



PERSPECTIVE

ANNUAL REPORT 2013

DCA – Danish Centre for Food and Agriculture

Research-based policy support
Knowledge exchange and industrial collaborations
National and international research alliances

PERSPECTIVES OF CURRENT RESEARCH



Photo: Lise Balsby

Knowledge is a good basis for decision-making, which is why the Danish ministries have a long tradition of collaborating with academic institutions.

Previously, the ministries had their own research institutes. With the reform of the Danish universities, government research institutions were merged with universities, and agreements were drawn up between universities and ministries on research-based policy support.

Aarhus University has signed an agreement with the Ministry of Food, Agriculture and Fisheries on the provision of policy support to the authorities in 13 research areas. Within each of these areas, the university is obliged to carry out research at a high international standard.

The 13 areas represent specific academic, social and commercial challenges. They are often challenges where solutions require collaboration between different disciplines and academic environments.

To ensure cross-disciplinary collaboration on policy support, Aarhus University has established DCA - Danish Centre for Food and Agriculture, which provides the framework for the initiatives within this area.

The collaboration is supported by an academic unit, which in addition to coordination and quality control of the policy advice also offers solutions within the area of knowledge exchange, international research, and collaboration with commercial entities and the sector.

In this the first annual report of DCA the objective is to open the doors and provide insight into the different aspects and activities undertaken by the centre in the areas of policy support for authorities, links to industry and supporting research.

DCA receives some 200-300 commissions from the authorities on an annual basis. Examples are given for each of the 13 thematic areas of some of this research-based policy support work.

An important element of DCA's consultancy work is that it is independent, impartial and at arm's length to both authorities and organisations.

In this context it is also important that the advice is research-based; in other words, that it is verifiable and based on scientific evidence that can be validated by other researchers.

Research in the 13 areas provides not only the basis for advice to the authorities. The research is also to a very high degree the premise for extensive cooperation with private enterprises and with the agricultural extension service.

In the annual report there are examples for each of the 13 thematic areas of how collaboration with private companies and professional bodies has resulted in the development of new products and technologies that have provided growth, development and employment within the agrifood sector.

What is so interesting is that within the agrifood sector the research into societal issues such as food quality, the environment and animal welfare often leads to the development of new technologies and products that bestow a competitive advantage on Danish food producers.

In the report we have tried to highlight these different perspectives: this is precisely why the annual report is called "Perspective".

We hope you enjoy reading the report.

Niels Halberg,
Director of DCA - Danish Centre for Food and Agriculture

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Published by

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PhD student Bashar Amer in the laboratory. Bashar works with metabolic-based studies of biomarkers that are affected by the consumption of dairy products and milk components. Photo: Lise Balsby

Printed by

Digisource

ISBN 78-87-93176-15-7

DCA'S AREAS OF RESPONSIBILITY AND ORGANISATION

DCA – Danish Centre for Food and Agriculture provides the framework for policy support, collaborative research, knowledge exchange and strategic partnerships with private companies and the industry.

Aarhus University carries out basic, strategic and applied research in the production of food products and bio-based products such as bionergy, fodder, fur and fibre.

The research is intended to form the basis for a sustainable production, not only in an economic sense, but also socially and ethically. The research must thus contribute to a production that is economically viable, acceptable to society and complies with ethical principles with regard to animal welfare and impact on the environment and climate.

Research into food and agriculture at Aarhus University primarily takes place in:

- Department of Agroecology
- Department of Animal Science
- Department of Food Science
- Department of Molecular Biology and Genetics
- Department of Engineering
- The MAPP Centre at the Department of Business Administration

To ensure cross-disciplinarity in research in food and agriculture, Aarhus University established DCA – Danish Centre for Food and Agriculture. The Centre's remit is to coordinate and quality-assure the research-based policy support. DCA additionally supports the exchange of knowledge and business partnerships as well as national and international research liaisons through a wide range of activities. DCA thus has three main areas of responsibility:

Research-based policy support

Via an agreement with the Ministry of Food, Agriculture and Fisheries, DCA supplies research-based advice to ministries and relevant government departments within agriculture, food and the environment.

According to this agreement, DCA shall carry out research and maintain a ready level of expertise within 13 thematic areas that are based on three elements:

- A development and growth-oriented food industry
- The responsible management of natural resources
- Food safety, consumer choice and healthy dietary habits

DCA carries out 200-300 advisory tasks per year that range from short memoranda to larger assessments, scientific reports and knowledge syntheses.

The agreement is based on the so-called arm's length principle, whereby the advice supplied by DCA is based solely on the science carried out by the academics, and the political and administrative considerations and deliberations are subsequently carried out by the relevant authorities.

Knowledge exchange and links to industry

DCA sets the frame for the strategic cooperation between Aarhus University and different organisations, segments and companies within the agrifood industry. DCA helps to build clusters and networks between research environments, companies and organisations.

The tasks involved focus on commercial collaboration and DCA is involved in match-making and other events that promote research collaboration with private companies.

The results of the research are communicated via newsletters and other media, but also via conferences, workshops and seminars, where there is the opportunity for companies, farmers and advisers to meet the scientists.

National and international collaboration

National and international research collaboration results in the development and solution of complex issues.

It is the responsibility of DCA to promulgate the needs and opportunities for research collaboration in national and international fora. DCA also promotes Danish participation in international research programmes within agriculture and food production, and DCA advises Danish authorities on national and international research in these areas.

Perspective

On the following pages there are examples of research, policy support and links to industry within the 13 thematic areas that form part of the agreement between the Ministry of Food, Agriculture and Fisheries and DCA.

LINKS TO INDUSTRY

Articles that focus on collaboration with private companies

RESEARCH

Articles that focus on research projects at Aarhus University.

POLICY SUPPORT

Articles that are premised on research-based policy support.

Photo: Lise Balsby



FUNDING

Food and agriculture research at Aarhus University has an annual budget of around 700 million DKK. The research is financed from different sources. DCA has a contract with the Ministry of Food, Agriculture and Fisheries on the provision of research-based policy support, which in 2013 was worth 285.6 million DKK.

Many research projects involve alliances with organisations, private companies, authorities and universities in Denmark and abroad. Applied science and other activities that are done in partnership with companies and organisations were in 2013 worth approximately 100 million DKK. Research activities are also financed via the Danish research councils, the EU framework programmes, and private foundations and companies.

DCA reports published in 2013

A number of the responses that DCA supplied to the authorities have been published in reports that can be downloaded or requisitioned in paper format. In 2013 DCA published the following reports (most of them only available in Danish):

- › A comparison of break crops vs. catch crops
- › Utilisation of biomass in Denmark – potential resources and sustainability
- › Report on consumer knowledge of hazardous substances in food products
- › Development in nitrogen leaching and surplus from Danish agriculture for the period
- › How much straw do pigs need to satisfy manipulation and rooting behaviour?
- › Environmental technologies in primary agriculture – economics and environmental efficiency
- › Seminar on current mink research
- › Effects of initiatives to reduce agricultural emissions of greenhouse gases
- › Nutrition and health claims – comprehension and use by Danish consumers
- › Nutrient balances and surpluses in agriculture 1991/91 2011/12
- › Influence of inorganic fertiliser on arsenic, lead, cadmium, chrome, mercury and nickel contents in crops
- › Geographical mapping of afforested areas at Elmelund, Ladby and Ravnholt
- › Danes' knowledge and understanding of the eight dietary guidelines
- › Status, causes and challenges for reducing the high mortality of organic suckling piglets
- › Soy and palm oil – Certification schemes for documenting production sustainability
- › 100-year anniversary of Danish Institute of Plant Pathology
- › Practical plant protection
- › Food waste in the food sector – from primary production to retail
- › Report on food quality

ACTIVITIES IN DCA

DCA consists partly of academic environments in a number of departments at Aarhus University that undertake research and development within agriculture and food, and partly of a smaller administrative unit that coordinates and quality-assures the research-based policy support. The Centre is also involved in organising knowledge exchange and strategic business liaisons with the sector and in supporting national and international research alliances.

CONTACT TO DCA

DCA is the gateway for authorities, companies and organisations that are seeking scientific advice or research collaborations in the agrifood sector.

Further information on the activities in DCA and contact details for members of staff can be found on www.dca.au.dk.

Agriculture – an industry of growth and development

The Danish food industry is being challenged by increased competition and by political and market demands for the efficient utilisation of resources.

Political ambitions in areas such as organic farming, nature and environment, climate, biodiversity, medicine consumption, animal welfare, and animal and plant health result in a demand for new management structures and technical solutions that can increase employment and propel development while supporting a green transformation.

The authorities are facing a testing time with the need to carry out analyses and implement new alternative structures for the regulations and incentives that underpin growth and development in the industry. The research endeavour within agricultural production must be able to support the continued development of the industry.

Initiatives based on existing and future regulations of the industry will generate new knowledge that will obligate considerations on the optimal use and protection of natural resources, on minimising impact on environment and climate, and on an agricultural practice that leaves room for cohesive tracts of high-quality nature.



BETTER WELFARE FOR DANISH PIGS – NATURALLY

● POLICY SUPPORT

The Ministry of Food, Agriculture and Fisheries has in March 2014 entered into an agreement with the agricultural industry and other stakeholders on improving pig welfare. DCA research supports the historic, new agreement on several fronts.

Pigs produced on Danish farms and in Danish fields must have a good life. "Naturally" most people would probably say, but it can nevertheless be a struggle for a pig to manoeuvre its way safely and soundly through life from birth to slaughter. Depending on the type of production (conventional or organic), about 22-33 percent of piglets will die within a few days of birth. Most of the surviving piglets will have half of their tails docked, male pigs will be castrated and older animals risk getting ulcers.

The producer is constantly seeking to reconcile optimal welfare with optimal production, efficiency and working conditions, but it can be a difficult balancing act in practice since there are many factors to consider.

Mortality, tail-docking, castration and ulcers are undesirable companions in pig production, but they can be minimised or even eliminated through targeted research. By combining research with practical experience in a close partnership between industry and research institutions, progress has already been made.

Research improves welfare

In spring 2014 the Ministry of Food, Agriculture and Fisheries, the agricultural industry and other stakeholders signed an agreement on improving pig welfare. In several of the areas covered by the new agreement and listed below, scientists from Aarhus University and DCA will be able to contribute with existing or future research:

- Higher survival rates of piglets
- Fewer lactating sows to be restrained
- Fewer pigs to be tail-docked
- Fewer ulcers in pigs and sows
- No male pigs to be castrated without anaesthesia
- Animal welfare to be incorporated into the "First pig on the moon" project

Piglet mortality has several causes. This means that there are several levers that can be tweaked in order to reduce it. One of the scientists working extensively with various aspects of pig welfare is senior researcher Lene Juul Pedersen from the Department of Animal Science. She has several ideas on how piglet mortality can be reduced.

– An obvious way ahead is to attach more importance to piglet survival in the breeding index. Today what you breed for is number of surviving pigs on day 5, and this has increased the number of weaned pigs significantly since the breeding programme was introduced, while the proportion of dead pigs has been considerably reduced, says Lene Juul Pedersen and continues:

– Increased monitoring of the farrowing has the potential here and now to reduce both the proportion of stillborn piglets and the proportion of piglets that die shortly thereafter. Similarly, improvements in the pigs' thermal environment at birth could reduce mortality. Measures such as straw and extra heating sources located in the right places in the farrowing pen could be a solution.

