



PLANT RESEARCH REVEALS ORGANIC FRAUD

Plant research can help scientists develop new methods to determine whether conventional crops are passing themselves off as organic.

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ANIMAL WELFARE IN PRODUCTION

A new project focuses on how market-driven initiatives might be used to create better conditions for breeding pigs.

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FUNCTIONAL FOODS OF THE FUTURE

Researchers are developing tomorrow's foods which might do more than just satisfy your hunger. They could also improve your health.

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Profile / FOOD & HEALTH



World-class food research

In 2010 the Ministry of Science, Innovation and Higher Education identified that the quality of Danish food research made it one of the country's key scientific focus areas.

The University of Copenhagen is Denmark's only educational institution conducting research and teaching about the entire food cycle – from farm to fork. Our world-class research focuses on many areas, including authenticity of ingredients, environmental and climate friendly production, food functionality, food safety, sensory science, nutrition, appetite regulation, behaviour patterns, physical activity and obesity. The University also pioneers the development of new techniques and methodologies in the fields of chemometrics, biotechnology and advanced plant and animal modelling.

The focus on food research provides the University with a unique starting point for interdisciplinary research in the natural sciences, health, sociology and humanities. There are many examples of this type of work by the University, such as the UNIK research initiative "Food, Fitness & Pharma", the OPUS project and the InSPIRe research platform, a collaboration between the University of Copenhagen, other universities and 20 businesses.

A particularly good example is the Copenhagen Plant Science Center. The centre conducts research in plant biotechnology, as well as sustainable ways to increase food production and yields.

These examples demonstrate the strong position the University holds thanks to its unique relationship with domestic and foreign research institutions, as well as its close co-operation with businesses producing food for over 30 million people worldwide.

Where are we headed?

Food research is central to the development of a biologically based society that can ensure sustainability and independence from fossil fuels, and the University is emphasising a combination of the production of food and the production of animal feed, energy and biological products. The University is dedicated to improving its efforts, in order to make sure that we can provide the world's projected nine billion inhabitants in 2050 with healthy and sustainable food.

The University of Copenhagen therefore has a strategic priority to increase its cooperation with businesses, both large and small, particularly those in the field of biotechnology. The areas of particular focus that the University hopes to examine are food safety, health and nutrition, food waste, ingredients, molecular gastronomy, sensory science, sustainability, designing healthy food components, "green food technology" and functional food.

The University of Copenhagen, together with Technical University of Denmark, has taken the first steps toward establishing the Copenhagen Food Science Center, which will serve to strengthen food research and the related university programmes, for the benefit of businesses, health authorities and society more generally.

World-class food research serves as the cornerstone for sustainable and integrated research at the University of Copenhagen. This ensures that consumers have healthy, good tasting and high quality food. For Danish businesses, it means maintaining their international competitiveness and in so doing contributing to economic growth and social welfare.

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Technology enlisted to improve food safety

The increasing demands on the safety and quality of food – particularly cold products such as rye bread – are a challenge for food producers as well as health authorities. To tackle these demands, a group of researchers has developed a set of technological tools that will ensure food safety and keep the food fresh.

BY SIDSEL HANSEN

CONTROLLING THE TEMPERATURE of food during its production, transport and serving is essential for food safety. Kitchen staff constantly has to move cold food products in and out of refrigeration to ensure that it does not get too warm, and so lead to the growth of harmful bacteria. But doing so can reduce the quality of the food and all the lifting can prove burdensome for staff.

Monitoring tools ensure efficiency and sustainability

Over a two-year period, a team of researchers looked into whether an increased use of computerised tools could provide more precise temperature information during preparation. It is hoped that the project, entitled ‘Using IT to control safety, food quality and sustainability’, will help businesses improve their work practices and food safety, thereby ensuring that customers have the best possible experience.

“We currently lack detailed information about the effect of temperature on the production of cold food, as well as

how temperature affects the growth of harmful bacteria on these food products,” Susanne Knøchel, from the Department of Food Science, says.

According to Knøchel, a greater knowledge of temperature conditions alone is not sufficient. Continual safety checks during food production are also necessary in order to maximise the improvements to food safety.

It is hoped that increased information about the temperature of food could lead to a better understanding of when it needs to be cooled. To accomplish this, the team is developing a computer-regulated in-line system that uses sensors to provide kitchen staff with real-time information about which food needs to be cooled.

“Businesses that manage to control temperature and hygiene tend to manage food safety well,” says project leader Bjarke Bak Christensen, the head of the Department of Food and Science. “These businesses discard less food and suffer less economically.”

The project is a collaboration between the University of Copenhagen, the Technical University of Denmark, the Danish Centre for Food Research and Safety and the business eSmiley.

