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Climate Programme for Finnish Agriculture – Steps towards Climate Friendly Food

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Ministry of Agriculture and Forestry 2014

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– Steps towards Climate Friendly Food

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Summary

Climate Programme for Finnish Agriculture – Steps towards Climate Friendly Food

The Climate Programme for Finnish Agriculture prepared by the Ministry of Agriculture and Forestry aims to further enhance the sustainability of the Finnish food system, which is founded on profitable food production and responsible consumption. By improving sustainability in a comprehensive way it is also possible to increase the profitability of production. The objective is to improve energy and material efficiency and reduce emissions per litre or kilo of production. The array of technology solutions we already have available should be taken into full use, while encouraging research and businesses to develop further innovations. In the future the consumers should be steered towards even more responsible consumption. Through all this we can ensure that Finnish food derived from sustainable production is well placed on the market.

Climate change brings changes to food production, both in Finland and globally. Active measures are needed to take advantage of the opportunities offered by the changing climate and to minimize its negative impacts. The Climate Programme for Finnish Agriculture presents a total of 76 measures to facilitate the adaptation of food production and consumption to climate change and/ or to mitigate the change. The selection of the measures was based on the most recent scientific research results and views of various experts involved in the food system. By implementing the measures put forward in the programme we will achieve more climate friendly food production and consumption.

The eight key measures identified in the Climate Programme for Finnish Agriculture are:

1. Carbon sequestration into soil
2. Measures relating to the use of peatlands
3. Plant breeding
4. Plant and animal health and preventing the spread of invasive alien species
5. Handling and treatment of manure and more accurate nitrogen fertilization
6. Energy efficiency and production and consumption of renewable energy
7. Reducing food loss all through the food system
8. Changes towards a more plant-based diet

In a climate programme the main focus is on climate impacts, but we should also aim for a comprehensive approach to all ecological challenges. It should also be kept in mind that, in spite of the varying objectives which the policy measures may have, the steering instruments should be mutually compatible. The signals and incentives that the steering instruments of the public authorities give to the various actors in a society must be free from conflicts in order that they contribute to achieving the common objectives set for that society. The Climate Programme for Finnish Agriculture is an important step towards better reconciliation of different policies.

1. Background and objective

The sustainable Finnish food system is founded on profitable food production. The objective of the Climate Programme for Finnish Agriculture prepared by the Ministry of Agriculture and Forestry is to promote the sustainability of our food system and to make this better known. The programme promotes and improves the energy and material efficiency of agriculture and the whole food system. The programme offers additional tools for improving productivity and profitability as well.

As the climate changes efficient measures are needed to adapt to this and to reduce greenhouse gas emissions. Climate change adaptation and mitigating bring new opportunities for the food system, but active measures are needed to benefit from these. Often a more sustainable food system also means a more productive food system.

The Climate Programme for Finnish Agriculture serves as an information bank for those acting on behalf of a more sustainable and productive food system. The programme brings together the most recent research information on the climate issues in food production and consumption, from the perspective of both adaptation and mitigation. The programme will be updated on a regular basis in line with the most recent studies and changing conditions and operating environments.

The programme presents climate change adaptation and mitigation measures relating to the food system. In addition, the programme also reflects on potential future means for adaptation and mitigation. Some of the measures included in the Climate Programme for Finnish Agriculture are already implemented under the Rural Development Programme. Some of the suggested measures are such that the various actors in the food system should at least consider their implementation.

The Climate Programme for Finnish Agriculture recognises the climate-related objectives set by the European Union and in other international contexts and promotes these, but the approach is different. The Climate Programme stresses a new way of thinking, i.e. comprehensive sustainability of food production and consumption. In the Climate Programme the focus is on climate impacts, but many of the proposed measures have other beneficial impacts on the environment as well. We should to a growing extent aim for a holistic approach to ecological challenges.

The implementation of the programme contributes to meeting the EU and international climate and energy commitments. The national reduction target for methane and nitrous oxide emissions set for the agriculture sector is 13% between 2005 and 2020 (Long-term Climate and Energy Strategy 2008). Studies have shown that it is going to be very difficult to reach this target (Agrifood Research Finland MTT Report 127). On the other hand, there are significant opportunities in agriculture with regard to climate change mitigation in e.g. energy production.

When this Climate Programme was being finalised the Rural Development Programme was still a draft and pending approval by the European Commission. This means that no final decisions had been made on the measures under the Rural Development Programme that were included in the Climate Programme or the related target areas or amounts of payments.