In addition to researching the importance of straw in the design of the farrowing pen and the piglets' immediate surroundings, Lene Juul Pedersen has also studied the role of straw in satisfying the manipulative requirements of pigs. In modern housing systems large quantities of straw must be applied to fully meet the requirements of the pigs, but since the pigs will respond with a higher growth rate, lower incidence of ulcers and less tail-biting, it would probably make good business sense to change the housing to better accommodate straw. In addition, increased dry matter in the manure may have the potential to reduce emissions of ammonia, greenhouse gases and odour, and increase the biogas potential.

Tail-biting is a problem that can be more painful for the pig than getting the tail docked, but if both tail-docking and tail-biting can be avoided, it would be the best solution for both the pig and the farmer. Scientists in the Department of Animal Science are involved in both Danish and international research projects on this issue. The research is supported by funds from, respectively, the Ministry of Food, Agriculture and Fisheries and the EU.

When it comes to finding out how the castration of male pigs can be avoided, scientists from Aarhus University are also involved. The knowledge on pig welfare that scientists from the Department of Animal Science generate could form a natural



Research shows that many problems in pigs can be reduced by giving them suitable amounts of straw.

part of the "First pig on the moon" project of the Danish AgriFish Agency. The project aims to reconcile environmental concerns, animal welfare and a larger pig production through innovative

solutions. Aarhus University is one of the partners in this major project.

● LINKS TO INDUSTRY

FUTURE PIGGERY GETS CO-FUNDING FROM AARHUS UNIVERSITY

Aarhus University is involved in the process of developing a "state-of-the-art" pig house for the sustainable production of finishing pigs.

The "First-pig-on-the-moon" project, which is part of the government's innovation strategy, is a vision that combines environmental concerns and animal welfare with a larger pig production and is designed to create growth. Aarhus University is a project partner and via expert groups and a number of partnership meetings they will provide input to the scientific underpinning for the design of the facility that is scheduled to be completed by 2016.

● POLICY SUPPORT

FINISHING PIGS NEED STRAW

Finishing pigs should be given around 400 g of straw each per day to meet their behavioural requirements for manipulation and rooting. Straw not only has a beneficial effect on welfare and growth, it also reduces the risk of ulcers, according to studies described in a DCA report.

If results are to be implemented in practice, it is necessary to design new pig facilities and manure systems that can cope with larger amounts of straw.

NO EASY ALTERNATIVES TO SURGICAL CASTRATION OF PIGLETS

● POLICY SUPPORT

Four alternatives to surgical castration of piglets were outlined by scientists from Aarhus University in a comprehensive report – the conclusion is that none of the four alternatives are easy to implement in Danish pig production here and now.

There are no easy alternatives to surgical castration – an issue that has again attracted a lot of attention following the transmission of a DR programme in early 2014 which cast doubts on the welfare of pigs on Danish pig farms – exemplified by the use of surgical castration. This is one of the conclusions of a major study into alternatives to surgical castration, which scientists at Aarhus University prepared for the Danish Veterinary and Food Administration.

Castration of male pigs is common practice in many countries and is carried out to prevent boar taint of the meat that ends up on the dinner table. But the EU Commission and numerous organisations have voluntarily pledged to cease castration by 1 January 2018, and scientists at Aarhus University were therefore commissioned to analyse possible alternatives.

Another reason why the search for alternatives to the castration of piglets was launched was because a summit meeting with the pig industry hosted by the Minister for Food, Agriculture and Fisheries in March 2014 resulted in a similar declaration that castration without the use of anaesthetics would be banned in Denmark by 2018 at the latest.

In the report the scientists have looked into the following realistic alternatives to surgical castration and undertaken a cost-benefit analysis of their implementation within a 2-5 year time frame:

- 1) An entire male production: reducing boar taint through diet, breed selection, management and housing conditions
- 2) immunocastration (male pigs are functionally castrated via two vaccinations)
- 3) sperm sexing
- 4) breeding your way out of the problem

These are the alternatives that scientists have looked at. All four options have both advantages and disadvantages.

Both the entire male pig production and immunocastration can be completed within two to five years. Both methods will improve animal welfare in early life, but there are also challenges:

– Both alternatives may reduce welfare of the pigs for a shorter or longer period later in life as a result of increased aggression and mounting behaviour if management and the social or physical environments are not adjusted, explains Bent Borg Jensen, senior researcher at the Department of Animal Science and main author of the report, and continues:

– It is not possible at this stage to determine whether male pig production and immunocastration will generally improve animal welfare compared with surgical castration, since the economic scope for welfare improvements with either of these methods is limited.

Both alternatives may be profitable at farm level, the report stresses. However, the implementation of an entire male production and immunocastration can bring new challenges for the pig sector, which must take account into consumer attitudes in the export markets and the expected increase in boar-tainted meat. Since the vaccine used by immunocastration is not species-specific but also works on humans, there is concern about consumer attitudes towards immunocastration despite an almost non-existent risk. An entire male production also requires better sorting procedures at the slaughterhouses to remove the pigs that are tainted.

This sorting method has a high priority in the pig industry, which prefers an entire male pig production as an alternative to castration, but there is a qualification.

– There is currently no internationally agreed and validated on-line method for evaluating carcasses that meets the requirements of a highly streamlined industry, says Bent Borg Jensen. The other two alternatives, gender selection and breeding against boar taint, are described as promising, but there is a need for further development of the techniques associated with gender selection while breeding against boar taint assumes that the analyses carried out by the pig sector show that there is sufficient basis for this.



Photo: Rikke Thomsen

From 2018, the European Commission and a wide range of organisations are committed to ceasing surgical castration. Scientists at Aarhus University have looked at four alternatives to castration, but none of them are easy to implement in the pig sector at the current time.

● RESEARCH

LIFE IS TOO SHORT

The mortality of suckling pigs in organic productions is around 33 percent according to a report by DCA. According to the researchers, this difference is due to the poorer opportunities for monitoring and access to the sows in organic herds where the animals and their young live outdoors. Organic piglets are also exposed to the dangers of outdoor living in the form of foxes and birds of prey.

The report contains proposals for how the mortality can be reduced, including alternative designs of the farrowing site, development of monitoring tools and the breeding of more robust pigs.

● LINKS TO INDUSTRY

SLOW-GROWING CHICKENS FARE BETTER

Slow growth means higher welfare. These are the early results from experiments with organic broilers at Aarhus University.

The researchers examined how the use of different feeding strategies and chicken types with different growth rates affected their feed intake, growth rate, welfare, health and meat quality. They were able to establish that fast-growing broilers had leg problems when they were fed the normal organic feed, while two other chicken types no problems had. The leg problems disappeared when the fast-growing broilers were fed an alternative feed that gave a lower feed intake and therefore a lower growth rate.

INTEGRATED PEST MANAGEMENT WIDENS FARMERS' CONTROL REPERTOIRE

RESEARCH

A wide range of control measures can be used in the battle against weeds, pests and diseases in agricultural crops. Denmark is leader of the pack when it comes to research in integrated pest management.

Life would be so much easier if all the farmer had to do was to sow and to harvest. But, unfortunately, farming is not that simple. Before the crop is ready for harvesting it has to compete with weeds for nutrients, light and water, and it will need to defend itself against attacks from pests and diseases.

The farmer can come to the aid of the plants – but this does not simply involve treating fields with various pesticides. These days the farmer's portfolio for plant protection consists of a wide range of measures in an integrated pest management (IPM) system.

Targeted spraying

IPM gives farmers more tools in the toolbox in the fight against weeds, pests and diseases. Researchers from Aarhus University are continually developing new methods and strategies for integrated pest management in close cooperation with, among others, the agricultural industry.

To this end, a significant research achievement is the intelligent spray boom, which researchers from the Department of Agroecology have helped develop.

The principle of the intelligent boom is that the nozzles will only open when weeds have been visually detected. The system consists of a camera, a vision system and an image processing module, and a control system for the opening and closing of individual nozzles. Field experiments carried out at Aarhus University's Flakkebjerg site in the spring and summer of 2013 show that herbicide consumption can be reduced by up to 60 percent.

The right crops

Researchers from Aarhus University are also working on developing new crop varieties that are resistant to the most severe plant pests and diseases. All other things being equal, higher plant resistance will lead to less use of chemicals.

Growing break crops and cover crops is another measure that can be used to reduce weed pressure and thus the use of herbicides. Researchers from Aarhus University are exploring different cultivation strategies and plant varieties to optimise the use of break crops and cover crops.

The knowledge created by researchers will be synthesized into decision support systems for farmers. In this way, the results will be translated into practical tools for the farmer.

Knowledge crosses borders

It is not only in Denmark that IPM is used to fight weeds, pests and diseases in crops. The EU has adopted a framework directive for the sustainable use of pesticides.

This means that all EU countries must have a national action plan for pesticides, in order to reduce the environmental and health effects associated with their use, and that individual countries must implement IPM in order to minimise the use of pesticides.

Research results from Aarhus University will benefit other EU countries partly via a number of international research projects. One example is the EU project DSS Herbicide where Aarhus University participated along with researchers from Poland and Germany. The project finished in 2013, and the objective was to disperse and adapt Danish knowledge on the intelligent use of herbicides in winter wheat to the other two countries.



Researchers from Aarhus University are involved in the development of integrated pest management methods, including an intelligent spray boom that can reduce pesticide consumption by up to 60 per cent.

RESEARCH

GLOBAL RUST REFERENCE CENTRE

The world production of wheat is under constant pressure from the destructive and infectious yellow rust disease. The fungus remains a threat to food security, and researchers worldwide therefore concentrate their efforts on reducing the problem.

Aarhus University is very active on this front, both in research and in the foundation of the Global Rust Reference Centre. The Centre, which is accommodated at the Flakkebjerg site, was established at the behest of the international institutions of CIMMYT, based in Mexico, and ICARDA, based in Syria.

POLICY SUPPORT

BETTER COORDINATION OF INFORMATION ABOUT QUARANTINE BACTERIAL PLANT PATHOGENS IN THE EU

The EUPHRESKO network, funded as an ERA-net by the EU and with participation of Danish researchers from Aarhus University, has since its inception in 2006 helped to strengthen the knowledge base and expertise in the field of plant health at national and EU level. The network funding from the EU ran out at the end of 2013, and the network is now self-sustaining with its affiliation to EPPO (European and Mediterranean Plant Protection Organization).

The original partners from 15 EU countries can look back on completing tasks such as coordinating national programmes for plant health research and initiating transnational research projects where Aarhus University researchers have participated in seven EUPHRESKO-initiated research projects. Read more about the network at euphresco.net.



Photo: Preben Olesen

Agriculture craves a new model for the application of nitrogen. A significant research endeavour lies ahead if, as recommended in the report by the Danish Commission on Nature and Agriculture in spring 2013, a model for a more intelligent and targeted control is to be developed.

RESEARCH STRATEGY FOR INTELLIGENT NITROGEN CONTROL

● POLICY SUPPORT

A greater degree of intelligent control of nitrogen use in agriculture has much potential but requires a great deal of research in the coming years. This is the conclusion of scientists from Aarhus University who have set out a strategy incorporating new technologies.