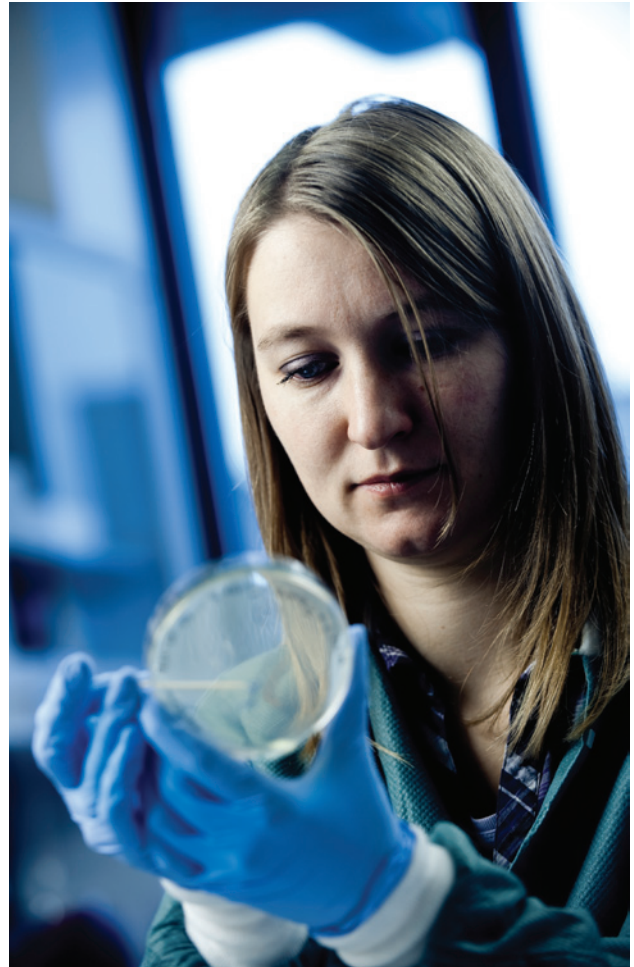
Fighting bacteria with knowledge

SALMONELLA, campylobacter and antibiotic resistant bacteria are examples of bacteria that are transferred via food products.

Every year, thousands of Danes are infected with bacteria from the food they eat. And while good hygiene at meat-packing plants and other food processing facilities is vital for food safety, so too is a good understanding of bacteria and the methods to combat them.

“The more we know about different types of bacteria, the better our preventative efforts can be. That’s why the University’s microbiology research is so important for food safety,” says Birgit Nørrung, Vice Dean for veterinary studies.

The University of Copenhagen conducts internationally recognised food safety research together with the Technical University of Denmark.



Improved food research collaboration

The University of Copenhagen and the Technical University of Denmark (DTU) have a long history of collaboration within research and education and now they want to join forces and create an internationally renowned centre for food and veterinary research in the Copenhagen Region.

The goal of the centre is to strengthen the national food industry, ensure the quality of food from farm to fork, as well as maintaining Denmark’s leading position in food research.

The two universities are responsible for 85 percent of all food research in Denmark and while each university has its own areas of specialisation, their collaboration enables them to draw out the best of each other.

Virtual access to food research

One of the first initiatives in the collaboration is the creation of a virtual centre that will allow businesses, authorities, researchers and students an easy and accessible overview of the University of Copenhagen’s and DTU’s activities in the field of food research.

Public health

– a public and private partnership

Choice and accountability are the watchwords of an interdisciplinary research project designed to assist both public and private stakeholders in developing a strategy to meet their shared responsibility for public health.

BY LINE SVENSTRUP BERGER

OBESITY AND TYPE 2 DIABETES have become increasingly widespread worldwide over the past 10 to 15 years. The World Health Organisation (WHO) says that obesity-related diseases are now some of the world's largest health problems. These numbers show that it is not productive to place the responsibility for a healthy lifestyle on either the individual consumer or food manufacturers. The public sector, as well as consumers and producers must all be involved if the unhealthy cycle is to be broken.

The University of Copenhagen is currently engaged in an interdisciplinary research project focusing on how we can control and prevent lifestyle diseases. The study looks at such approaches as regulating the kinds of food we as consumers are allowed to purchase.

“When you look at our health and our consumption of food and medicine, and the amount of exercise we get, you can see that our decisions are influenced by policies relating to food and health, combined with a complex set of market incentives,” says senior researcher Jørgen Dejgaard, of the Institute of Food and Resource Economics.

“The overall objective of this research is to gain a better understanding of the role that private and public regulation play in the management of lifestyle diseases and their causes.”

For food producers, what we eat is their business; they need to be able to make a profit from the products we buy. But, seen from the point of view of society in general, the relative health of products – in terms of things like the cost of healthcare – is also a significant consideration.



Two sides to the equation

One of the ways that policy makers can get both sides to agree is through regulation. The research project “Public and market regulation in the fight against lifestyle diseases – Opportunities and barriers”, looks at regulating foods from three different perspectives – economic, sociological and legal. The study investigates the effect the three perspectives have on each other.

Taking responsibility

According to law professor Mette Hartlev, socioeconomic factors play an important role in the development and prevention of lifestyle-based illnesses. She believes that society as a whole – both the public and private sectors – has a role to play.

The goal of the research project is to suggest strategies for the public and private sectors to live up to their responsibilities when it comes to public health. The project looks at the effect of legislation, as well as strategies for accountability in companies through self-regulation, according to Karsten Ronit, associate professor of political science.

One option could be for companies to be shown the benefits of marketing themselves as producers of healthy foods. Ronit points to the example set by Arla when the dairy producer introduced reducedfat milk. He adds, though, that it is up to the individual companies to find the strategies and solutions that can help them live up to their responsibility.