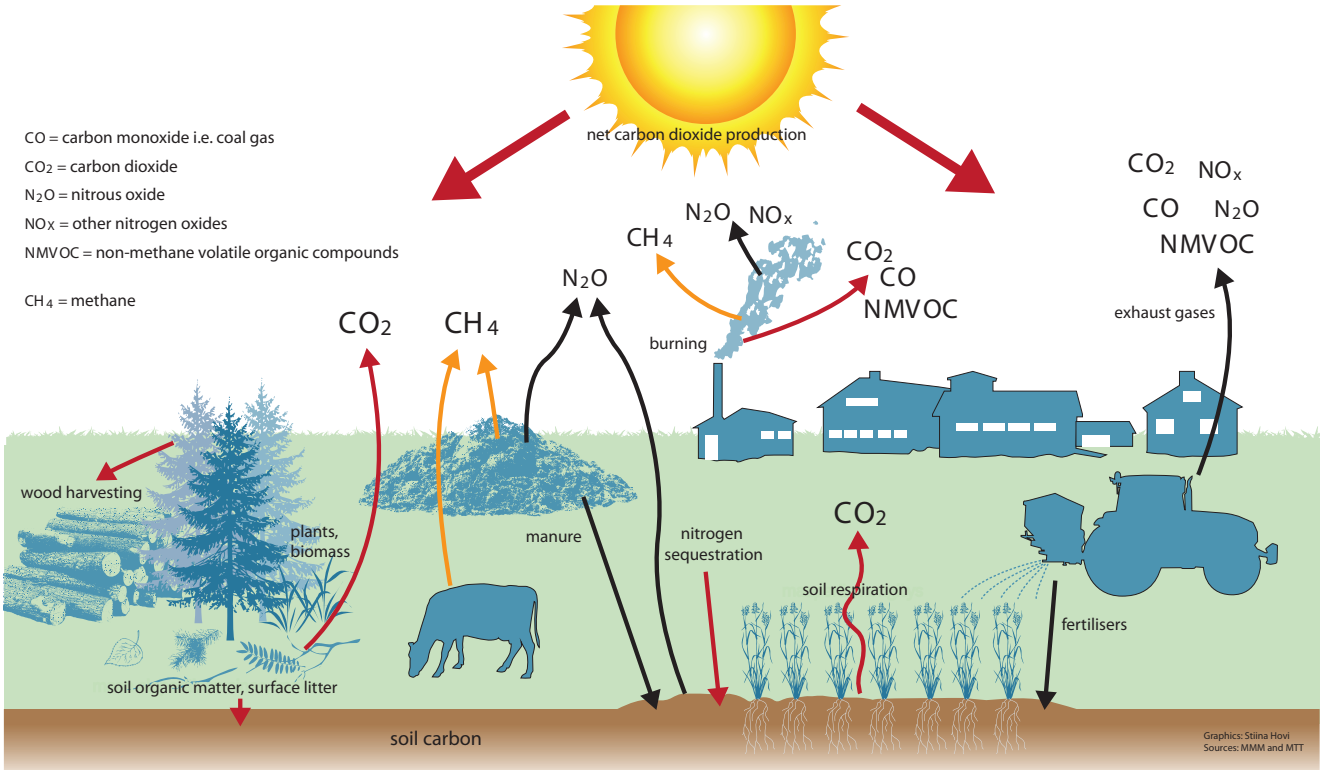


Figure: How greenhouse gases are produced. Graphics: Stiina Hovi/Kantri © Maaseudun tulevaisuus

2. Key measures

The eight key measures identified in the Climate Programme for Finnish Agriculture are:

1. Carbon sequestration into soil
2. Measures relating to the use of peatlands
3. Plant breeding
4. Plant and animal health and preventing the spread of invasive alien species
5. Handling and treatment of manure and more accurate nitrogen fertilization
6. Energy efficiency and production and consumption of renewable energy
7. Reducing food loss all through the food system
8. Changes towards a more plant-based diet

1. Carbon sequestration into soil

Organic matter (e.g. manure, straw) added into the soil improves the water and nutrient holding capacity of arable land and boosts microbial activity. These enhance the production potential of arable lands, their ability to adapt to changing conditions and climate change mitigation by increasing the soil carbon stores. Support is available for increasing the soil carbon stocks through the environmental operations under the Rural Development Programme (2015–2020): incorporation of slurry into the soil, recycling of nutrients and organic matter, environment management grassland, plant cover on arable land in winter, use of organic cover for horticulture plants and seed potato, and organic production. Requirements promoting the sequestration of carbon into the soil are also included in the cross-compliance conditions for support payments to farmers and the greening payment introduced in the beginning of 2015.

2. Measures relating to the use of peatlands

Peatlands store significant amounts of carbon. Cultivation of peatlands (e.g. tillage) breaks down the peat, which reduces the amount of carbon sequestered into the arable land. Greenhouse gas emissions from the cultivation of peatlands are much greater than those from the cultivation of mineral soils. The use of peatlands is regulated through operations under the Rural Development Programme concerning management of water economy in arable lands and environment management grasslands and through the national nutrient recycling project by reducing the need to clear peatland areas for manure spreading. Environment payments and payments for areas facing specific constraints are not paid for cleared arable land, which restricts the growth of the organic cultivation area.