– Grain yields and nitrogen utilisation can likely be increased within the framework of the current regulatory system for nitrogen. However, there is a need to develop new methods to ensure more precise and differentiated estimates of crop nitrogen requirements, both on individual areas and for individual years.

These are the conclusions of Erik Steen Kristensen, head of Department of Agroecology, and Niels Halberg, director of DCA.

They have looked closely at new technologies and approaches that can be used in a future regulation of nitrogen in crop production. There is much work to be done on the research front.

The notion of introducing new regulations for nitrogen was triggered by a report by the Danish Commission on Nature and Agriculture (DCNA) that landed on the tables of agricultural advisers,

politicians, interest groups, authorities and farmers in spring 2013. In this report, some words keep reappearing. Words like vulnerable and robust areas and intelligent regulation.

It is the strong wish of the industry that the report's recommendations are translated into action. Scientists at Aarhus University, who were represented on the commission and also delivered some of the research that formed the background for the report's recommendations, have since its release been working actively with the spirit and intent of the report.

The report by the DCNA stated, among other things, that there is a need for regulating nitrogen in a more intelligent and adaptive way. Agriculture has for years complained about the requirement for fertilization to be 10-15 percent below the economic optimum.

– There is a need to consolidate and modernise both the knowledge base and the regulatory system. As the recommendations in the DCNA report also emphasise, nitrogen application needs to be more differentiated so that it is based to a higher extent on knowledge of local conditions (soil, preferential flow, reductive capacity, etc.), Erik Steen Kristensen and Niels Halberg point out.

To this end, a range of approaches is required. Based on the existing regulatory framework, there is a need to improve the premise for the so-called economically optimal allocation of nitrogen by site-differentiating the standards. This could be done by an assessment of the crop nutrient status in the growing season. There should also be a more individualised use of catch/cover crops in the autumn in relation to the sowing of a winter crop. In order to enhance the knowledge base within the existing regulatory system, they identify a new approach that uses laser and 3D technologies to improve estimates of crop biomass and nitrogen uptake and forms the basis for determining nitrogen requirements.

Another approach is based on a regulatory system that charts vulnerable and robust areas, and that can gradually be expanded with improvements in knowledge. One of the tasks involved here is the identification of flow paths from the field to the recipient and quantification of the natural potential of flow paths to retain and reduce nitrate concentrations.

– A central issue for the cultivated soil is the mapping of drainage and volume of runoff via drains as well as the reduction potential of the soil profile to drainage level, they say. Information is also needed on the effect of targeted measures to reduce nitrate leaching and their potential use in regulating the nitrogen supply. This can be in the form of controlled drainage and constructed wetlands.

The timetable for the implementation of a new regulatory system will depend on the research and level of knowledge achieved in the coming years. Year 2018 is a realistic estimate of when a new system for a more intelligent and targeted regulation of nitrogen may be ready.

– If a major research effort is initiated in 2014, we estimate that by 2018 we can have a model ready for differentiated nitrogen allocation within the existing regulatory system. However, for the research effort needed to support a future system that can distinguish between robust and vulnerable areas we are looking at a longer time-scale, since the research depends on the availability of resources, say Erik Steen Kristensen and Niels Halberg.

Finally, there is a need for more knowledge about how different forms of differentiated regulation and enhanced knowledge about vulnerable and robust areas and new measures will be utilised in the management of the farms.

● RESEARCH

INTELLIGENT IRRIGATION CAN PROTECT THE ENVIRONMENT

Farmers may look forward to significant water savings in irrigation, without compromising the crops. A large EU project with the participation of Aarhus University is developing a technology that will enable precious water to be saved on the farm. If successful, the technology could also reduce the leaching of nitrogen to the aquatic environment.

The scientists will develop a system for the farmer that enables him to water effectively and accurately – precisely where and when it is needed. Some of the tools are sensors that can measure the well-being of plants, growth simulations models, meteorological data and state-of-the-art irrigation systems.

● POLICY SUPPORT

NORM REDUCTION LEADS TO GREATER LOSS THAN INITIALLY EXPECTED

Since 2002, farmers in Denmark have faced a maximum nitrogen limit for their crops that has been set at 25 kg below the economically optimal level.

The loss caused by this reduction has hitherto been estimated at 1.2 hkg per hectare, but a report from DCA shows that the loss is larger than previously thought. The loss is now estimated at 3-5 hkg per hectare.

The costs to the industry are estimated to be between 480 and 975 million DKK, against the previously reported estimate of 160 million DKK.

GENOMIC SELECTION REVOLUTIONISES LIVESTOCK BREEDING AND CREATES GROWTH IN AGRICULTURE

RESEARCH

Genomic selection is a relatively new tool within selective breeding, which can help agriculture choose the most suitable animals and plants – to the benefit of Danish agricultural production. In 2013 genetic research at Aarhus University's Foulum site was augmented by a strategic research centre that gathers the research strands within genomic selection.

Improved breeding, lower production costs, higher milk yields, lower environmental impact and better animal welfare.

The list of potentials and possibilities is long for genomic selection, which has revolutionised the world of research in recent years. Genomic selection is a new kind of tool for selective breeding based on the principle of using DNA sequences across the entire genome rather than just individual genes or information from relatives.

It is a novel approach where researchers can integrate ever more finely detailed knowledge of genetic factors and enormous amounts of data. The result is a much more efficient selection of the animals and plants best suited for the future.

– Genomic selection simply transforms the work of selective breeding, says Mogens Sandø Lund. He is the centre leader of the newly started strategic research centre GenSAP - Center for Genomic Selection in Animals and Plants, which was established in 2013 at Aarhus University's Foulum site.

Genomic selection has hitherto concentrated primarily on pigs and cattle, but the Center's name suggests there are other areas where the technology can be expected to improve efficiency.

Plant production is a relatively new field for genomic selection, but researchers at Aarhus University along with partners in the industry are already busy using the technology to improve selective breeding of a number of seed varieties. Mogens Sandø Lund sees a great potential in genomic selection, for which many have high expectations:

– Breeding based on genomic information provides a significant contribution to one of the major challenges of the future

– namely that of providing an adequate, high-quality food supply for a growing population while ensuring high animal welfare, biodiversity, and minimal environmental impact, he says, and continues:

– If this is to be successful, we need a thorough understanding of the underlying genetic mechanisms for traits that are important to food production in both animals and plants.

So even though researchers have come far and have achieved great results in the use of genomic selection, the technology is still in its infancy. The work at the Center is therefore primarily concerned with basic research and methodology development.

Professional organisations and enterprises make financial contributions to the Center, since the researchers are developing tools and knowledge that will be of practical use in future farming. The Center has received a five-year grant. The total budget is provisionally 68.7 million Danish kroner.

FACTS ABOUT GENSAP

9 research partners from Denmark and abroad
8 industrial partners
13 researchers from Aarhus University are directly attached to GenSAP.

The research centre at Foulum could in 2013 boast a new strategic research centre. GenSAP gathers the different elements within genomic selection.



The research centre AU Foulum established a new strategic research centre in 2013. GenSAP gathers the threads in the area of genomic selection.

POLICY SUPPORT

ENVIRONMENTAL TECHNOLOGIES IN PRIMARY AGRICULTURE

Reduction of odours, use of pesticides, and feed nutrients. These are some of the focus areas in a review by DCA of the environmental technologies used in the primary agricultural sector that researchers at Aarhus University have compiled.

The list is reviewed annually and is intended to be used by the Danish AgriFish Agency as a tool for prioritising applications to the environmental technology research fund of the Ministry of Food, Agriculture and Fisheries, which includes grants for investments in new green processes and technologies in primary agricultural production.

LINKS TO INDUSTRY

UNIVERSITY HAS LONGSTANDING COMMERCIAL LINK ON BREEDING AND GENETICS

For a number of years Aarhus University and VikingGenetics have collaborated on breeding and genetics in a number of research projects in an effort to produce healthier and more productive cows for agriculture. The parties have, for example, collaborated closely on the development of a method that uses blood or tissue samples to select the best breeding stock shortly after calves are born.

The method used is called genomic selection and is a quantum leap forward compared to previous breeding methods. The work with increasing the speed and accuracy of the selection process was awarded a prize at the agricultural show Agromek.

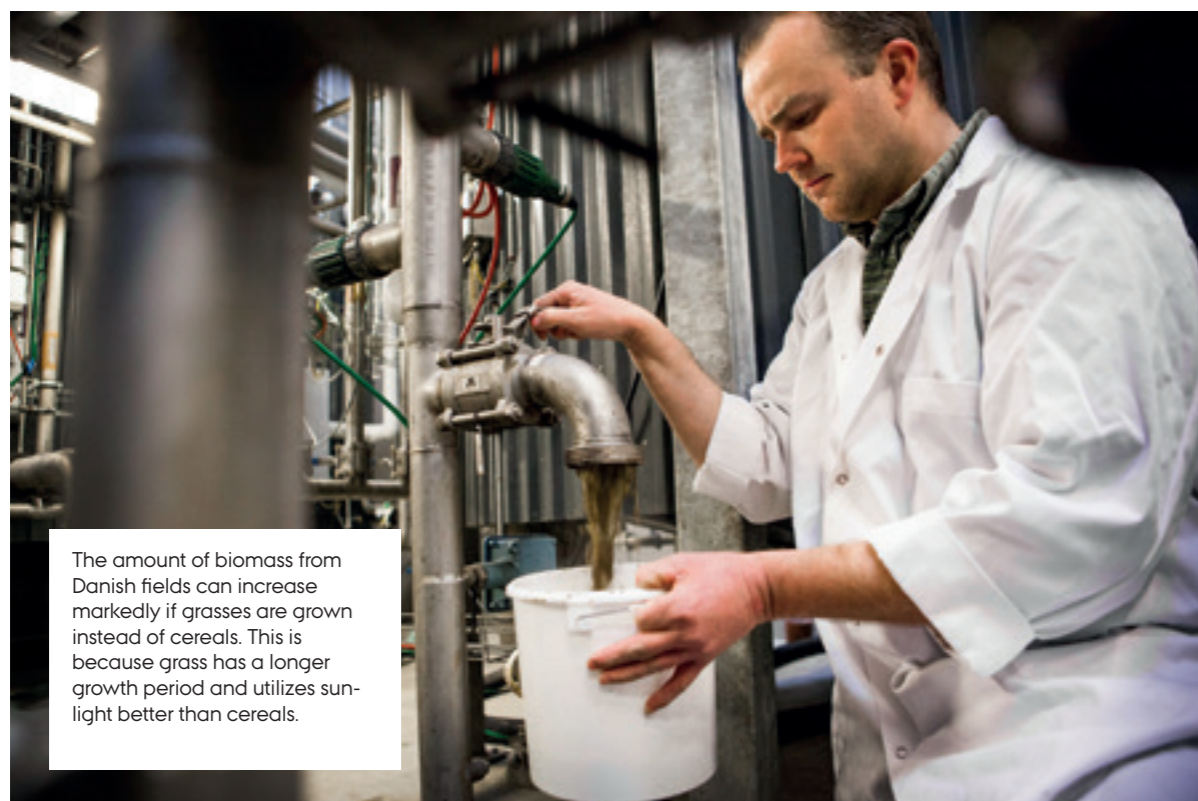


Photo: Lisa Balsby

The amount of biomass from Danish fields can increase markedly if grasses are grown instead of cereals. This is because grass has a longer growth period and utilizes sunlight better than cereals.