The researchers involved in the project stress that changes in consumer habits and lifestyle cannot be achieved over night.



About the project

Public and market regulation in the fight against lifestyle diseases – Opportunities and barriers is a part of “Food, Fitness & Pharma”, the University’s largest multi-disciplinary research initiative into understanding, preventing and treating lifestyle diseases. The initiative is supported by a five-year, EUR 16 million grant from the Ministry of Science, Innovation and Higher Education as part of its UNIK programme.

More information about other UNIK initiatives is available at foodfitnesspharma.ku.dk.



Plant research reveals organic fraud

Many consumers pay a little extra to buy milk if it's organic. But few will pay up for organic Italian flour if there is a chance it is produced in Bulgaria and does not live up to the requirements for organic cultivation. To tackle this issue, a new research project is focusing on developing methods that can reveal the geographic origin of food products, as well as its method of cultivation.

BY SIDSEL HANSEN

FRAUD INVOLVING THE AUTHENTICITY of food has become increasingly prevalent in the past few years. A new Italian study has shown that every third food product that is labelled as 'Italian' contains ingredients from other countries around the Mediterranean. And in the autumn of 2011, Italian police discovered that 700,000 tons of conventional food products (wheat and beans) were falsely labelled and sold as high-value organic produce. Cases like these demonstrate that there is a need for tools that can trace the origins and methods of cultivation of food products.

Tracking authentic food

AuthenticFood is a new European research project that is building on the results of the project OrgTrace, which dealt with finding ways of tracing a plant's geographic origin and whether it was cultivated conventionally or organically, by studying its chemical composition.

The goal with AuthenticFood, according to professors Søren Husted and Jan K. Schjørring along with PhD student Kristian Holst Laursen, is to develop and test a range of new and sophisticated methods of analysis that can be adopted within three years by food authorities in Denmark and the rest of the EU.

They add that the methods of analysis will be valuable tools for use in spot checks of organic food products, making it a supplement to existing certification and control procedures.

When plants grow, they absorb all the elements in the periodic table, but the relative levels of the elements are determined by the soil's mineral content that can vary strongly even over small areas, and this makes it possible for the researchers to trace plants back to the fields they were grown.

"There is enormous interest in tracing the origins of food products and whether the product is actually what it says it

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There is enormous interest in tracing the origins of food products and whether the produce is actually what it says it is.



is,” AuthenticFood’s manager, Husted says. “For example, whether it is organic, or whether it was wild or cultivated in a greenhouse or in a field. Responsible food producers are very interested in making sure that consumers trust their products.”

A wealth of plant research

In order for a project like AuthenticFood to be possible, it is necessary to conduct a significant amount of basic plant research. Robust analytical methods are required in order to analyse the elements in a plant within a reasonable amount of time. Research is also needed into how plants absorb elements, store and transport them and incorporate them into different types of cells in the roots, stem, leaves and fruits. As a result of this research into discovering a plant’s unique fingerprint, new knowledge about transport processes and the physiological role of elements in plants will be generated.

The project has also revealed that it is not simply elements that can give a plant a unique fingerprint. The variation of an element’s stable isotopes can differ so much that it can provide strong evidence of a plant’s origin and reveal details about how it was cultivated. This aspect will be further explored by the AuthenticFood team in the coming years as just one of the innovative studies taking place at the new and advanced facilities of the Copenhagen Plant Science Center.

Copenhagen Plant Science Center

Gathers world-class research and education about plants and plant-generated food products.

The vision is to use plant research to answer the challenges of climate change, food shortages, the fossil fuel energy crisis, as well as the threat from reduced biodiversity.

The centre will serve as a physical meeting place for the research community and private businesses. The Copenhagen Plant Science Center is located at the Frederiksberg Campus.

In addition to building bridges between the research and business communities, the centre will also be a focal point for close collaboration with other faculties at the University of Copenhagen, as well as leading experts from Denmark and abroad.

Tackling the burden of weighing too much

Overweight people who do not exercise run a high risk of becoming obese, and developing diabetes and cardiovascular disease. But scientists still don't know how much exercise overweight people need to do before it has a noticeable effect on their health. It is also unknown why overweight people have such a hard time altering their lifestyle, despite being bombarded with messages to exercise more. These are both issues that the interdisciplinary project FINE was established to investigate.

BY CARSTEN MUNK HANSEN

THE MODERATELY OVERWEIGHT – those with a BMI of between 25 and 30 – are an overlooked group in the media, which tends to focus on the severely overweight and the obese. But the interdisciplinary research team behind



Changing lifestyle is up to the individual, but very few can really do it alone.

Facts about FINE

The interdisciplinary project FINE (fine.ku.dk) studies the factors that determine an individual's congenital insulin sensitivity. It also looks into the way physical exercise affects metabolism, cultural health and energy balance.

The project involves researchers from biomedicine, ethnology, sport and nutrition and in so doing applies many different perspectives on exercise and obesity. The first results of the clinical studies are expected to be published in 2012. Articles by Astrid Pernille Jespersen on the humanistic aspects of the study have already been published.

FINE receives support from the research initiative UNIK – Food, Fitness & Pharma (foodfitnesspharma.ku.dk), and from the Center for Healthy Aging (healthyaging.ku.dk). FINE is lead by associate professor Bente Stallknecht from the Department of Biomedical Sciences at the University of Copenhagen.