3. Plant breeding

Plant varieties suitable to the changing climate conditions are developed through plant breeding. Besides the breeding activities it is important to test the varieties by official variety tests in different parts of the country. Besides new plant varieties there is also a need to take back into use some of the plant genetic resources stored in gene banks, i.e. Finnish local crops. Local varieties, or landraces, that are well adapted to the local environmental conditions will be an important source of new properties. Appropriate selection of varieties makes it possible to ensure profitable and sustainable agriculture and to optimise the use of nutrients and, where necessary, growth regulators and plant protection products.

4. Plant and animal health and preventing the spread of invasive alien species

Changing climate may cause new animal diseases and pests to spread to Finland. Some of the dangerous pests have been classified as particularly harmful invasive alien species in Finland. There are special schemes in place for monitoring the presence of animal diseases and plant pests both within the EU and nationally. The identification of diseases and pests and monitoring schemes need to be developed further. Operators are trained to identify dangerous pests and emerging animal diseases and detect plant health and animal disease risks in their activities and to prepare for these. Further development is also needed in the diagnostics for indentifying diseases and pests.

Climate change enhances the potential of other invasive alien species to spread towards the north and expand their habitats. Support for the use of biofuels with the aim to mitigate climate change may in fact contribute to the spreading of invasive alien species. Species used as biofuel elsewhere in the world and in Europe are alien to the Finnish nature and may cause problems should they become established here.

5. Handling and treatment of manure and more accurate nitrogen fertilization

Efficient manure handling and treatment methods and efficient nutrient recycling contribute to reducing ammonia and methane emissions from manure and to substituting for the use of nitrogen fertiliser produced by means of fossil energy, thus mitigating the greenhouse gas emissions from agriculture. Organic materials can be utilised, depending on the process, for energy production in biogasification, preservation of soil organic matter and returning nutrients, especially nitrogen, phosphorus and potassium, to plant production. Better handling and treatment of manure may also reduce the need for land clearing as it may be easier to transport the manure to areas where such nutrients are needed. The aim of the national programme concerning the utilisation of nutrients in agriculture is to significantly improve the efficiency in using manure by

2020. Gaseous emissions can also be reduced by changes in the feeding of animals both directly and through manure.

Because of climate change the yield production potential should be utilised to the maximum in order to secure sufficient food production volumes. Location-specific nitrogen balances show the level of natural mineralisation of the arable land and possible excessive or too low fertilisation relative to the production potential of the site.

6. Energy efficiency and production and consumption of renewable energy

Higher energy efficiency reduces the creation of greenhouse gases per unit of energy produced. Energy efficiency is also promoted by operations under the Rural Development Programme, such as energy plans, inspections and investment aids. A national coordination project for energy efficiency is to be launched by means of funding from the Rural Development Programme. The strategies for the agriculture and horticulture sectors for promoting energy efficiency have been compiled into a sectoral agreement to be updated during the winter 2014–2015 and signed by the Ministry of Agriculture and Forestry and national agricultural and horticultural producer organisations.

Use of renewable energy reduces the use of fossil energy sources, provided that the total energy consumption does not grow. Production and use of renewable energy enhances the emergency supplies and has positive impacts on regional economies. Measures under the Rural Development Programme to encourage the production and use of renewable energy concern the setting up of non-agricultural business activities in the rural areas by means of both the building instructions for agriculture and agricultural investment aid.

7. Reducing food loss all through the food system

Throwing away edible food is a significant ecological and economic burden. With regard to the climate it means that the emissions from the production were caused for nothing. Among other things reducing food loss is promoted by projects to enhance the functioning of the food chain. The projects aim to increase the awareness of and advice on the impacts of food loss and means to reduce it. Under the Rural Development Programme support is available for investments concerning environmental technology and recycling.

8. Changes towards a more plant-based diet

The Finnish Nutrition Recommendations 2014 encourage to increase the use of vegetables, berries, fruits, whole-grain cereal products and fish and to use less red meat and meat products. A diet in line with the recommendations can be constructed in various ways. A more plant-based diet contributes to reducing the climate impacts of food production. Work towards a more plant-based diet is done by implementing the Government Resolution on the promotion of new and sustainable environmental and energy solutions in public procurement. Projects to promote the functioning of the food chain and other similar projects contribute to promoting raw material choices that are in line with sustainable consumption.

Selection criteria for measures

Research, advice and communication on best practices are needed for promoting all the above-listed measures.

The proposed measures promote the sustainability of the Finnish food system because:

- The measures are widely accepted among the actors.
- The measures reduce the negative environmental impacts of food production and consumption.
- Some of the measures may also improve the profitability of food production in the short term.
- The measures reduce the costs of food consumption.
- The measures highlight the Finnish food production and consumption culture by maintaining Finnish agriculture and rural cultural landscapes and supporting local food culture.

3. Monitoring the implementation of the measures

Greenhouse gas emissions and actions to reduce them are reported on a regular basis to the Secretariat of the UN Climate Convention and to the European Union.