HUGE BIOMASS POTENTIAL IN DENMARK

● POLICY SUPPORT

There is a large and untapped potential for a significant increase in the biomass production in Denmark. There is even potential for a larger sustainable food production, for bio-based energy and for other materials if the right crops are grown. This is the conclusion of a report by DCA.

At a time when the Danish Energy Agency has announced that 2013 was the first year since 1996 that Denmark has imported more energy than it has exported, there would appear to be a large untapped biomass source of energy in the country.

The potential first and foremost lies in the fact that it is possible to produce more biomass than we hitherto have done. But this approach cannot stand alone. According to a report published by the DCA, which examined the prospects for the sustainable use of biomass in Denmark, it is also essential that there is a development in biorefining technologies.

Agriculture and forestry harvest a total of around 18 million tonnes dry matter in biomass each year, of which about 3.5

million tonnes are used for energy purposes. The remainder is used for fodder, food, livestock bedding, etc.

Doubling the biomass yield

Agriculture could in the future harvest a far larger amount of biomass, according to Uffe Jørgensen, senior researcher at the Department of Agroecology. He is co-author of a DCA report on the potential resources and sustainability of utilising biomass resources in Denmark, which he and colleagues from the universities of Aarhus and Copenhagen have penned.

– By growing crops that make more efficient use of sunlight, it is possible to double the biomass yield per unit area. This can be done by simply growing grass instead of grain, explains Uffe Jørgensen.

The report describes a scenario in which nine percent of the farmland, corresponding to more than 200,000 hectares, is converted into high-yielding biomass production. The extra production from the converted land and the by-products from other agricultural sources could deliver an additional 8-10 million tonnes of dry matter on top of the 3.5 million tonnes already used today.

Food production can be maintained

A change from grain to biomass production will clearly reduce the production of fodder and food. Uffe Jørgensen, however, points out that several of the biomass crops have a high protein content.

– By extracting the protein from grass crops, for example, we will largely be able to maintain the production of fodder and food. What will change is that the feed production in Denmark will have a larger contribution from protein feed – which is currently imported – than from grain starch (energy feed), Uffe Jørgensen explains.

The report also reveals that an increased production and use of biomass can have both positive or negative consequences for nature and the environment. It is necessary to assess the effects of individual biomass chains separately, since it is not possible to make a general statement on the effect of the utilisation of biomass on a given sustainability parameter.

The report provides examples of biomass productions that have decidedly negative impacts on the environment and climate. Increasing the area with grass and other perennial crops will,

on the other hand, reduce nitrogen and pesticide use, and help build up soil carbon. A sustainable biomass production could, in other words, mitigate national environmental and climate problems.

Analyses and technical development needed

Being able to exploit the potential of an increased biomass production depends on several factors, including the development of competitive technologies for handling and refining the biomass.

– There is no doubt that we are facing a large task in moving the current agricultural production towards more bio-production. However, it may be possible to take it in small steps; for example by starting with the separation of a feed fraction from green biomass before it is used in biogas plants, says Uffe Jørgensen.

He also points out that there is an untapped biomass resource in agriculture and forestry amounting to just over five million tonnes of dry matter, most of which could be used for energy purposes. This should be seen in light of the fact that the annual import of wood to the Danish energy sector is three million tonnes and rising.

Thus, there is low-hanging fruit that can be harvested to significantly improve the sustainability of the energy supply – while also creating local jobs and growth. But the choice of biomass production and conversion technology is very important for the sustainability of the production.

● RESEARCH

DCA LAUNCHES RESEARCH PLATFORMS

Until 2017 DCA will be investing 50 million DKK in the creation of a technology platform that will act as a framework for research and development of production systems and technologies for the biorefining of green biomass. The ambition is to create the basis for a sustainable and bio-based production of energy and fuels, new feed products and other high-value products.

The platform consists of four sections covering the following areas: "Green biomass through diversified land use and smart management", "High-quality protein from green biomass", "From biomass to energy via HTL" and "Social and environmental, organic and economic assessments."

● LINKS TO INDUSTRY

NEW BUSINESS CLUSTER FOR BIOMASS INDUSTRY

Biocluster Foulum is the title of a pilot project with the ambition of developing a strong international cluster and becoming a powerhouse for the production and refining of green biomasses, founded on the expertise within Agro Business Park and Aarhus University's research centre AU Foulum.

Biocluster Foulum will help transform new research and innovation into new businesses start-ups and develop new bio-based business areas for existing businesses. Taking part in the pilot project is a consortium consisting of Aarhus University, Danish Agriculture & Food Council, Viborg Municipality, Viborg Trade Council, Central Denmark Region and Agro Business Park.

FARMS TO CONCENTRATE THE MILK ON-FARM

LINKS TO INDUSTRY

Large dairy farms are looking to concentrate the milk on-farm in a research project with Arla Foods and Aarhus University. This will reduce transport costs and should offer dairy farmers a better price for their milk.

Large Danish dairy farms will in the future be able to help dairies to concentrate the milk used for cheese or milk powder. This will result in the dairy's milk tankers having to make fewer journeys, in lower CO₂ emissions and in less need for milk cooling. Dairy farmers should also achieve a higher sales price for their milk.

These are some of the thoughts behind a new research project involving researchers from Aarhus University together with, among others, Arla Foods and the Cattle Research Centre.

– Much more of the milk is now being used for milk powder, milk-based ingredients and for cheese. In the production of milk powder and cheese, the milk is often concentrated before it is further processed. Instead of doing this at the dairy, there are benefits to doing this at an earlier stage of the production chain. When doing it on the farm the large amounts of water removed can be recycled into feed and for cleaning, explains Lars Wiking, associate professor at the Department of Food Science and leader of the AU activities in the project.

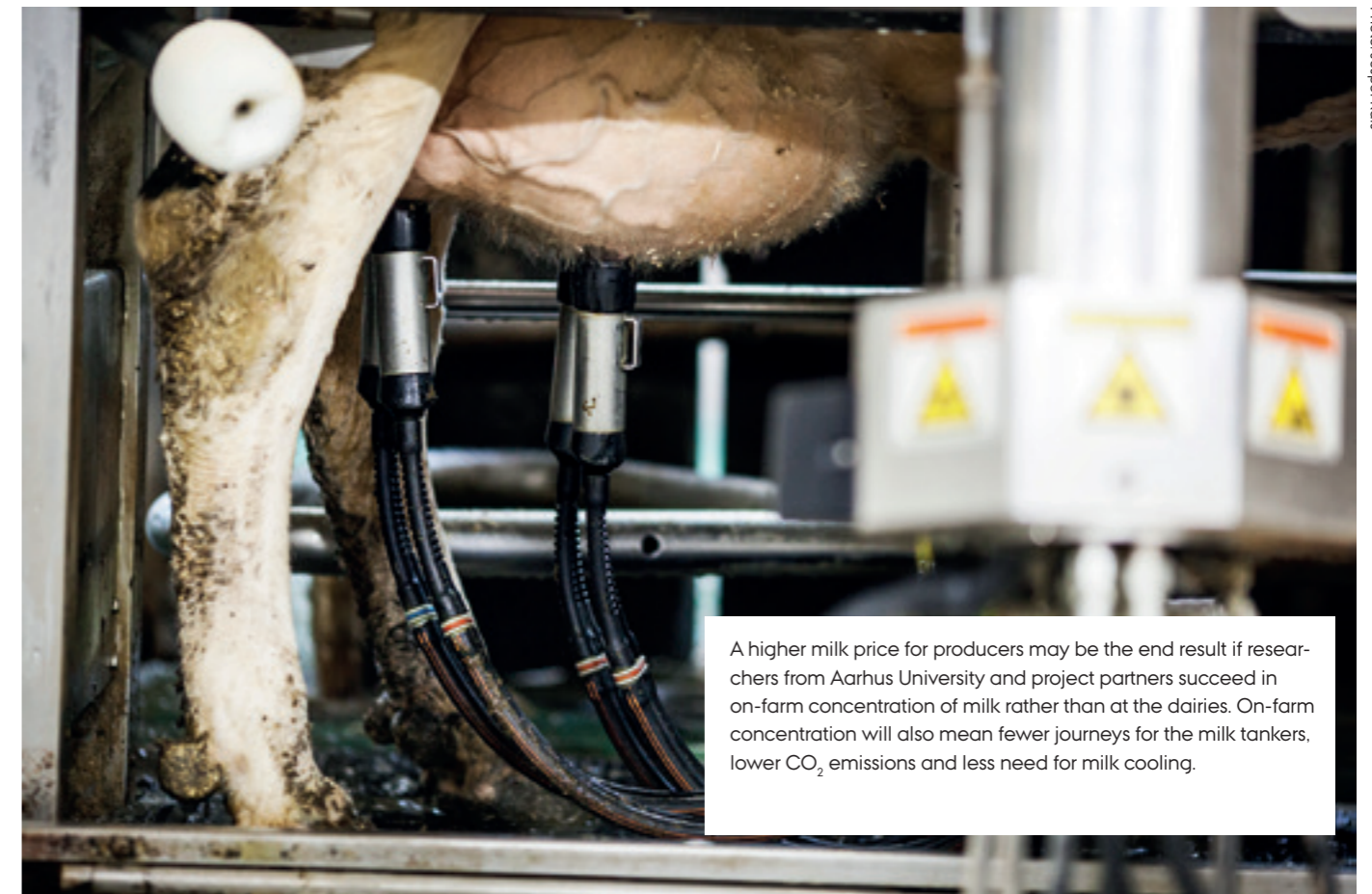
The purpose of the project is to develop a sustainable process for the on-farm production of a milk concentrate and to ensure that the concentrates are of a high standard, have good storage qualities and are suitable for further processing. It is also the partners' responsibility to demonstrate the concept to the farmers and to calculate the economic, climatic and environmental costs of moving the milk concentration process to the dairy farms.

– There is a focus on optimisation of the new methods in terms of energy consumption and loss of milk components. The results can be used as a decision base for the introduction of the concept to the large dairy farms in Denmark, and thus the project has the close attention of the dairy farmers and the Danish dairies, says Lars Wiking.

The concentration is primarily relevant for the largest dairy farms due to the cost of the investment in equipment, but with the current structural developments in Danish farming, the number of farms with more than 500 cows is set to grow and these will be responsible for most of the Danish milk production. Precisely farms with more than 500 cows form the basis for calculations in the project.

– Preliminary calculations based upon figures for 2012 for farms with more than 500 cows show a total saving of 11.2 million kroner per year, a reduction in CO₂ emissions of 1300 tonnes per year as well as a reduction in groundwater usage and waste-water production of each 91,980 m³ per year, explains Lars Wiking.

The project, which has a total budget of 7.4 million kroner, runs until the end of 2015. GEA Processing supplied the milk filtration facility and act as consultants in the project.



A higher milk price for producers may be the end result if researchers from Aarhus University and project partners succeed in on-farm concentration of milk rather than at the dairies. On-farm concentration will also mean fewer journeys for the milk tankers, lower CO₂ emissions and less need for milk cooling.

POLICY SUPPORT

FOOD WASTE IS BAD FOR THE ENVIRONMENT

The production of the food we eat impacts the environment. In the EU, the consumption of food and beverages is thus responsible for 20-30 percent of the total environmental impact and more than half of the total contribution to the nutrient load.