FINE (Four-IN-one) wants to place greater focus on the moderately overweight, a group that includes a third of the population, as many of them are likely to develop obesity, diabetes and cardiovascular disease unless they change their lifestyles.

“Exercise is one of the most important aspects of lifestyle change. Physical activity contributes to weight loss and increased insulin sensitivity. The greater your insulin sensitivity, the greater the likelihood that you will avoid serious lifestyle illnesses,” explains Bente Stallknecht, associate professor and leader of the FINE project, which is studying the effect of exercise on a group of healthy but moderately overweight and inactive men between the ages of 20 and 40.

30 or 60 minutes?

“We are studying how exercise affects their muscles and energy balance. We are also investigating whether exercise makes their insulin more effective, as well as the difference between exercising for 30 minutes a day, 60 minutes a day and not at all.”

Now that all the individuals have been tested, the clinical part of the study has been completed. The team is working to analyse the data, but before it can be determined whether overweight people need to do 30 or 60 minutes of exercise a day before experiencing positive effects, Stallknecht will have to publish the results in scientific journals. The first



scientific articles dealing with the project's clinic trials are expected to be published throughout 2012.

It is not a coincidence that the FINE team chose to examine the effects of 30 and 60 minutes of exercise a day, as these are the official recommendations from the Danish National Board of Health.

Exercising is hard when done alone

Despite major public campaigns, such as the '30 Minutes of Exercise a Day', many overweight people have not been convinced to change their lifestyles.

Ethnologist Astrid Pernille Jespersen closely followed and interviewed many of those participating in the study to find out what they thought about their lifestyles and what their motivations were for changing it. She thinks she may know why so few do.

"Our findings indicate that it takes as much effort to change your lifestyle as the enormous efforts that went in to keeping the subjects exercising during the study. This group of men between the ages of 20 and 40 tend to have busy lives that include studies, work and family and if it were left

up to them they would have a hard time fitting exercise into their daily rhythm," Jespersen explains.

She points out that the 12 weeks the clinical trials lasted, the study participants also experienced an enormous lifestyle change, yet they were under constant observation by laboratory personnel, who could see who needed extra motivation, and who could provide the participants with precise data about their bodies. The study participants were also equipped with a range of devices such as pulse watches, which we can see helped motivate them.

"It is not possible to translate such a comprehensive approach to the rest of the population," Jespersen admits. "But experiences from the project ought to be used in future health initiatives. What is paradoxical about changing lifestyle is that it is up to the individual to do it, yet very few can really do it alone."

The FINE team is planning to invite all the study participants in for follow-up interviews in 2012 to discover how many of them managed to maintain the new lifestyles they were given during the 12-week study, and how many returned to their old habits.

Market-driven animal welfare in production

The idyllic picture of sows and their piglets roaming freely and naturally over the peaceful countryside is not the reality of Danish pork production. Sows are often penned or otherwise confined when they farrow and then nurse their piglets. A new project focuses on how market-driven initiatives might be used to create better conditions for breeding pigs in Denmark.

BY LINE SVENSTRUP BERGER

EXPERTS AGREE THAT IT IS DETRIMENTAL to the welfare of sows to be confined when they farrow and nurse their young. Alternative production systems that allow sows to range freely are available, but they are more expensive for farmers.

In the project 'Market Driven Animal Rights', scientists are examining how pork production involving free-roaming sows could be promoted by assuring that the farmers adopting free-range methods will be paid more for maintaining higher ethical standards.

"This project is intended to identify the interests, attitudes and economic consequences of free range pig farming," says professor and project manager Peter Sandøe.

About the project

Professor Peter Sandøe from Institute of Food and Resource Economics is the project manager.

Project implemented in cooperation with Aarhus University and the Pig Research Centre.

The project has received a grant from the Danish Pig Levy Fund.

"We want to see if it is possible to create the kinds of incentives that will ensure that the lion's share of Danish sows are allowed freedom in all phases of production."

Denmark should be a pioneer – again

In years past, Danish pig producers were market leaders in animal welfare. In the 1990's, Denmark was in the forefront of protecting pregnant sows. At that time, farmers that allowed the pregnant sows to roam free were paid a premium price for the pigs they sold. Today, about 75 percent of pregnant sows in Denmark are free-range, and starting in January 2013, an EU regulation will require all pregnant sows to be free-roaming.

Sandøe, however, wants Denmark to take animal rights one step further.

"Denmark should improve conditions for farrowing and nursing sows and allow them to remain free after they give birth and nurse their young."

Sandøe believes that market-driven incentives are the way forward. Passing legislation like the Animal Protection Act, he says, without offering up economic benefits to farmers only shifts the problem to other countries. The societal benefits of putting an effort into free range pig farming is depending on demand and costs.

Sandøe recognises that getting consumers to buy free-roaming pork will require a long term investment.

"It will be expensive at start-up, but the longer the production methods are online, the more costs will go down," he says. "Eventually, free range will be accepted as the norm and poorlyproduced products will disappear in the same way that eggs from caged hens were pulled off the shelves this year.