The implementation of the measures of the Climate Programme for Agriculture is monitored and reported to the management group of the Food Department of the Ministry of Agriculture and Forestry. The impacts of the programme are assessed by various procedures in the context of e.g. the follow-up of the implementation of the common agricultural policy, regular evaluations of the Rural Development Programme and implementation of projects promoting the functioning of the food chain.

The implementation of the Climate Programme for Agriculture is coordinated with the work of the climate team of the Ministry and other systems for national implementation and coordination. Adaptation of agriculture to climate change is reconciled with the National Climate Change Adaptation Plan 2022, currently under preparation.

The implementation and way of thinking of the Climate Programme for Agriculture are integrated into the regular strategy work, operating and financial planning and budget preparation at the Ministry of Agriculture and Forestry.

4. Impacts of climate change

Climate change impacts on the cultivation conditions in all parts of the world. As the climate changes Finnish agriculture will also be faced with significant changes, some of which will have positive impacts on the production while some will restrict it. According to the forecasts based on climate models available at the moment, most of the impacts taking place in the Finnish climate will be beneficial for agriculture. (TEHO Plus 2014).

The effective temperature sum will be rising and, accordingly, the growing season will get longer. Already for the past thirty years we have observed an earlier start for the growing season, and according to forecasts this trend will continue. By the middle of the century sowing can be done 2 to 3 weeks and by the end of the century even a month earlier than today. If this is taken advantage of in an appropriate manner, both agricultural production volumes and range of products may grow.

Autumn and winter precipitation is going to increase. In Finland the early part of the growing season is typically quite dry, which restricts the growth of the crop. Both precipitation and evaporation during the growing season may be increasing, which means that the drought problem will not be removed. In the future sufficient and correctly-timed water intake by the plants will be a key factor for realising the increased yield potential. According to forecasts, more of the rainfall will come as heavy rains. Increased autumn precipitation and possible lack of frost in the ground may increase susceptibility to erosion and nutrient leaching.

Climate change is going to increase the risk to plant production caused by pests. New pests may be introduced to Finland along with new crops or certain species of living organisms may turn into pests as the heat and moisture conditions are changing. The limit for the occurrence of plant species and varieties and pests has already moved more to the north.

Climate change impacts on the global markets because of changes in the production areas of different plant species. The production conditions in many already unfavourable areas will become even worse and the conditions in areas which traditionally have yielded high surpluses will be changing. All in all, significant changes in food production and markets are to be expected, both globally and in Finland. Adaptation measures should be introduced without delay, but mitigation efforts should also be incorporated in the production systems.

Photo: Hanna Koikkalainen

5. Measures in the food system for climate change adaptation and mitigation

National research on the various kinds of opportunities for adaptation and emission reduction is needed for the adaptation to and mitigation of climate change. There is still considerable uncertainty with regard to the calculation of emissions from agriculture and impacts of the actions to reduce them. Information is also needed on the implementation of the means for emission reductions and the costs involved in order that the emission reduction measures can be targeted in a sustainable and cost-efficient way.

Measure

1) Research on means for adaptation and emission reduction in agriculture, their implementation and costs involved. Information on research results is communicated in a usable form.

1. Advice

Through advice we can improve the farmers' knowledge and skills in both environmental and animal welfare and health issues. Advice contributes to reducing the climate impacts of agricultural production, increasing energy efficiency and preventing risks caused by climate change. Transmitting new information in a way that is adapted to the circumstances of the farm helps to develop the farm and manage the risks. Under the Rural Development Programme farmers can choose the topic area for the advice according to their own specific needs.

Measures

2) Production and compilation of material on climate issues in agriculture for use by the farmers.

3) Climate issues included in the training of farmers to be taken into account during visits to farms.

4) Measure of the Rural Development Programme: Aid for the utilisation of advisory services.

2. Risk management

Climate change increases the uncertainty of supply on the world market. Maintaining the domestic, diverse agricultural production and emergency supplies is an important part of climate change adaptation.

The National Climate Change Adaptation Plan was adopted as a Government Resolution 2022 in autumn 2014. The aim of the plan is that the Finnish society will be capable of managing the risks associated with climate change and adapt to changes in the climate. The plan specifies the objectives and how these can be reached. Measures presented in the National Adaptation Plan have also been included in this Climate Programme for Agriculture as far as they concern the food system.

Plant breeding and variety tests

Varieties cultivated in Finland need to be adapted to the long time of daylight and acid soil. Domestic plant breeding as well as the availability of national plant genetic resources for plant breeding are important aspects of securing emergency supplies. Plant breeding aims to produce high-yielding and robust varieties with due account for resistance to diseases and pests, stem strength and, with regard to grasses, nutritional value. Official variety tests carried out in different parts of the country produce information on the best and sustainable choices of varieties to the farmers and processing industry.