But the food we do not eat also has a negative impact on the environment. It is especially in private households that food waste occurs, but there is also food waste in other links of the chain.

In order to reduce the problem you first need to understand where and how this food waste arises. This has been described in a DCA report on food waste in the food sector, covering the whole chain from primary production to the retail stage.

RESEARCH

MORE PROTEIN AFTER CALVING IMPROVES IMMUNE SYSTEM AND MILK YIELD

A higher allocation of protein to calving dairy cows gives higher milk yields and results also suggest that the immune system is strengthened. This is the conclusion from a study on eight cows that were given a higher protein ration in the form of the milk protein casein. The difference was found to be about 7 kg of milk per day already three to four days after calving and this difference remained constant until the end of the experiment, 29 days after calving.

Despite a tendency towards a more negative energy balance and a highly efficient use of the extra protein for milk production, the cows also showed signs of an improved ability to maintain normal bodily functions such as immune response and synthesis of the transport protein albumin in the blood. Studies of how these results can be implemented in practice are currently in progress.

Responsible management of resources

The focus on nature and environmental protection, biodiversity, climate change and food security generates a demand for knowledge on the potential, status and amplitude of natural resources. Resources are affected by production which also needs to move towards a green transformation. This will require more effective and targeted measures and regulations that tread new paths rather than following the traditional system of directives and control.

The authorities need a scientific base for monitoring, assessing and documenting the potentials and limitations of natural resources and the positive and negative effects of production on resources. There should also be focus on the implementation of alternative structures of regulation that encourage a responsible management of the resources.

Current and future regulations of natural resources will continue to demand a growing fount of knowledge and documentation about the production and its uses.



ONLINE DECISION SUPPORT SYSTEM CAN ALLEVIATE SOIL COMPACTION

RESEARCH

For years scientists have been beating the drums about the problem with soil compaction, but field machinery nevertheless keeps on getting bigger and bigger. A research-based tool developed at Aarhus University in cooperation with researchers abroad can now help ease the pressure on the soil.

Agriculture is challenged by the need for highly efficient field operations to achieve a viable production. This has led to the use of larger and heavier machines. The regulations on slurry spreading that were initiated to protect the aquatic environment have meant that the heaviest machines are often used in very wet conditions in early spring. This damages the soil structure – in many instances permanently – and this has a negative effect on yields.

– As a scientist I need to sound the alarm because we can see that the subsoil below 30 cm depth is subjected to massive forces and pressure when machinery weighing many tonnes drives on the soil – sometimes exerting a pressure that causes permanent damage, says Per Schjønning, senior researcher at the Department of Agroecology.

Per Schjønning and his colleagues have studied the significance of the subsection of cultivated land to heavy loads and compaction. Besides a long-term yield loss of three to five per cent, which has been experienced every year since driving with heavy machinery in the field 25 years ago, there are environmental problems associated with soil compaction.

– Compaction not only results in lower productivity, but the soil's filtering capacity is also compromised. Preferential flow in soil macropores may increase the transport of, for example, particle-bound pesticides and phosphorus to the aquatic environment. Compaction may also result in poorer aeration of the soil, which leads to denitrification where nitrate is converted to nitrous oxide. The result is loss of useful nitrogen from the soil and an increase in the atmospheric concentration of this greenhouse gas, says Per Schjønning.

Despite the grave message from the researchers, it is nevertheless possible for farmers to protect the fields from further damage. In recent years, researchers from Aarhus University and a research team from Switzerland have developed an online tool, Terranimo®, which is freely available on the Internet (www.soil-compaction.dk). Terranimo® is under continuous development

and allows you to test the consequences of driving a particular machine on a given soil type at a given water content, depending on user input (tyre type, tyre pressure, wheel load).

– It is actually possible to perform field operations that do not damage the soil structure. But we are in a situation where many farmers are stressed economically and may not have the wherewithall for a system that can reduce tyre pressure when they drive off the road and into the field, says Per Schjønning.

He gives lectures on the challenges of soil compaction and senses that the farming industry has become more aware of the problem in recent years. In addition to the decision support tool that he has helped to develop, he also sees potential in the new technologies being devised for driving machinery in the field.

– We have over the past four years tested a slurry spreader, which is shaped like a tricycle and where each tyre is 1.05 m wide. The V-shape of the machine means that no part of the field will be subjected to more than a single pass of a wheel and we avoid tramlines.

Even with an 11 tonne wheel load we achieve higher yields than with a traditional slurry tanker with five aligned wheels in the same track and a six-tonne wheel load on each wheel. We will be taking soil samples in 2015 and with the traditional slurry tanker we expect to see damage deep into the subsoil. A system such as the one previously outlined but with a six-tonne wheel load may provide a workable solution that imposes no damage to the soil structure, says Per Schjønning.

Another possible scenario for solving the soil compaction problem is to replace the steel in field machinery with lightweight composite materials. This can reduce the weight and thus the destructive forces. Using rubber belt tracks instead of tyres does, in principle, have the potential to solve the problem of the very large loads. But rubber belts that allow a good pressure distribution at the soil-tyre interface have yet to be developed.

POLICY SUPPORT

SATELLITES AND AIRCRAFT USED FOR FIELD SURVEYS

Remote sensing data in the form of satellite imagery and laser measurements performed from aircraft are some of the information channels brought into play by researchers at Aarhus University when constructing the methods authorities use for a number of control measures in agriculture.

These methods are primarily associated with farm subsidies under the single payment scheme. The systems are continuously improved and will in the future support the EU regulations that will stipulate greater crop diversity and the preservation of permanent pastures.

Drones are another tool that researchers will use to map Danish fields.

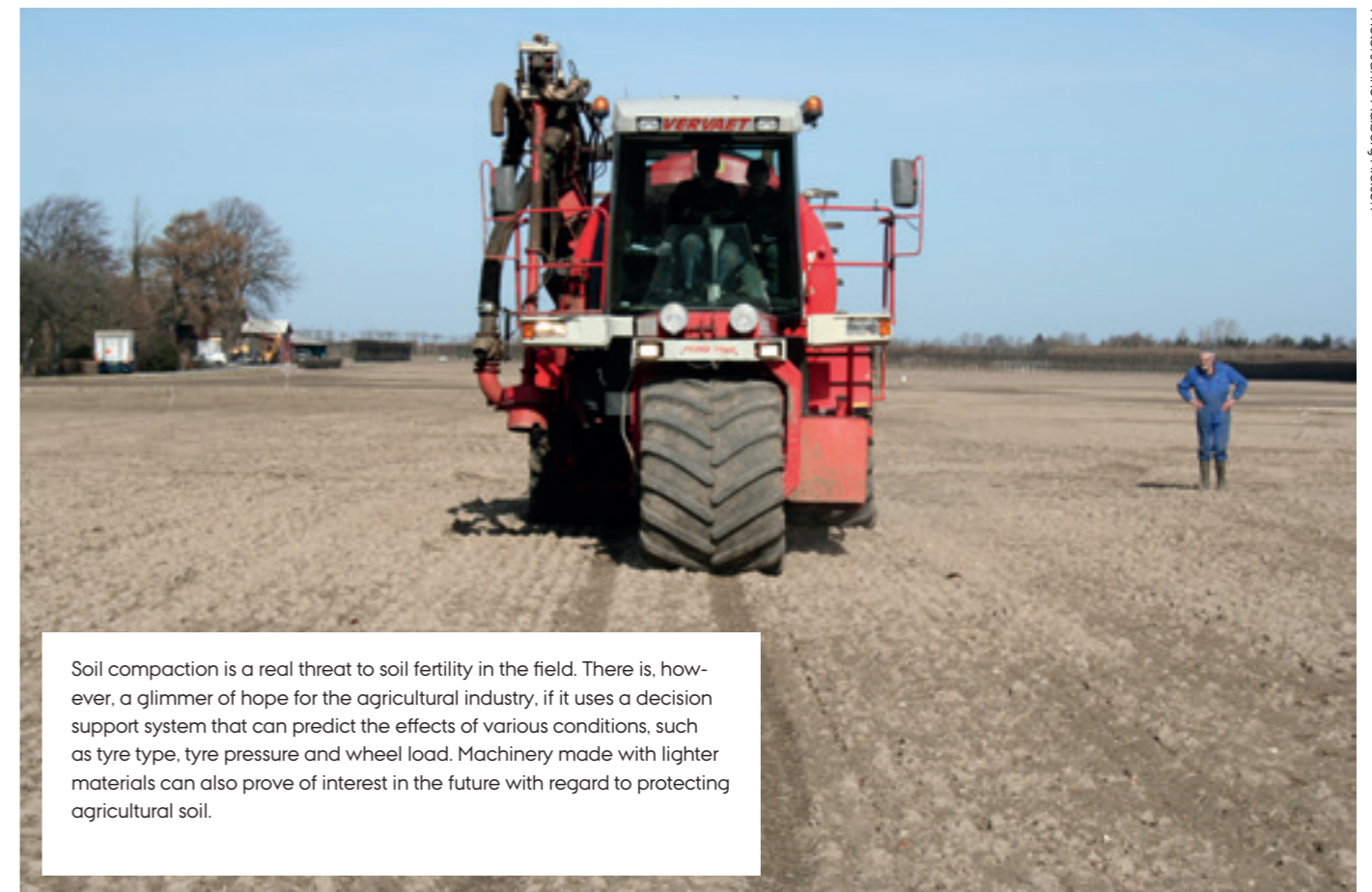
LINKS TO INDUSTRY

POTATO FUNGICIDE BANNED

The active ingredient metalaxyl-M used against potato blight has been removed after just a few years on the market. This is a consequence of measurements carried out by the so-called Pesticide Leaching Assessment Programme (PLAP).

The system, which consists of five field plots located at different sites in Denmark, is managed jointly by GEUS (the Geological Survey of Denmark and Greenland) and the departments of Agroecology and Bioscience at Aarhus University, and is funded by the Environmental Protection Agency.

Since 1999, 50 approved pesticides and 50 metabolites have been studied in PLAP. Many of the tested pesticides have not given rise to any changes in their approval status, but five substances have been banned, partly as a result of the measurements in PLAP.



Soil compaction is a real threat to soil fertility in the field. There is, however, a glimmer of hope for the agricultural industry, if it uses a decision support system that can predict the effects of various conditions, such as tyre type, tyre pressure and wheel load. Machinery made with lighter materials can also prove of interest in the future with regard to protecting agricultural soil.

THE HISTORY OF DANISH HISTORIC ANIMALS

● POLICY SUPPORT

Researchers from Aarhus University have reviewed the work on preserving the genetic resources of Danish livestock

The creatures that walked along the drovers' road (Hærvejen) across Jutland and the pigs that provided bacon to English households are a part of Danish history. Jutland cattle and Danish Landrace pigs helped create prosperity for Denmark. The Danish-Swedish Farmdog breed was, as working dogs on every farm, an important help in keeping rats and mice at bay.

The booklet on the genetic resources of livestock tells the story of Denmark's old livestock breeds. The report describes the qualities of the breeds and how they were created to begin with. It explains the work done to preserve the old breeds so that important genetic resources are not lost.

The colourful booklet is richly illustrated with pictures of the different breeds, and cows, rabbits, sheep, horses, dogs, geese, pigs, goats, pigeons and bees all gain a mention.

