispbread, similar to a Skåne gingerbread made from wholegrains, which can be stored for a long time.

"We will also develop new processing techniques and meat analogues from faba beans, oats and hemp. From a preparedness perspective, the aim is to develop a good dry product with a long shelf life, but we see that the products we develop could also replace instant noodles or freeze-dried food on camping holidays," Purhagen says.

THE SWEDISH WOMEN'S Voluntary Defence Organisation and Helsingborg Municipality are also partners in FORCE. Along with researchers from Lund's Faculty of Engineering and the Swedish University of Agricultural Sciences, they will develop recipes that can be prepared both in the field and in municipal school kitchens.

"In the future, in a potential situation with limited access to energy, food must still be safe. This makes food hygiene particularly important, in combination with different methods of preparation, logistical solutions and storage conditions. This requires interdisciplinary research, which is one of FORCE's strengths," concludes Purhagen. ●

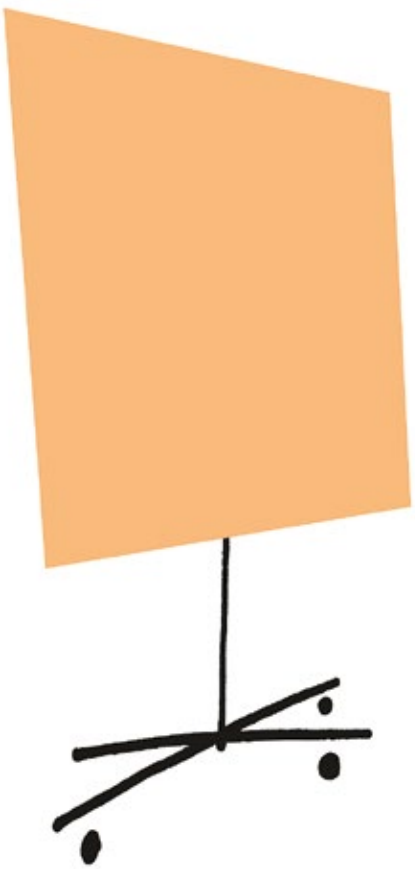
FORCE

The Centre for Food System Resilience and Competitiveness brings together researchers from Lund University, the Swedish University of Agricultural Sciences, KTH Royal Institute of Technology and the Agri-Food Economic Centre.

FORCE is one of five centres that have received five years of funding from Formas. The centre will run collaborative projects with partners from industry, civil society and the public sector, as well as conduct policy work.

Markus Nikinmaa, at Finland's VTT Technical Research Centre, has answered the question of how to make fibre-rich snacks as tasty and as crunchy as ordinary snacks. In his doctoral thesis, he demonstrates that it is entirely possible to produce snacks using wholegrain oat flour that compare favourably with snacks made from sifted flour.

Text **Ylva Carlsson** Illustration **Lene Due Jensen**



How to make healthy wholegrain

Many consumers find fibre-rich snacks too dense and not particularly tasty, so work on Nikinmaa's thesis aimed to produce healthy snacks that are perceived to be just as appetising as popular snacks made from low-fibre ingredients such as maize or potato flour.

IN HIS RESEARCH at VTT in Espoo, he tested 30 different types of wholegrain oat flour to investigate how to improve the structure of fibre snacks. Wholegrain flour is rich in dietary fibre, vitamins, minerals and antioxidants – and contributes to a greater feeling of satiety.

"By choosing wholegrain oat flour with the optimal composition, you can create extruded snacks with a fluffier texture," says Nikinmaa.

THE RESULTS SHOWED that the flour's fat content is decisive: the lower the fat content, the fluffier the snack. Flour with a high starch content also had a positive effect on both taste and texture.

Nikinmaa also studied how increasing the amount of rye bran can affect the structure of extruded snacks. Bran

PHOTO: VTT

"I hope my research will contribute to people starting to eat more fibre."

Markus Nikinmaa
VTT Technical Research Centre

snacks tastier

is rich in fibre but can negatively affect a porous product. Tests showed that the consistency of the rye-based snacks can be significantly improved by using fibre-degrading enzymes and lactic acid fermentation.

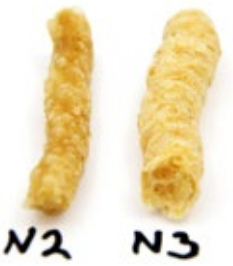
"They turned out just as tasty, light and fluffy as ordinary snacks made from sifted flour. Also, our rye snacks have a significantly higher fibre content."

AN INCREASED INTAKE of dietary fibre is linked to a number of health benefits, such as a reduced risk of cardiovascular disease, type 2 diabetes and obesity.

"I hope my research will contribute to people starting to eat more fibre. For this to happen, shops must have a wider range of tasty wholegrain products. Bread and snacks are just the beginning," says Nikinmaa.

THE RESULTS HAVE already attracted attention. The Finnish company Happy Plant Protein, a spin-off from VTT, is one example. They will develop a new method for using extrusion to produce plant protein concentrate. ●

Thesis: Markus Nikinmaa. *Wholegrain and dietary fibre in extrusion.* Helsinki University. 2025.



↑ In his research, Markus Nikinmaa has seen how the fat content of flour can affect texture. A lower fat content results in fluffier snacks.