Plant and animal health and invasive alien species

Climate change, growing trade and new crops increase the occurrence of animal diseases and plant pests. The liberalisation of world trade, increased tourism and the consequent import of living organisms further increase the possibilities and risks of spreading not only particularly harmful invasive alien species but also of other alien species to larger areas.

Within the EU as well as in Finland the challenges in preventing the spreading of invasive alien species are even greater due to the free movement of goods and legislation on internal markets. Various monitoring systems have been introduced to detect the presence of plant pests and animal diseases and changes in this. The responsibility of the actors themselves is vital as plant pests and animal diseases should be detected and preventive measures launched as early as possible to minimise the damage. The Finnish Food Safety Authority has a contingency plan with measures to destroy the colonies for the most significant new plant pests and animal diseases. Besides chemical substances, biological prevention and diverse crop rotations should also be promoted. (Ilmasopu 2009).

Protein crop production

Protein self-sufficiency with regard to feed is an important aspect of the self-sufficiency of Finnish food production. The self-sufficiency of Finland and the EU in feed protein is very low, in Finland just 15%. Competition for soya will be increasing as climate change is likely to make its cultivation more difficult in the current main production regions. The impacts of climate change will make it possible for Finland to raise the self-sufficiency in protein as the conditions for cultivating leguminous crops (e.g. pea and broad bean) and turnip rape and oilseed rape improve in the long term. The possibilities to cultivate autumn-sown oilseed crops will also get better.

The cultivation of protein crops also allows to diversify cropping systems and crop rotations, which enhances the climate change adaptation capacity of agriculture. Leguminous crops are capable of fixing atmospheric nitrogen. We may become less dependent on industrial fertilisers if nitrogen can be made available to the crops via nitrogen fixing plants. (Omavara 2013). Protein crops should also yield a higher contribution margin compared to fodder cereals to turn protein crop production into an attractive alternative for farmers.

By expanding the cultivation of leguminous crops we could substitute more than half of the soybean meal used for feed. As the conditions for domestic protein crop production continue to improve, at least in theory this could substitute for the use of soybean meal altogether. Special inputs are needed to the breeding of early varieties of oilseed rape, increasing the robustness of pea, development of broad bean varieties that are free from harmful substances, selection of more competitive cereal varieties than at present with regard to the protein yield, and breeding of disease resistant protein crop varieties.

Photo: Tero Sivula, Rodeo/MTT archive

Sustainable livestock production

Climate change and tightening competition for natural resources in the future may create pressures to increase agricultural production in Finland. In particular, sectors where a lot of water is needed for the production, such as animal husbandry, would benefit from Finland's abundant water resources. Cattle husbandry that rests on a comprehensively sustainable basis is founded on the use of domestic protein and grass feed. Perennial grasslands allow to increase the amount of soil organic matter and improve the permeability of the soil, i.e. ability of water to move through it. When used for grass production, arable lands with mineral soil may turn into carbon sinks.

Risk to farmers' income

Besides managing the production risk it is also necessary to manage the risk with regard to farmers' income. Market uncertainties will be even greater in the future, which means that means for regulating the risks are also needed. For risk management there is a need for long-term strategies, development of new insurance products by insurance companies, and increased business thinking and risk-awareness among farmers.

Connections with other sectors

The changing climate conditions which impact on agriculture are linked, among other things, to the transportation sector as problems in transportation have impacts on e.g. the collection of milk and replenishing the feed stocks. Extreme weather events may affect the supply of energy, which is why securing stand-by power sources is important.

Measures

5) Development of the identification of animal diseases and plant pests through research and advice.

6) Development of methods for assessing the impacts of climate change (incl. costs and benefits) suited for use by sectors, local and regional actors and companies as well as methods for risk and vulnerability studies. (Objective of the Adaptation Plan 2022, included in the implementation of the plan).

7) Advance prevention of production and income risks in agriculture and development of concrete risk management means in cooperation with producers, research and the private sector (incl. insurance institutions). (Management of financial risk is an objective of the Adaptation Plan 2022, included in the implementation of the plan).

8) Breeding of varieties tailored for our production conditions and adaptation of location-specific cultivation plans to the future conditions by utilising the regional forecasts.

9) Development of cooperation between advice, research and farmers as well as technology industry to promote the introduction of new adaptation tools.

10) As part of the implementation of the Finnish Bioeconomy Strategy the self-sufficiency in protein crops is improved with the aim to reach 30% self-sufficiency. Encouragement is provided for taking advantage of the opportunities for innovative joint projects offered by the European Innovation Platform (EPI) in order that researchers and farmers will engage in joint efforts to develop technologies and market-oriented opportunities for increasing protein self-sufficiency.

11) Efficient utilisation of research on protein crops in advisory services and training of farmers.

12) Increased use of leguminous and oilseed crops in animal feeding e.g. by developing recipes in a way that more domestic protein can be used in feeds.