The past relates to the present and to the future

Preservation of the old Danish livestock breeds enjoys great interest. Not only are they of particular importance to cultural history; there is also focus on the usage of the races in connection with niche productions. It is also possible that the old livestock breeds carry valuable genes and gene combinations otherwise lost to modern livestock.

The purpose in preserving the genetic resources of livestock is to ensure that genetic variation is preserved. The preservation of genetic resources is thus intended for both the old breeds worthy of preservation as well as the modern livestock breeds.

Animals of the past

Feral animals were already tamed 10,000 to 11,000 years ago. Feral sheep and goats paved the way, followed by wild boar, aurochs and several other species. After a few thousand years domesticated breeds emerged.

Livestock followed human migration. The introduction of livestock from other countries was, in the first half of the nineteenth century, a common method to improve the local livestock. In this way the so-called rustic breeds emerged, specially adapted to local climates and uses.

” *The preservation of genetic resources is thus intended for both the old breeds worthy of preservation as well as the modern livestock breeds.*

The concept of breed was connected to the different physical characteristics, i.e. colour, markings and horns. Special physiological characteristics helped describe the different breeds and their suitability for specific production purposes and production systems.

In 1985 the then Ministry of Agriculture (later the Ministry of Food, Agriculture and Fisheries) established the Committee for the Preservation of Genetic Resources in Danish Livestock, which has functioned up until 2012. The committee was tasked with contributing to the preservation of genetic resources in Danish livestock, and has been responsible for the overall coordination of the work on the genetic resources of livestock.



Photo: Colourbox

The genetic resources of old and modern animal breeds are worth preserving.



Feral animals were already tamed 10,000 to 11,000 years ago

● RESEARCH

MORE ORGANIC STEAKS ON THE MENU

By crossing dairy cows with beef cattle, researchers have investigated the possibility of increasing the currently very small production of organic meat from young cattle. The results are promising, since the 45 animals in the study achieved a very good growth rate. The meat quality was also evaluated and was found to be somewhat poorer than expected for the bulls in terms of qualities such as meat tenderness, but was found to be good for the heifers.

A new business platform for organic farmers could be developed based on the findings of the project, but steers rather than bulls will probably need to be used in order to ensure a good quality of the carcass and meat and a good eating experience. Results of the project also includes perspectives to reduce the culling of bull calves and the export of baby beef.

● LINKS TO INDUSTRY

GOOD CHEESE IS IN THE GENES

The production of cheese, yoghurt and other dairy products depends on the milk's ability to coagulate.

Researchers are close to tracking down the specific genes in cows that affect the milk's suitability for cheese production and are developing a practical test for the specific genes.

There are plenty of opportunities for creating a competitive advantage by acting quickly, developing a genetic test and implementing it in the national breeding programmes. The goal is to eliminate the gene for non-coagulating milk and increase the number of cows with good coagulation properties. The project is a collaboration with Arla Foods and VikingGenetics.



Photo: Rasmus Nyholm Jørgensen

The work on drones attracted a lot of international attention in 2013. Discovery Channel was one of the TV crews to film the attempt to spot wildlife in the field.

DRONES USED TO SPOT GAME

RESEARCH

The use of drones has grown explosively in recent years, and the miniature helicopters have also made tentative ingress into agriculture. Researchers at Aarhus University in 2013 sent up drones to examine, among other things, their suitability for spotting game in the field before field operations with large machinery.

Thousands of deer, hares and pheasants die every year when large harvesting machines make their way across the field. It is particularly a problem during summer months when the animals leave their place of birth and migrate to the edge of the woods.

The industry and the authorities have for many years been clamouring for more wildlife-friendly harvesting methods – and the drones may be the start of a downward trend with fewer collisions with animals during harvest.

Researchers ran the first test of a drone equipped with a heat-sensitive camera an early morning in the Nørreå valley, east of Viborg, in the early summer of 2013.

After just a few traversings of the fields, the first evidence was in the bag that drones can become the new eye in the sky that helps farmers or their contractors avoid animal collisions.

– In the future, we can provide the farmer with a tool for locating the whereabouts of wildlife in the field with high accuracy.

POLICY SUPPORT

SURVEY EASES IDENTIFICATION OF HIGH-VALUE NATURAL AREAS

Aarhus University has developed a so-called High Nature Value card, which from 2015 will be used to prioritise the areas where nature preservation will have the largest effect and therefore qualify for subsidies for their management.

EU member states are required to develop a national HNV indicator to be included in the planning, prioritisation and allocation of subsidies under the rural development programme. This is to comply with the EU target of halting the decline in biodiversity and to achieve favourable preservation status for species and habitats.

LINKS TO INDUSTRY

FIELDS TO BE A SAFE PLACE FOR ANIMALS AND MACHINERY

Driverless field machinery may soon be a reality on Danish fields. Such machines will require some serious monitoring to safeguard humans and animals during field operations.

Researchers from Aarhus University and University of Southern Denmark are therefore partnered by Kongskilde, for one, to develop advanced sensors and computer technologies for intelligent robots that can register their surroundings and thus increase automation and safety in agriculture. The hope is that the developed technology will be market-ready in a few years.

The problem with game is that it will often not run away when approached by agricultural machinery but just presses against the ground. It is therefore extremely difficult to spot the animals and prevent a collision. Even for a hunter with a trained dog it is nearly an impossible task, says Rasmus Nyholm Jørgensen, senior researcher at the Department of Engineering and one of the key people involved in developing more wildlife-friendly harvesting methods.

In addition to the sad fate of the animals being hit, food quality is also a parameter associated with collisions with wildlife in the field.

The game killed in the field can be infected with bacteria, so there is the risk that the harvested crop can cause bacterial poisoning in those who eat it. There are several examples of bacteria in forage grasses having killed entire cattle herds.

Researchers at Aarhus University have in recent years been looking at different solutions in order to minimise the number of animals killed. In addition to drones, they are examining the use of different driving patterns in the field to allow the game to escape and remain in hiding. This approach is supplemented in several research projects with sensors and cameras that can help the driver avoid the animals and other obstacles in the field, such as large rocks, that can damage the machinery.

The drones will be used in experiments to demonstrate whether a driving pattern starting from the middle of the field will result in the animals moving away from the machines when they approach.

– The advantage of using drones is that a field inspection in the future could be very fast. We are already able to inspect large areas in a very short time, says Rasmus Nyholm Jørgensen.

Although researchers have made great strides towards devising a solution, there is still some way to go before a viable commercial product will be available and before farmers can drive in the fields without killing wildlife.

– We have developed algorithms that can detect the presence of animals in the photos of the heat-sensitive camera attached to the drone. However, at this relatively early stage of development, we have problems distinguishing between objects in the fields that have been heated by the sun and animals that emit heat. The goal is to develop a system that is able to distinguish between animals and other objects, he explains.

Rasmus Nyholm Jørgensen hopes that the projects using drones, sensors and different driving patterns can contribute new useful knowledge that can ultimately minimise the number of animals being killed on farmland.

– Many farmers are really tired of the situation and would like to solve the problem. We would very much like to help with this and we also believe that we can deliver, he says.

CONSTRUCTED WETLANDS HELP REMOVE NUTRIENTS EN ROUTE FROM SOIL TO WATER

RESEARCH

Researchers at Aarhus University are in a number of projects looking into the effectiveness of constructed wetlands in removing nutrients from drainage water. Preliminary results indicate that they are an interesting remedial measure.

Tile drains in fields could be said to present a bit of a paradox. On the one hand they are a prerequisite for food production since they prevent fields from becoming flooded, but on the other they may act as a kind of motorway for runoff from fields, which results in nutrients being transported directly from the fields to the aquatic environment.

The movement of nutrients from fields to waterways should be minimised. The loss of nutrients via drains is estimated to be responsible for 45 to 60 percent of total nitrogen loss and 33 percent of total phosphorus loss.

Researchers and business organisations have come up with solutions such as constructed wetlands or drainage filters that are designed to interrupt the direct transport link between soil and water by putting a plug on the drain, establishing a "filter zone" and collecting the nutrients where it is most effective.

The construction of wetlands is a new instrument under Danish conditions, and research and development in this area has only recently begun. Charlotte Kjærsgaard from the Department of Agroecology at Aarhus University and colleagues and research partners are focusing on a number of solutions to reduce the loss of nutrients. Although these solutions have different advantages and disadvantages, early results show that they do have an effect.

– Preliminary results from the first constructed wetlands with surface flow show that nitrogen reduction efficiency varies from around 10 to 20 percent during the coldest winter months to around 30 to 80 percent or more for the rest of the year. The overall effect is therefore dependent on the seasonal changes in drainage runoff. The first results for the measuring year 2013 for two installations in glacial till soils with significant winter runoff (66 to 70 percent of total runoff into drains) show a nitrogen reduction of 33 to 43 percent. It is also important to consider the synergistic effects of a remedial measure, and here the early results show that there is also a positive effect on phosphorus,

with 33 to 75 percent of the phosphorus being removed for the year as a whole depending on location, explains Charlotte Kjærsgaard. The projects also involve working with filter matrices in constructed wetlands, and here the results show that these solutions can achieve a higher effect in winter.

Filters are therefore a potentially promising measure. However, there are still a number of challenges to overcome with filter solutions where there is a need for greater insight, including the problem of secondary effects. Finally, a partnership with University of Copenhagen involves the development of phosphorus filters that can effectively remove phosphorus from drainage water. These solutions are being tested under field conditions.

A prerequisite for using remedial measures in drainage water is sufficient knowledge about drainage flow. The extent of drainage from Danish agricultural land is uncertain, but it is estimated that more than 50% of the area, corresponding to 1.5 million hectares, is systematically drained.

– In practice, the lack of or inadequate drainage charts means that in some areas it may be difficult to implement drain filter solutions, or it can be associated with a high degree of uncertainty if the extent of the drainage basin is incorrectly estimated, says Charlotte Kjærsgaard. The researchers highlight the need for drainage maps and a more solidly founded knowledge base for predicting drainage flow using readily available hydro-geological data.

The Geological Survey of Greenland and Denmark and the Geological Institute at Aarhus University are working on improving estimates of drainage runoff, where the mapping of the spatial geological variation may prove crucial for predicting drainage flow at the local scale.

An existing remedial measure for reducing the leaching of nutrients is the use of catch crops. Preliminary results show that the constructed wetlands can replace or supplement catch



Photo: Charlotte Kjærsgaard

Constructed wetlands with surface flow can become a new measure in the same way as catch crops. The wetlands can remove nutrients from drainage water that would otherwise leach to the aquatic environment.

Scientists from Aarhus University are involved in several projects concerning various types of constructed wetlands. The first results show good effects.

crops, but that the effect varies considerably and depends on the nitrogen load from the catchment area, the reductive effect of nitrogen in the wetland and the effect of catch crops on the individual field.

Constructed wetlands may provide other functional features than the capture of nutrients: they may, for instance, add to the natural diversity of the cultivated land, but they can also function as a buffer for storm water from the fields after heavy rainfall.