The hope is that the price for free-roaming pork will be lower than for organic pork, but higher than for conventional."

Using incentives to make a difference

Increasing the number of free-range sows requires making it beneficial for farmers, as well as customers. The team is examining which improvements will have an impact on the average pork consumer – not only on those consumers already concerned about animal welfare.

They are also examining the farmer's motives for starting



Animal welfare is an international trend that is growing faster than we think.

animal-friendly production. The ways in which free-range products can become part of the marketing strategy of food and retail outlets in Denmark and export markets are also being considered.

The project's report, "People and Pigs", compiled by the Centre for Bioethics and Risk Assessment, shows that the public at large and consumers often think differently about animal welfare. Sandøe believes it is important to look at animal friendly production as a quality issue in much the same way that organic products have been marketed.

"It is interesting to see that animal welfare is making its way up the agenda of consumer politics in countries such as Australia and the United States. This is an international trend that is growing faster than we think," says Sandøe.

Improving freedom of movement for Danish pigs

In a three-year project in collaboration with Pig Research Centre, financed in part by Danish pork producers, research is being done on a new holding system for farrowing and nursing sows.


A sty is being developed where the sow would only be confined during the actual birth of the newborn piglets to help insure their survival.

Allowing the nursing mother to roam promotes milk production.

The piglets grow faster, creating value for the farmer more quickly. The process benefits both the animals and the farmer.

The project is led by Associate Professor Christian Fink Hansen, Department of Large Animal Sciences.

Feeding the billions, one small farm at a time



By the year 2050, global population will increase from 7 billion to 9.5 billion. Millions of people already lack enough food, and one way to prevent even more from slipping into malnutrition is to increase agricultural productivity. The greatest potential for increasing output lies in small farms, which make up 80 percent of agricultural production.



BY RIKKE PAPE THOMSEN

HISTORY HAS SHOWN that we cannot address global food shortages by simply squeezing even more out of modern industrial farms. Nor is it sustainable to boost the crop yields of agricultural producers in the Northern Hemisphere and then ship the food to the Southern Hemisphere, where food shortages are greatest.

The greatest potential for increasing food production rests with those farmers who today harvest the very least, according to Professor Andreas de Neergaard, a specialist in the agriculture in developing countries and a member of the Department of Agriculture and Ecology.

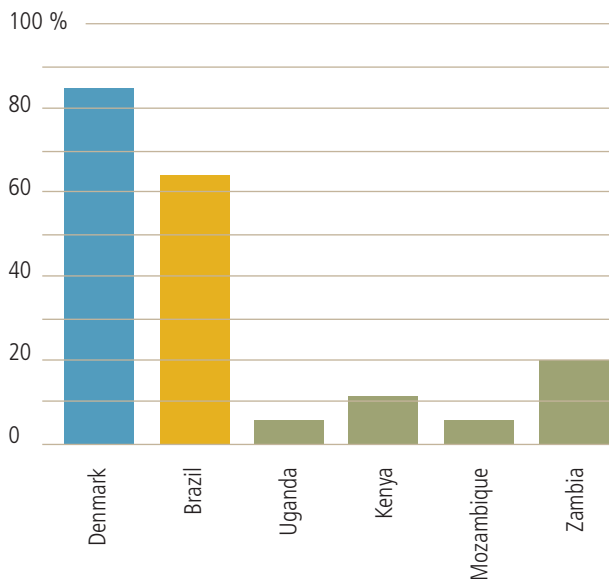
“Increasing productivity on small farms might seem like something of an uphill battle when you consider that they are typically run by poor farmers with limited access to

resources like water, fertilisers and pesticides,” says de Neergaard. “But, in reality, today’s farming methods could allow us to at least double production many places.”

More nutrients

Significant improvements in crop yields in the short term will require increased use of fertiliser to add more nutrients to the soil. Small farmers are often unable to use fertilisers due to the expense and the difficulty shipping them to remote farms. But alternatives may be available.

“The majority of today’s poor farmers actually produce less food than they eat,” explains de Neergaard. “They don’t make any money to buy things like fertiliser. If they could use locally available fertilisers, it would make a huge difference in getting more nutrients into the soil.”



Relative harvest amounts for selected countries, compared with the maximum possible harvest. Due to the high level of mechanisation and strict laws preventing the use of chemical fertilisers, Danish farmers cannot increase their margins significantly. Brazil, a developing country that relies on its agricultural sector for economic growth, has harvest margins comparable with those in the US. In Africa, where chemical fertilisers are not used and where the soil is poor, harvests are well below potential.

Source: madtilmillarder.dk

Region	Number of studies	Area (mil. Hectares)	Average change in harvest margin (%)
Africa (combined)	114	2	+116
East Africa	71	1.4	+128
Tanzania	9	0.06	+67
Uganda	17	0.7	+54

Changes in harvest margin after conversion from traditional to organic farming methods in Africa.

Source: madtilmillarder.dk

Organic, local, inexpensive

Agro-organic farming methods allowing farmers to save on the cost of fertiliser would have major economic advantages in low-yield situations. Organic fertilisers that are locally produced and readily available – like manure or plant residue – would be ideal. A nearby juice or biogas plant could produce waste that could easily be converted into fertiliser after composting.