The entire planet's wellbeing was in focus when the 2025 EAT-Lancet Commission presented its new conclusions in October. It states that the global food system must be sustainable for both the environment and human health. To make this possible, we should follow a ***Planetary Health Diet*** *(PHD) of 2,400 calories per day, the majority of which should come from wholegrains, legumes, fruit, vegetables and nuts.* Text **Ingar Nilsson**

The EAT-*Lancet* report promotes a planetary diet for health and sustainability

The first EAT-Lancet report was presented in 2019. Since then, 70 experts from 35 countries have been working to compile and update the results of new research on food systems in different parts of the world, as well as their effects on health and the environment.

"We want everyone to be able to choose healthy food that is sustainable for the environment," said The Lancet's editor-in-chief, Richard Horton, when he introduced the report.

PHOTO: ISTOCK

"However, our recommendations are similar to the Mediterranean diet, and also to traditional diets in other parts of the world."

Walter C. Willett
Professor of Epidemiology and Nutrition, Harvard University, USA

←Research shows that a diet based on the EAT-Lancet guidelines is good for every organ in the body.

The report's authors describe how we could change our eating habits and emphasise that healthy food must be accessible and affordable.

"We see that most people do not eat, or do not have access to, sufficient amounts of fruit and vegetables," said Walter C. Willett, nutrition researcher and professor at Harvard University in the US. "However, our recommendations are similar to the Mediterranean diet, and also to traditional diets in other parts of the world."

ACCORDING TO THE commission, if the world's adult population followed the PHD, the number of people at risk of premature death could be reduced by almost 15 million. It would also help halve emissions from the food chain by 2050.

Willett was active in the group that developed the dietary guidelines.

"The most surprising thing about the research results was that a diet based on our recommendations is good not only for the cardiovascular system, but also for every organ in the body." ●

Read more: Rockström et al. *The EAT–Lancet Commission on healthy, sustainable, and just food systems.* The Lancet. 2025.

PHOTO: MÅRTEN SVENSSON / LANTMÄNNEN

↑ Feed content plays a role in the cows' carbon footprint.

Climate-smart milk production with the right concentrate

For Swedish food production, it is vital that feed for dairy cows provides high yields, healthy animals, good feed efficiency and good economics. Researchers at the Swedish University of Agricultural Sciences and Lantmännen's feed developers have now shown that it also plays a major role in the cows' carbon footprint.

Cecilia Lindahl, Lantmännen Agriculture

SustAinimal is a knowledge centre with Formas as its primary funder, where academia, industry and public agencies conduct joint research on the future role of food-producing animals. The Lantmännen Research Foundation is co-funding projects at SustAinimal.

As part of SustAinimal, a feed trial was recently conducted at Framtidsgården Viken. It aimed to investigate the climate impact of different feed regimes and to identify sustainable feed regimes that provide high returns while having a small carbon footprint.

Climate impact is usually linked to both the carbon dioxide generated during the production of feed ingredients and the methane formed when cows convert feed into milk. There are many ways to calculate and measure climate impact, but the Swedish feed industry has agreed to use a standard European method.

THE EXPERIMENT COMPARED three feed concentrates with equivalent nutritional contents, but with different estimated climate impacts from the raw materials. One of the concentrates contained a large proportion of industrial by-products, such as wheat bran, feed flour and distillers grain. The second concentrate contained a large proportion of raw materials that can be produced on the farm. A traditional concentrate for high-yield cows was used as a control.

Cows' milk production has a major role in climate impact, feed efficiency and economics. One of the project's goals was to maintain high yields during the trial period.

To account for the effect on productivity, the cows' climate footprint per kilogram of milk was compared. Cows that ate feed with a lower carbon footprint had a significantly lower climate impact per kilogram of milk, despite slightly lower milk production and higher feed intake. In the experiment in which the cows' methane emissions were measured in their exhaled air using a GreenFeed instrument, no differences were found, regardless of feed composition.

RESEARCH SHOWS THAT it is important to consider production results and feed efficiency when calculating climate impact, and that it is possible to reduce the carbon footprint of Swedish milk production through a deliberate choice of feed ingredients.

The ongoing research projects in animal husbandry correspond well with the foundation's goal of increased agricultural production with minimised environmental impact. ●

PHOTO: HELÉN PE/ LANTMÄNNEN

↑ A diet that includes wholegrain rye contributes to positive health effects.

Recently concluded projects

Reduced inflammation with rye

In a major clinical study at Chalmers University of Technology in Gothenburg, researchers have shown that eating wholegrain rye can help reduce low-grade inflammation. This is linked to the gut flora. The study, which compared the intake of a diet with wholegrain rye with one with sifted wheat, included breakfast products, soft bread and crispbread. ●

Biostimulants increase yield

Biostimulants are a type of cultivation aid that may increase yields by making crops more resistant to unfavourable conditions. Most products on the market are not designed for Swedish conditions. In a recently completed project at Agro Plantarum, researchers developed methods for testing biostimulants under Swedish conditions. ●

Drones help plant breeding

Researchers at the Swedish University of Agricultural Sciences have developed aids for breeding crops that can withstand drought or make efficient use of irrigation. They used advanced analysis of drone images to study the crop's reaction to changing water availability. The focus has been on forage grasses for use as feed for ruminants. ●

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 healthy and sustainable future food.

The foundation has an open call for proposals every year. Applications are assessed on their newsworthiness, scientific quality and business potential. ●

See: *www.lantmannen.com/researchfoundation*

For more information:
Helena Fredriksson
Telephone: +46(0)10-556 00 00
Email: helena.fredriksson@lantmannen.com

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