POLICY SUPPORT

LARGE CONTRIBUTIONS FROM DCA TO THE COMMISSION ON NATURE AND AGRICULTURE

Forty-four recommendations with 144 proposals for activities towards a more intelligent regulation of agriculture. This was the final outcome when the Commission on Nature and Agriculture published the report "Nature and farming - a new start" on 18 April 2013. The contribution by DCA to the Commission's work has been considerable with a number of background papers on topics such as greenhouse gases, nutrients, technology, and resources for agricultural production. Aarhus University was represented in the 12-man strong commission by, among others, Jørgen E. Olesen, professor in climate change and agriculture at the Department of Agroecology.

LINKS TO INDUSTRY

SCIENCE AND COMMERCE JOIN FORCES FOR THE DEVELOPMENT OF A COST-EFFECTIVE MONITORING SYSTEM FOR NUTRIENT LEACHING

Sorbisense A/S – a knowledge-based company with headquarters in central Jutland – and scientist Anders Lindblad Vendelboe from the Department of Agroecology have teamed up to develop a low-cost system for measuring total pesticide and nutrient leaching from agricultural drains and groundwater boreholes.

The system can thus be an important tool for agriculture which may in future be faced with nutrient emission restrictions at farm level. The project has received 2.1 million DKK from the Advanced Technology Foundation and uses the Sorbisense sample probes.



Photo: Jesper Raas

Researchers at Aarhus University are leading a project on the biological air purification of livestock housing combined with point extraction. The ambition is to reduce odour problems from the pig houses for the benefit for the local environment and for the people working on the farm.

AIR EXTRACTION FROM SLURRY CHANNEL AND BIOLOGICAL AIR PURIFICATION TO TRAP MORE ODOUR AND AMMONIA FROM PIG FARMS

RESEARCH

Controlled extraction of air from slurry channels combined with an effective biological treatment is the bid of an ongoing research project for a reduction in odour from pig farms.

Better indoor air quality for the people working on the farm, a large reduction in emissions from livestock housing and the development of an effective biological air purification system with a large national and international market potential.

These are the great and promising ambitions of a new research project involving researchers from Aarhus University who will be working on the biological air purification of livestock housing combined with a relatively new ventilation principle called partial point extraction – the extraction of the air from the slurry channel under the pig house.

The combination of local exhaust ventilation and new knowledge on biological purification means that it could become possible to eliminate large amounts of ammonia and odours from the housing in an affordable way.

– The continued development of livestock production in Denmark requires cost-effective solutions to reduce ammonia emissions and odours. Rather than trying to biologically purify the entire air volume from an animal house, an integrated solution consisting of biological air purification and point extraction has the potential to significantly reduce costs, achieve a more

POLICY SUPPORT

LOW HEAVY METAL CONTENT IN MINERAL FERTILISED CROPS

The contents of arsenic, lead, cadmium and mercury in Danish crops that receive synthetic fertiliser or animal manure are below the maximum permissible values for these metals in feed, according to a technical report prepared by researchers at the Department of Agroecology at Aarhus University for the Ministry of Food, Agriculture and Fisheries. The background to the report is that movements are afoot at EU level to impose maximum limits on the levels of heavy metals permitted in mineral fertilisers. The aim is to protect soil resources and ensure that food is uncontaminated. The report illustrates how the use of fertilisers affect the content of heavy metals (arsenic, lead, cadmium, chromium, mercury and nickel) in crops grown under normal field conditions in Denmark.

effective cleaning process and reduce waste volumes, says project manager Anders Feilberg from Aarhus University, and continues:

– This is because ammonia and odours are primarily emitted from the manure channel and can be captured in a ventilation flow that actually represents only 10-20 per cent of the total air volume.

The effect of combining the two known technologies is not precisely known, but the people behind the project expect that there is a large potential and will be a great demand for such a product in the future, not least in light of the ever-tightening regulations on livestock production in a growing number of countries.

In the German state of North Rhine-Westphalia all new pig finishing units with a capacity of more than 2000 pigs will now need to have an air purification system installed. Over a three-year period the requirement will be phased in for existing units with capacity in excess of 2000 finishers.

The project partners also expect to be able to substantially reduce odour from the housing.

– The project will help to significantly reduce odour emissions so that the livestock industry can continue to develop without being a nuisance to its neighbours. We expect the air purification system will be able to reduce odour from the manure channel by more than 80 per cent, says an optimistic Anders Feilberg. It is expected that the combination of biological air purification

LINKS TO INDUSTRY

SEMINAR ON BREAK CROPS AND CATCH CROPS

Catch crops and break crops were the focus of a seminar at the Foulumgaard experimental station in September 2013. Nearly 300 farmers, consultants and others with a professional interest in the special crops attended the event, where participants were shown catch crops in spring barley and the cup plant *Silphium perfoliatum*, which may have a great potential as a sustainable crop for organic biogas production and fertiliser.

Seminar organisers were Aarhus University, LMO, Knowledge Centre for Agriculture and Organic Denmark, and the event is expected to be repeated in 2014.

and point extraction can reduce ammonia emissions by about 65 percent. This number is achieved by an expected efficiency for the biological air purification unit of 90 percent combined with the capture of 70 per cent of total ammonia emissions from point extraction.

The project also includes optimisation of the measurement and control of air flow from the point extraction to ensure an efficient capture of the polluting substances from the manure channel. The project will initially be laboratory-based where the basic processes in odour reduction will be examined, but with a concurrent installation of a full-scale demonstration unit at a pig facility.

Researchers from Aarhus University will be working alongside colleagues from the Pig Research Centre, Danish Technological Institute, a farmer and the manufacturer of industrial ventilation systems, SKOV A/S

FACTS

BioPunkt has received 4.89 million DKK from the Green Development and Demonstration Programme of the Ministry of Food, Agriculture and Fisheries.

Total budget is 6.9 million DKK.

The project started on 1 September 2013 and finishes on 1 March 2016.

AGRICULTURE CAN SAVE 1.1 MILLION TONNES CO₂ PER YEAR

● POLICY SUPPORT

Agriculture emits large amounts of greenhouse gases but a number of measures may be used by farmers to reduce emissions and increase soil carbon storage.

What can agriculture realistically do to help society reduce greenhouse gas emissions? And how much do individual initiatives help? Researchers from Aarhus University provide answers to some of these questions in a new report published by DCA – Danish Centre for Food and Agriculture. The calculations show that agriculture can reduce emissions of methane and nitrous oxide by up to 1.1 million tonnes CO₂-eq. per year and increase carbon storage in the soil by 0.9 million tonnes CO₂.

The government's climate policy relies on agriculture to do its bit to reduce Denmark's greenhouse gas emissions. The climate policy contains a comprehensive list of relevant measures that can help achieve this. To enable policy makers to choose the most suitable measures and design incentive structures they need to know the effect on greenhouse gas emissions of each measure and its cost to society.



Photo: Lise Balsby

Agriculture can help reduce greenhouse gas emissions, but the measures used must be chosen wisely.

DCA and University of Copenhagen have produced a report that describes and assesses the effects of the measures that agriculture may employ to reduce greenhouse gas emissions. The list of available options concentrates, in particular, on methane and nitrous oxide emissions and also on changes in soil carbon contents. Some of the measures can also provide biomass for the energy sector. These effects are also included in the report.

” *It seems that the largest and most economic effects can be achieved by taking some of the cultivated organic soils out of production.*

A number of options

Agricultural production impacts the climate and the environment in many ways. This also means that there are a number of areas where emissions can be reduced; for example in crop production, livestock production, animal manure management, fertilisation and land use.

Within each of these areas there are several measures that can be applied to reduce emissions. Farmers can, for example, choose to convert to perennial energy crops, shift from rotational to permanent pastures, or cease drainage and cultiva-

tion of organic soils. They can choose to grow more grassland legumes, reduce methane from cows via feeding or breeding, or enhance soil carbon through conservation tillage. They can produce biogas using livestock manure or grass-clover, or they can cover the slurry tanks or acidify the slurry to reduce methane from the manure.

The report gives many other ideas, and provides specific estimates for the greenhouse gas savings that can be achieved from each measure and from combinations of measures. Besides describing the effects and secondary effects of different approaches, the report contains an overview of the estimated reduction in greenhouse gas emissions from Danish agriculture by 2020, taking into account any interaction between measures.

– If initiatives to reduce greenhouse gas emissions in agriculture are not to become too expensive and result in stagnation of food production, then regulations in this area should be tackled wisely, says professor Jørgen E. Olesen, who is the main author of the report.

– It seems that the largest and most economic effects can be achieved by taking some of the cultivated organic soils out of production. There are also several options available for reducing methane emissions from livestock manure that also reduces ammonia emissions. These must be some of the elements that we bring into play, but it is obviously necessary for agriculture to have the right conditions for investments in this area, he points out.

● RESEARCH

EUROPEAN RESEARCH NETWORK FOR STANDARDISING METHANE MEASUREMENTS

Senior researcher Jan Lassen from Aarhus University and a Dutch colleague are in charge of a new EU-funded network, where one of the aims is to improve measurements of ruminant methane emissions that are harmful to the environment.

The network is funded under a so-called EU COST Action and has received 4 million DKK to cover travel and networking activities. The aim of the network is to enable the interchange of research results between the more than 50 researchers involved in order to standardise the different measurement methods that are used today.

● RESEARCH

NITRATE IN THE FEED MAKES FOR GREENER COWS

Cows emit large amounts of the greenhouse gas methane, which is 21 times more powerful than carbon dioxide and therefore poses a serious challenge in relation to climate change.

Senior researcher Peter Lund from the Department of Animal Science has added nitrate to the diet of cows and has managed to reduce methane emissions by 20 percent. There have been similar studies abroad, but the attempt at Aarhus University is different in that it also attempts to determine the level of nitrate that yields the most effective reduction in methane emissions.

Food safety, consumer choice and healthy diets

The perceived quality, safety and health of food products is very important to society, consumers and to the sales and exports of the food industry.

Political ambitions for food safety, health, export and growth require knowledge on market development, food consumption, and the effect of consumption on public health.

There are conditions attached to economic growth and health. This increases the need for knowledge on the demand for nutritious and healthy foods that will be a factor in creating economic growth and employment in society and will support production development and promote healthy dietary habits in society.

Authorities need to monitor and assess the quality, safety and health of foods and to examine consumer behaviour and implement structures that promote healthy dietary habits, responsible and ethical marketing and the labelling of food products.

BERRY NICE NEW BERRIES

RESEARCH

Consumers can look forward to healthy berries being sold as snacks in shops in the future. Results from a recently completed research project at Aarhus University shows that redcurrants, gooseberries and blackcurrants are very suitable as healthy, high-quality snack products, but that the quality depends on the individual variety and not on production methods. A newly developed method raises hopes of new marketing opportunities for producers.

So far, Danish red and black currants have been used mainly for jams and juices. However, a research trial with new varieties of red and black currants and gooseberries has led scientists at Aarhus University to conclude that the berries have the potential to be grown as a luxury item that can be eaten fresh as snacks or used for decorating cakes and food and in this way potentially increase the income of the producers.

- The yields and sizes of the berries tell us that with the right production methods and varieties there is a potential for fruit growers in growing berries for fresh consumption, explains senior scientist Lillie Andersen, who was in charge of the research project "Luxury berries for fresh consumption".

The quality of the berries has also been studied extensively in the projects for properties such as sugar and acid content and colour. Here, researchers are very clear in their conclusions in relation to quality.