13) A research programme on adaptation is prepared to produce information for the implementation of the National Climate Change Adaptation Plan adopted as a Government Resolution in autumn 2014. The decision on the research programme is made separately on the basis of broad-based preparation. (Objective of the Adaptation Plan 2022, included in the implementation of the plan).

14) Support for the cultivation of protein and oilseed crops by granting EU-funded single payments as coupled support for protein and oilseed crops.

3. Plant production

More accurate nitrogen fertilisation

All measures that improve the utilisation of nitrogen contribute to reducing nitrous oxide emissions. For more efficient utilisation of nutrients what is the most essential is that fertilisation is as accurate as possible, based on what the plants need, which means that both the quantities of fertilisers applied and the timing of their application are optimised. This is the most sensible in economic terms as well. (MTT Report 127).

Measures

15) Encouragement to farmers to join the environment payment scheme.

16) Measure of the Rural Development Programme: Environment and climate measures – Balanced use of nutrients.

Plant cover on arable land in winter

Protecting the surface of arable land by plant cover in winter reduces soil erosion and increases the accumulation of carbon into the soil by increasing the amount of organic matter.

Measure

17) Measure of the Rural Development Programme: Plant cover on arable land in winter (target area at the end of the programming period is 880 00 ha in the focus area for the measure and 420 000 ha in other areas, payment according to plant cover: for 20% the payment is 4€/ha, for 40% the payment is 18 €/ha in the focus area and 9 €/ha in other areas, for 60% the payment is 36 €/ha in the focus area and 11 €/ha in other areas, for 80% the payment is 54 €/ha in the focus area).

Photo: Yrjö Tuunanen, MMM/Mavi

Precision farming

In precision farming the variation between and within the parcels is taken into account. This means that fertilisation can be reduced in areas where high yields cannot be produced and, correspondingly, increased in the most productive areas. In a study commissioned by the EU the potential of precisions farming was estimated to be a 5% reduction in the amounts of chemical fertilisers used. The impact of precision farming may not be reflected in the total amounts of fertilisers used, if fertilisation is reduced in certain locations and increased in others. The fertilisation limits of the farm-specific environment measure concerning balanced use of nutrients must also be taken into account as they may restrict the possibilities to increase the use of fertilisers on specific parcels. (MTT Report 127).

Measures

18) Guidance to farmers in technology choices and cultivation methods to improve the efficiency of cultivation processes in specific locations. Intelligent applications are developed in cooperation between research, technology industry, advisory services and farmers.

19) Encouragement to farmers to measure the yield volumes and quality (N level) for specific locations and, based on the results, to monitor the nutrient balances of specific parts of arable lands. Nutrient balance maps are converted into “contribution margin maps” showing the economic aspects of cultivation. The contribution margin calculation also includes the fuel consumption for specific locations.

Managing water economy of arable land

Unusually high groundwater level in organic soil slows down the decomposition of peat, thus considerably reducing the emissions. Underwater peat layer is protected from aerobic microbial decomposition and thus, the thinner the peat layer that is exposed to oxygen, the lower the total emissions from arable land. Preventing the decomposition of peat is also in the interest of the farmer as the organic matter that is beneficial for the soil structure is retained for a longer time in the arable land and the use life of the drainage system is extended. It has been estimated that the use life of organic arable land may lengthen from 130 years to 500 years if the water level is raised from 70 cm to 30 cm. (MTT Report 127). Management of the water economy of arable land is also important in mineral soil to secure the intake of nutrients and producing a good yield in extreme conditions, such as periods of drought or flooding.

Measure

20) Measure of the Rural Development Programme: agricultural investments (investment aid for controlled subsurface drainage) and control of runoff waters (environment payment; target area 40 000 ha, payment 70€/ha/a to be used for implementing the measure by controlled subsurface drainage and 250 €/ha/a for implementing the measure as controlled irrigation and recycling of runoff water).

Increasing soil carbon sinks

Based on the results of the soil monitoring at the MTT Agrifood Research Finland (samples from years 1974, 1987, 1998 and 2009), on average the soil carbon stock has decreased. Good cultivation practices make it possible to increase the carbon stock by adding carbon input into the soil or by slowing down the decomposition of organic matter in the soil. In the future it may be more difficult to maintain the carbon stocks as the rising temperatures due to climate warming accelerate the decomposition of organic matter. (MTT Report 127). One reason for the fall in the carbon stocks is the young age of arable lands in Finland, i.e. decomposition resulting from the clearing of the lands still continues. (Heikkinen 2013).

The cross-compliance conditions that are a condition for payments to farmers require that set-aside arable lands are green fallow or covered with stubble, while open fallow is accepted in exceptional cases only. Burning of stubble is also allowed only as an exception, for example, if necessary to prevent plant diseases or pests.