“It is important that farmers handle fertiliser correctly,” says de Neergaard. “Organic material thrown haphazardly on a field is not necessarily a good source of nutrients. We study how composting and other methods can produce premium organic fertiliser that remains on crops and doesn’t wind up running off into the surrounding environment.”

Organic fertilisers

The challenge of using organic fertilisers is that the concentration of nutrients is relatively low. And much of the nutrients the fertilisers do contain are hard for plants to absorb. Many of the studies in this area have focused on making it easier for plants to tap into the nutrients that compost contains.

Using papayas to break down compost

One method being looked into by the Department of Agriculture and Ecology is whether adding enzymes from papayas to liquid compost can help. The experiment is inspired by farmers in Egypt, who have traditionally thrown unripe papayas into their compost. There, the enzymes in the fruit accelerate the breakdown of nitrogenous compounds, and the faster the degradation, the sooner a farmer can get nutrients to his crops in the field. Unripe papayas contain the enzyme papain, which breaks down peptides and makes it easier for plants to absorb the nutrients from the compost.

Fertilising with fetid fish waste

Giving high-growth tropical vegetables enough of the nutrient-rich fertiliser they need can be a challenge. The plants must be fertilised throughout the growing season and solid organic fertilisers like compost don’t provide nutrients quickly enough. Scientists are now experimenting with liquid organic fertilisers like fermented fish and vegetable waste that can be sprayed directly onto crops. With liquid fertilisers, it is also possible to add oxygen or adjust the production process in other ways that make it easier for the plants to absorb the nutrients it contains.



Linseeds

may help battle obesity

It was a question asked by the Danish Ministry of Food, Agriculture and Fisheries in 2008 that led to a study at the University of Copenhagen into the health effects of linseeds and linseed fibre. The Ministry was keen to find out whether our bodies absorb the fat from the seeds when they are used as an ingredient in rye bread. But initial results from the study indicate that the seeds may, in fact, reduce the level of fat absorbed by our bodies.

BY SIDSEL HANSEN

LINSEEDS ARE ABOUT 30 PERCENT FAT and raise the fat content of a typical rye bread up from three to ten percent. Until now, however, it was not known whether our intestines absorbed this fat. To find out, a research group began a study in which two groups of young people were asked to eat rye bread, though only one group ate rye bread that contained linseeds as an ingredient.

More fat out than in

The study demonstrated that the amount of fat present in the faeces of study participants was significantly greater when a subject ate linseeds. In fact, the extra amount of fat was greater than the fat content of the linseeds, indicating that they may draw extra fat out of the body. This led the team to consider linseeds as a potential tool in the fight against obesity.

“We suspected that it was the fibre that is found on the outside of the linseeds, known as the mucilage layer, that was responsible for drawing out the fat,” Mette Kristensen, head of the team at the Department for Human Nutrition, explains.

Fibre tested on rats

The linseed fibre was extracted and tested first on rats that were either fed linseeds, linseed fibre or a diet containing neither. While all the rats ate precisely the same amount of food, the rats with diets containing ten percent linseed fibre gained far less weight during the three-week study.

The fat content in the faeces of rats with high fibre diets was also 20 percent higher than those that did not eat any linseed. This means that the fibre affected the uptake of fat to such an extent that their weight was also affected. While there have so far not been any weight loss studies on people, many smaller studies indicate that linseed fibre, even in small doses, increases the level of human fat excretion. It has also been confirmed that cholesterol levels in humans fall after only a week of adding linseed fibre into their daily diet.

Significance for appetite

People who add linseed products to their diet also feel less hungry. It is thought that linseed fibre absorbs water and expands in the stomach, making it move slowly to the intestines and so signalling a sense of fullness to the brain.

Linseed fibre is therefore of interest as both a dietary supplement and food ingredient, and the team hopes that this new information will soon be able to make people healthier.

Researchers go

➔ **BACK TO THE FUTURE** ⬅

for healthy eating



Humanistic researchers and natural scientists have joined forces to form a research consortium that looks at the past to understand the present and change the future of healthy eating through an understanding of human food perception and identity.

BY SUSANNE KERNER OG CYNTHIA CHOU

IN THE WORDS OF American anthropologist Marvin Harris, understanding “why people eat rancid mammary gland secretion, fungi and rocks (also known as cheese, mushrooms and salt)” and not fat-free, high protein delicacies such as cockroaches, locusts and crickets is one of the motives behind this research. As lifestyle diseases such as diabetes are shown to cause up to 63 percent of global deaths today, why don’t people simply choose to eat what is good for them? Changing that could save millions in the annual health budget.

We eat what we are and we are what we eat

Seriously lacking in the research knowledge of health and food is a holistic understanding of how cultural and physiological determinants of food perception and eating behaviour help form human identity – an understanding that is necessary and urgent to meet local and global needs in the food-health sector in countering preventable life-

style diseases of today and for tomorrow. The project Food Perception and Identity takes its point of departure from the idea that “we are what we eat” and “we become what we eat” as a result of how we eat.

“This project will enable us to identify the motives behind people’s food choices and to then suggest possibilities to move human food behaviour in a better and healthier direction,” says research leader Cynthia Chou from the Department of Cross-Cultural and Regional Studies. This is also why the research team is particularly interested in working with national and international food-health policy makers, NGOs such as the World Health Organisation, and disseminators like the new Nordic Food movement and all levels of the Danish food sector.”