- Production methods have no influence on the quality of the berries. It is all down to the variety grown. The sensory perception of the berries has not been tested, says Lillie Andersen.

New cultivation method

The production method that scientists have been working on since 2009 consists for the blackcurrant bushes of taking two to three main stems and growing them along wires into an 1.8 m high espalier. The purpose is to give the leaves as much light as possible and to grow uniform berries that are easy to harvest.

One of the challenges of this production method is that the currant bushes have many "sleeping" shoots, which are activated. Therefore, new growth from the bottom has to be removed several times during the season.

The berries are grown both organically and conventionally and this has presented some challenges.

- For the organic production the price of the berries will be relatively high. In some years, the yields can be low and in other years they will be the same as in the conventional production. The problem is particularly with aphids, but there is a new remedy on the market to control aphids in organic farming that looks promising, says a hopeful Lillie Andersen.

Good and healthy qualities

The scientists believe that the findings from the research can form the basis for a burgeoning production of fresh berries, not least because the berries have lots of good qualities.

- The berries have high anthocyanin and vitamin C contents, which makes them suitable as healthy sweet snacks. We suspect that the berries can become a hit with consumers, as there is a surge in the interest in Nordic food and consumers also demand healthy products that are produced under controlled conditions, explains Lillie Andersen.

Growers take the new knowledge on board

She knows of growers who are now growing berries using the new production system. Meanwhile, the search continues for the most suitable berry varieties.

- We are continuing to study some large-berried blackcurrant varieties and some virtually thornless and hairless gooseberry varieties, she says.



Photo: Lisa Baisby

Gooseberries and a number of other berries are suitable as high-quality products and may present new marketing opportunities for growers.

LINKS TO INDUSTRY

APPLES UNDER COVER PREVENTS SCAB

Researchers at Aarhus University are developing a number of methods to safeguard the quality, durability and yield of both organic and conventional fruit productions.

The researchers have shown, among other things, that a cover over the apple trees reduces the need for chemical spraying and increases yields. It also means that leaves and fruits get less wet when it rains and dry more quickly. The researchers have also shown that spraying strategically with the raising agent potassium bicarbonate has a good effect against the fungus. The research is conducted in close cooperation with the horticultural industry.

LINKS TO INDUSTRY

QUALITY AND KEEPING QUALITY OF APPLES AND PEARS CAN BE PREDICTED

New research at Aarhus University shows that by measuring the dry matter content it is possible to predict the potential fruit quality and keeping quality of apples and pears several months before they are picked. The results are important to the industry because growers then have the chance to act early and improve their product. If a low dry matter content is measured, growers prune the upper roots of the tree, which inhibits growth but produces fruit with higher dry matter and sugar contents.

The studies also showed that the differences in fruit dry matter content can be seen as early as July and that the differences are maintained throughout fruit development.

CONSUMERS ARE CREATURES OF HABIT

● POLICY SUPPORT

Nutrition and health claims on foods can help consumers onto the right path when buying healthy food for the family – or can they?

It is supposed to be so easy to buy food. Many food products have labels declaring the content of, for example, fat, fibre or vitamins. The Danish Veterinary and Food Administration even employs the Keyhole label that combines several nutritional criteria in one label.

But what do the consumers say? Do they understand and use the nutrition and health claims when they select the products for their shopping trolleys? The results of the research into this question are published in a report by the DCA – Danish Centre for Food and Agriculture, Aarhus University.

– Eating habits and food choices are a hot topic in the political debate. Diet and eating habits have an impact on the incidence of lifestyle diseases such as diabetes, cancer and cardiovascular disease. On the policy side, there is a desire to coax consumers into healthier food choices, says one of the authors of the report, research assistant Kristina Aachmann from the Centre for Research on Customer Relations in the Food Sector (MAPP Centre) at Aarhus University.

We are creatures of habit

The results of the study show, among other things, that consumers do things by habit.

– Food shopping is very much influenced by habit. Although consumers perceive health as important when choosing foods and perceive foods bearing health claims as being healthier, this does not necessarily translate into the purchase of healthy products. A number of other properties such as taste, price, brand and packaging also influence our choices, explains one of the co-authors of the report, Professor Klaus G. Grunert from the MAPP Centre.

Nutrition and health

The study focused on certain food groups, namely dairy products, breakfast cereals, ready-made meals, soft drinks and oils and fats. The researchers examined consumer response to nine different nutrition claims and five health claims.

Nutrition claims are statements that indicate that a food has particular nutritional benefits due to the presence or absence of energy, nutrients or other ingredients. An example is the common Nordic Keyhole brand which aims to help consumers choose healthier foods. Other examples include expressions such as “sugar-free” or “low-fat”.

Health claims tell you about the link between a food or its constituents and health. There are two types of health claims. One type is related to the effect of a substance on the physical or mental functions of the body or on weight control. An example of this is “Calcium is important for the development and maintenance of bones.”

The second type of health claim describes or concerns the potential reduction in the risk of contracting a particular disease. An example here is “Contains cholesterol-reducing plant sterols. A high blood cholesterol level is a risk factor in the development of coronary heart disease.”

Consumers generally have a medium to good understanding of nutritional claims, but a significantly poorer understanding of health claims. A large proportion of consumers even believe that it is industry and not the authorities that are responsible for the health claims.

Understanding – and misunderstanding – the Keyhole symbol

Scientists from the MAPP Centre had a special focus on the Danish Veterinary and Food Administration’s Keyhole symbol. Previous studies have shown that more than 90 per cent of consumers know this symbol. However, when it comes to understanding exactly what the symbol means, it is a different story.

Consumers understand the general message that Keyhole products are healthier, while the finer detail is apparently less well known. Only 10 per cent of consumers, for example, are aware that fat, fibre, wholegrain, sugar and salt content are included in the label. Some consumers misunderstand the concept of the Keyhole symbol and associate it with organic farming, additives, calories/energy content, or environmental impact.



Many consumers misunderstand the concept of the Keyhole symbol and associate it with organic farming, additives, calories/energy content, or environmental impact.



Photo: Colourbox

● POLICY SUPPORT

CONSUMERS KNOW VERY LITTLE ABOUT THE CHEMICALS IN FOOD

Danish consumers have poor knowledge of a number of harmful chemicals in food. This goes both for their actual knowledge of the facts and for their own assessment of how much they think they know about them. The more we know about a chemical, the more we worry about it.

The presence, the effect and the preventative methods for excessive intakes of the other harmful chemicals that were included in the study are described in the DCA report on Danish consumers’ awareness of harmful chemicals in food.

● RESEARCH

CONSUMERS AND THE EIGHT DIETARY GUIDELINES

In the report on how well Danes understand the eight dietary guidelines, researchers from Aarhus University provide an overview of consumer understanding of the official dietary recommendations. This is knowledge that the Danish Veterinary and Food Administration can use to formulate its new, revised dietary guidelines.

It is one thing to put together a good set of recommendations; it is quite a different matter to communicate this advice to consumers and to ensure that the advice is understood and followed. The researchers state in the report that if the advice is to be followed, consumers need to be equipped with the ability, motivation and opportunities to do so.

SPIN-OFF COMPANY DEVELOPING NEW BIOACTIVES TO CONTROL APPETITE

LINKS TO INDUSTRY

Senior scientist Jan Stagsted is investigating the potential of specific protein hydrolysates for prevention of obesity and diabetes in a spin-off company. His work is based on research carried out in the Department of Food Science at Aarhus University.

Agro Business Innovation A/S and SEED Capital Denmark have invested in a knowledge-intensive food research project that looks into whether dietary supplements based on specific protein hydrolysates can counteract the development of obesity and diabetes and thus be used in weight control and lifestyle-related diseases.

The company behind the research project is Diet4Life ApS, founded by Jan Stagsted, biochemist, dr.med and senior scientist at the Department of Food Science, Aarhus University.

With the help of experiments on cells, rats and pigs, Diet4Life examines the long-term effect of regular consumption of specific proteins pretreated and digested with specific enzymes. The intention is to look at their suitability as dietary supplements and whether these protein hydrolysates have a dampening effect on appetite.

– The incentive to invest in Diet4Life comes from having followed Jan's research at Aarhus University in recent years and believing in the commercial potential of Diet4Life. Lifestyle diseases, like obesity and diabetes, are a global challenge, and food and health are becoming increasingly interlinked, says Lars Visbeck Sørensen, director of Agro Business Innovation A/S.

The first spin-off

Diet4Life is the first spin-off from the Department of Food Science at Aarhus University.

– The setting up of Diet4Life is an important step in commercialising parts of the food research projects undertaken at

the department and we look forward to having a close future cooperation with the company. The first spin-off will hopefully result in increased focus on the importance of commercialising knowledge and an increased number of spin-offs from research in the future, says Michelle Williams, head of the Department of Food Science, Aarhus University.

Large market

Lifestyle-related diseases such as diabetes and obesity represent a growing challenge for humanity and health systems in most parts of the developed world. According to international assessments, at least 20 percent of the world's population are expected to develop lifestyle-related diseases, and with a global population of seven billion people, the potential market for products that can counteract this development is vast. According to WHO, the direct healthcare costs of obesity-related diseases amounted to over 10 billion euro in 2010.

– The global obesity epidemic is a well-known fact, and the healthcare costs are enormous. We have a belief that growth in this sector can be immense, and that Diet4Life has huge potential. We therefore look forward to a fruitful collaboration with Diet4Life and to follow the company in the future, says Frank Knudsen, Investment Director of SEED Capital.

Dietary supplements based on natural food ingredients, such as protein hydrolysates, will probably be implemented faster and cheaper and have fewer side effects than drug-based initiatives.

POLICY SUPPORT

FOOD QUALITY IS IN THE EYES OF THE BEHOLDER

In the DCA report on food quality, researchers from the Department of Food Science clarify some issues on the concept of food quality. The report describes documented qualities called quality parameters and how these can be measured. The descriptions cover the whole production chain from field to fork; in other words, the primary producers, the slaughtering and processing stage, the retail stage, authorities and consumers.

– Quality has no meaning until we describe the attributes that you intend to base it on. Not until this happens does the use of the word make sense, says one of the authors of the report, associate professor Ulla Kidmose.

RESEARCH

FIBRE AND MODERATION ARE GOOD FOR YOUR HEALTH

We are far too inactive and we eat the wrong things. This can lead to obesity, diabetes and other lifestyle diseases. By using pigs as models, researchers have examined what happens at the metabolic level, and whether anything can be done to prevent the problems.

The results showed that bread with different types and levels of dietary fibre affect the metabolism differently. Dark rye bread and white wheat bread containing arabinoxylan had the largest effects on metabolism and lowered the acute glucose and insulin response compared to standard white wheat bread. The studies were performed in parallel on pigs and humans with metabolic syndrome, and furthermore showed that the results in animals and humans were similar.



Miniature pigs fed ad libitum are used in research on obesity and diabetes.

375

Number of researchers (incl PhD students) at Aarhus University who work in food and agriculture research.

285,8

The millions of Danish kroner received by DCA in 2013 for undertaking research-based policy support for the Ministry of Food, Agriculture and Fisheries.

200

The approximate number of responses that DCA gives to authorities as part of the contract with the Ministry of Food, Agriculture and Fisheries.

13

The number of areas of scientific expertise covered by the contract with the Ministry of Food, Agriculture and Fisheries.