Photo: MMM archive

Perennial grass cover

Perennial grass cover reduces erosion in arable land, thus also reducing the decrease in soil organic matter, i.e. carbon sequestered into the soil in arable parcels. Combining data in the soil database with data on plant species in arable lands gives information on the cultivation of different plants in organic soil. The share of grass is available for the years 1995 and 2008 and, based on the results, the share of grass has decreased, which means that the emissions have increased. Increasing the share of grass would extend the time it takes for the peat to decompose. Based on the average results from Nordic measurements of peat compression it can be calculated, as an example, that a peat layer of 30 cm is sufficient for the cultivation of carrots for 15 years and for grass cultivation for 60 years. (MTT Report 127).

Organic production

A Government Resolution on the Government development programme for the organic product sector was adopted in May 2013. The core principles of organic production include careful collection and utilization of nutrients, diverse crop rotations and diversity of plant species (Organic Production Programme 2013). Contrary to the common perception, organic production may not be better than conventional one with regard to eutrophication or climate impacts. (Roininen & Katajajuuri 2014; Pulkkinen et al. 2014). However, there is not enough data on the climate and eutrophication impacts of organic production as there are no national emission models based on measurements made in organic lands that would be applicable to organic production. (Saarinen 2014). According to studies (Tuomisto 2012), in general the cultivation methods in organic farming have positive impacts on the environment when calculated for the production area but not for the quantity produced due to the lower yield levels. In organic production, too, the emissions relative to the production volumes need to be reduced e.g. through higher productivity.

Crop diversification and retaining permanent grasslands

Because of the reform of the EU's common agricultural policy, new environmental requirements will be included in the direct payments funded by the EU as from 2015. 30% of the direct payments will be used for greening measures with the aim to promote agricultural practices that are beneficial for the environment. Farmers have to comply with three greening measures in their eligible hectares.

Cross-compliance conditions are a condition for support to farmers funded or part-funded by the EU as well as, in part, national support to farmers and structural support. Of the cross-compliance conditions especially the prohibition on burning stubble and plant cover required for set-aside lands as well as requirements of the Nitrates Directive have impacts on the climate.

Measures

21) Study of methods for measuring carbon sequestration in arable land, volume of carbon sinks in Finnish arable lands and cultivation methods through which the carbon sink can be increased. A pilot project on increasing the carbon sink is launched.

22) Three greening payment measures in direct support:

a) Crop diversification: at least two crops cultivated on farms with 10–30 hectares of arable land and three crops on farms with more than 30 hectares. As an exception, in area C two crops may be accepted on farms with more than 30 hectares. Not applicable on farms with more than 75% of arable land under grass and/or fallow if the arable area in other uses does not exceed 30 hectares.

b) Retaining permanent grassland: permanent grassland area in the whole country may not fall below 5%. In addition, requirement to retain permanent grasslands located in Natura areas.

c) Ecological focus area: at least 5% of the arable area of the farm must be so-called ecological focus area (fallow land, nitrogen-fixing crops and short-rotation coppice/energy wood). The requirement may rise to 7% in 2018. Derogations may be allowed for areas and farms meeting certain requirements (e.g. forest-dominated areas and farms where most of the lands are under grass or fallow).

23) Measure of the Rural Development Programme: environment management grassland (target area 140 000 ha, payment for riparian zone grassland located in the focus area for the measure 500 €/ha/a, in other areas 450 €/ha/a, for perennial environment management grassland 50 €/ha/a and for nature management field grassland in the focus area 120 €/ha/a and in other areas 100 €/ha/a).

24) Measure of the Rural Development Programme: organic production (target area 20% of the agricultural area in 2020, payment 160 €/ha/a and for outdoor vegetable production 600 €/ha/a).

25) Study of the climate and eutrophication impacts of organic production and developing new methods for their assessment.

26) Measure of the Rural Development Programme: environment payment. Operations of the environment payment incorporation of slurry into the soil, recycling of nutrients and organic matter, environment management grassland, plant cover on arable land in winter and use of organic cover for horticulture plants and seed potato increase the amount of carbon in arable land (target area 5 000 ha, payment 300 €/ha/a for annual horticulture plants and seed potato and 500 €/ha/a for perennial horticulture plants).

27) More advice on the benefits of crop rotation and set aside to agricultural production and cross-compliance requirements and concerning soil carbon, benefits from increasing this and measures through which the amount of carbon can be increased.

28) Improving the efficiency of organic production through research and advice.

4. Livestock production

Handling and treatment of manure

Animal manure is a significant resource because of the nutrients and energy contained in it, but it is also a significant potential source of environmental loading. All kinds of manure require careful and appropriate handling and treatment in all stages of the process for efficient utilisation of the valuable nutrients and to minimise the emissions. Nutrients in manure that do not end up in use by the growing crop are wasted and constitute an environmental hazard. The main issues with regard to careful handling and treatment of manure include feeding according to the relevant recommendations, rapid collection of manure from housing facilities, appropriate storage, and timely spreading using efficient methods and according to the needs of the plants. In addition, manure may be processed to produce energy and fertiliser products with different nutrient contents for plant production.