Across theoretical and physical boundaries

The research team’s combined methods will include field-work inside Denmark stretching all the way to the Middle East and Asia and spanning large time periods as it includes a historic-archaeological aspect, next to contemporary anthropological as well as sensory science, and media and communication studies.

“This will contribute towards a new understanding of the development of food culture and eating practices both in a historical and global perspective and allow multi and inter-disciplinary research across theoretical boundaries and different scales of understanding. This is crucial for the understanding of food perception, identity and health,” Cynthia Chou concludes.

X-ray scanning

to keep Danish food on top

A new research project using groundbreaking X-ray food scanning techniques could make it possible to one day reveal cartilage, wood, insects, paper and other soft foreign objects in our food. The goal of the project, a collaboration between researchers and businesses, is to maintain high product standards and keep the Danish food industry among the world's leaders.



BY LINE SVENSTRUP BERGER

DANISH FOOD IS RECOGNISED globally for its consistent high quality and high level of food safety. The whole production chain contributes to maintaining and improving this international position. But now a new inter-disciplinary project is hoping to strengthen this position further by developing a new X-ray scanning technology. The project is a collaboration between researchers and businesses that aims to maintain high product standards and help keep Denmark competitive.

From Roskilde Festival to CT scanning

It all started at the 2009 Roskilde Festival when professor Robert Feidenhans'l, of the Niels Bohr Institute at the University of Copenhagen, got talking to a representative from the meatpacking industry. He learned that conventional CT scanning was already being used in the meat industry. Coincidentally, Feidenhans'l himself was using the technology in his own research, and after the meeting he visited the Danish Meat Research Institute (DMRI) to study their use of CT scanning.

"It was incredibly exciting. They were employing some rather advanced technology, and I thought it would be beneficial to collaborate with them, he says."

The partnership resulted in the X-ray scanning project and eventually wound up earning a grant from the Council for Strategic Research, a part of Danish Agency for Science, Technology and Innovation.

Goodbye, foreign objects

Improving quality and food safety requires constantly developing newer and more effective techniques that can also examine products internally. Ordinary quality control procedures, which only inspect the surfaces of products, are far from adequate. Traditional X-ray scanning makes it possible to see into a product, even if it is packaged. The problem with X-ray scanning, though, is that it's not possible to differentiate between varying contrast and soft foreign objects. Doing that would require the development of new detection capabilities.

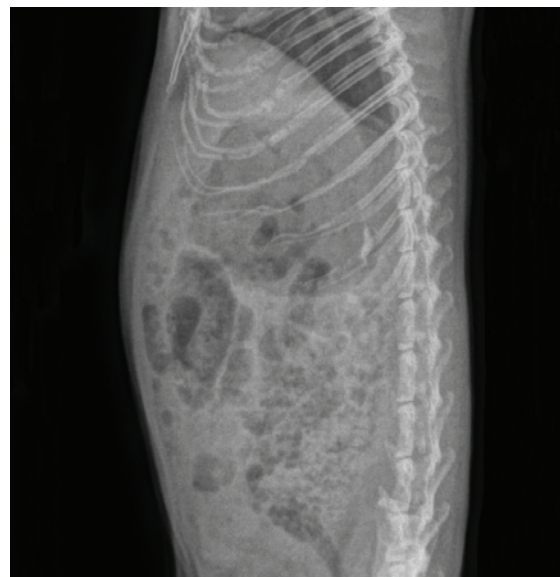
"We wanted to develop new X-ray technologies that were designed for soft and light materials," Feidenhans'l says.

About the project

Project title is NEXIM – New X-ray Imaging Modalities for Safe and High Quality Food

The project is realised from 2012-2015

Partners are The University of Copenhagen, the Danish Technological Institute, the Technical University of Denmark, Toms, Foss, Tulip, Danish Crown, Arla, Tican, Daloon, InnospeXion, Lantmännen



“That would mean that these techniques would provide us with new contrast mechanisms to separate objects that have the same X-ray absorption properties, but different micro-structures. In this way we would be able to find soft foreign objects such as dead flies and other insects, paper, plastic and cartilage in food products such as meat, fish, grains, breads and dairy products.”

A leader in the food industry

Even though the occurrence of insects or paper in food is minimal, it is always unwanted. But, according to Lars Bager Christensen, a project manager with DMRI, part of the Danish Technological Institute, it can still happen even in highly automated food production. While there is some variation from one market to the next, modern standards of cleanliness are incredibly high, and one of the goals of the project is help keep Danish food exporters competitive.

“Businesses that cannot deliver high-quality products are not chosen as suppliers. The project is directed especially toward high-value markets such as Japan and British supermarkets, which demand a very high standard of food safety and expect X-ray detection,” Christensen says.

“By developing this new X-ray technology, we’re keeping the Danish food industry on the cutting edge, both in terms of detecting foreign objects and ensuring its quality,” Feidenhans’l says, adding that the new technology will benefit other researchers as well, and it is precisely this applicability that earned it the grant.

But foreign objects aren’t the only thing the new technology will be helping to identify. It is hoped that it will be used to find out more about food quality, fibre content, fat levels and other qualities of food. According to Christensen, this information would be attractive to Danish food manufacturers such as Toms, Arla, Danish Crown and Lantmännen.

Business community vital for creating real product

The development of the new X-ray scanning techniques is happening in close collaboration with some of the world’s leading research groups in the field. The project also involves Danish food manufacturers and producers of inspection equipment for the food industry – a partnership that gives these businesses a unique opportunity to work together and be amongst the first to employ the new technology.

“It’s important that businesses join us so that they remain aware of the developments and tell us what we should be helping them with. We don’t know the user’s needs, but through a dialogue with businesses we can develop usable products,” Feidenhans’l says.

The project is currently broadly focused, but over the next few years Feidenhans’l expects to be able to identify specific focus areas. Doing so is unlikely to result in a finished product, but it should form the basis for a new project in collaboration with a business that wants to develop a specific product from it.

Functional foods of the future

Much of the world's population is eating itself sick on a diet of unhealthy food. Lifestyle diseases are out of control. But although food is part of the problem, it could also be part of the solution. The development of the functional foods is underway and will require close collaboration between the food industry and universities.



BY DAN STÆRK

WHETHER IT'S APPLE PEELS against diabetes or seaweed to fight depression, many foods can be used as effective weapons against lifestyle diseases. The development of functional foods could help to slow the growth of lifestyle illnesses like obesity, cardiovascular disease, type 2 diabetes and depression.

At the University of Copenhagen, we are working to identify and map the biological and chemical properties of a number of bioactive food ingredients. Apple peels, for example, contain chemicals that inhibit the enzymes that break down carbohydrates. This facilitates the regulation of blood sugar and reduces the risk for serious complications related to diabetes, making them a potential functional food for diabetics.

Seaweed, an underrated food source in Denmark, also has enormous potential as a functional food. The bioactive ingredients in some species can help inhibit the receptors involved in depression, while other species contain a wide spectrum of antioxidants.

Explosive growth in lifestyle diseases

Research into functional food comes as we continue to make fundamental changes in the way we live our lives. Many adults now have mentally demanding, yet physically sedentary, jobs. Children sit in front of a computer or TV for hours, and all of us are surrounded by large amounts of often unhealthy food. All this has led to an explosive growth of lifestyle diseases.

But treating these types of illnesses requires more than just medicine. Equally important are things like increased physical activity and changing our diets to include foods that have preventative and curative effects. Developing functional foods is an important part of this equation.



We've shown that apple peels contain chemicals that inhibit the enzymes that break down carbohydrates. This facilitates the regulation of blood sugar and reduces the risk for serious complications related to diabetes, making them a potential functional food for diabetics.



Identification of potential health benefits

Our latest research into functional foods has concerned mostly type 2 diabetes, cardiovascular disease and depression, and has focused on plant-based foods such as fruits, vegetables, spices and seaweed.

This is possible thanks to advanced technologies that can characterise the chemical and biological properties of substances down to the molecular level. Compared with previous technologies, this ability to characterise ingredients represents a major step forward and has allowed us to identify a number of foods that have the potential to improve people's health.

There is still a long way to go before our results lead to functional foods showing up in stores. Bringing these products to market will require not only close collaboration between the food industry and universities, it will also take political initiative.

What are functional foods?

Functional foods are defined as foods or nutrients that, in addition to their basic dietary value, either improve health or prevent illness.

Functional foods' additional health benefits can either come from naturally occurring nutrients or added ingredients.

Did you know that...

... we actually eat much healthier than our great grandparents did?

A century ago, the average family spent between 50 and 60 percent of its income on food. Today, food expenses amount to just nine percent of our wages. This drop in spending does not mean that the quality of our food is any worse than what our ancestors ate. On the contrary.

“When people were spending half of their income on food, they were probably not getting a lot of food and were probably not getting very good food either,” explains historian Tenna Jensen, from the SAXO Institute. “Inefficient production methods drove up the cost of food, so low-wage families often endured monotonous and fatty diets that caused many people to suffer from malnutrition-related illnesses.”

“The average diet today is much more varied. More people are able to include things like fruits, vegetables and fish in their diet. Sugar consumption, contrary to what many people believe, is actually lower than it was before the Second World War. It wasn't until the 1950s that we saw improved food production methods and a generally better economy.”



... we eat better quality food than our great grandparents did?

On average, we eat far more than previous generations, but the food we eat is of higher quality.

“It's not just a matter of how much you eat. The quality of what you eat also plays a role,” says Tenna Jensen. “We do eat more protein, carbohydrates and fat than we did 100 years ago, but that doesn't necessarily mean that we are less healthy, because today's food is produced in different ways.”

“Pork is a good example. We eat far more pork than our forefathers, and you would assume that it would be making us fatter. But today's pork is much leaner, because pigs are slaughtered when they are younger and fed a soy-based diet. So in reality, our high consumption of pork, which is also significantly cheaper today due to more efficient production methods, may actually be beneficial to our health.”

Historian Tenna Jensen, using food supply data compiled by Statistics Denmark, studied Danish eating habits over the last 100 years. The results of her research can be used to determine such things as which diets historically are most closely linked to lifestyle-based diseases in specific population groups.