Ammonia emissions are produced at the different stages of manure handling and treatment of manure, including emissions released when using fertilisers. Most of the nitrogen in manure may evaporate into the air unless this is prevented. (Grönroos 2014). Some of the measures to reduce emissions from feeding and those of manure relating to climate are the same, but the impacts may also involve certain complications. Covering the manure stores may reduce ammonia emissions but it may increase nitrous oxide emissions. On the other hand, reducing ammonia emissions reduces indirect greenhouse gas emissions from fallout and, thus, on the whole it is a beneficial alternative, especially as the amounts of ammonia emissions are usually greater than those of nitrous oxide emissions. (MTT Report 127). It is important to examine the interactions of the different measures in a comprehensive way.

Environmental loading caused by manure spreading depends a great deal on the spreading techniques and methods. Equipment placing the manure into the soil and covering it with earth reduce the risk of nutrient loading of surface waters and ammonia emissions into the air.

Manure may be processed to separate the material into solid, liquid and gas fractions. This allows to utilise the organic material, depending on the process, in energy production, maintaining soil organic matter and/or returning nutrients to plant production more efficiently than in the original manure. (MTT Report 21). There are several techniques available for processing liquid manure, but only a few for solid manure. Measures before and after using a certain technique must be taken into account in the processing. There must be appropriate storage facilities for the manure products and the same principles as for raw manure apply to their spreading,

Photo: Tarja Haaranen

Emissions from the handling and treatment of manure can be reduced by biogasification, if the whole chain from the biogas process to storage of the digestion residue and use of arable land is properly done (see Chapter 5.7.1) (MTT Report 103). In the fractioning of liquid manure the dry and liquid fraction are separated from each other. It is economically more sensible to transport the dry fraction further away e.g. to parcels where the soil phosphorus level is not high or to crop farms. The liquid fraction with a higher nitrogen-phosphorus ratio is suited for arable lands where the phosphorus figure is high, often located close to the main farm buildings.

Manure separation and efficient utilisation of the fractions may reduce the need to clear arable land in regions with high stocking densities, as well as balance the work load on animal farms. The equipment needed for separation can often be shared by several farms or the separation can be purchased from another operator. Crop farms receiving the dry fraction must have appropriate storage facilities or intermediate storage needs to be organised on the livestock farm from which the dry fraction is spread directly to the lands of the recipient farm.

Measures

29) Launch of a national programme on the utilisation of nutrients in agriculture with the aim to ensure efficient utilisation of manure by 2020, taking full advantage of the means and resources under the Rural Development Programme (2014–2020), e.g. measures concerning advice, training, development, cooperation and investments.

30) Developing technology for the handling of recycled manure fractions in farm storage and logistics and site-specific dosage, for example, as sowing fertilisation in cooperation between research, technology industry and advisory services.

31) Measure of the Rural Development Programme: agricultural investments.
Ensuring sufficient funding for investments in improving the efficiency of the handling and treatment, storage and use of manure.

32) Measure of the Rural Development Programme: agri-environment-climate payment.
Environment payment operations incorporation of slurry into the soil (target area 140 000 ha, payment 40€/ha/a) and recycling of nutrients and organic matter (target area 50 000 ha, payment 40 €/ha/a) and measure of the Rural Development Programme: Environment and climate – Balanced use of nutrients (target area 1.79 million ha, payment 54 €/ha/a for arable crops and 200 €/ha/a for horticulture plants).

5. Land use

In the case of organic soil the emissions from land use can be influenced by reducing the clearing of peaty lands and decomposition of peat in cultivated arable areas through long-term grass cultivation and in mineral soil by increasing the soil carbon stocks or slowing down the decrease in the current stock.

Support may be applied for from the Ministry of Agriculture and Forestry for land consolidation operations between farms where scattered arable land, forest, road or other land property in different ownership may be combined in larger and more functional units in terms of their management. Farm size has grown in Finland but often the additional lands are small in size and located far away from the main farm buildings. Land consolidation reduces the need for transferring machinery and equipment, and offers a good means to modernise the structure of farms and improve the use of lands. The practical arrangements of land consolidation projects are the responsibility of the National Land Survey of Finland. (NEEAP-3 2014).

Slowing down the growth in cultivation in organic soil

Since 2007 about 3 000–4 000 hectares of arable land has been cleared in Finland each year. In 2000–2009 the average share of peaty lands in the cleared area was less than 26%. (MTT Report 150).

There are several reasons for the growth in the use of peaty lands for cultivation.

- Livestock farms expanding their operations have needed more land for manure spreading and cultivation of forage crops in areas where there is a shortage of arable land.
- Arable parcel structure of farms has been improved by land clearing.
- Poorly productive forest land has been cleared into arable land, hoping for a better economic return.
- Rise in arable land prices and rents due to the small supply has increased the clearing of farms' own lands.
- The costs of clearing are relatively low and it is a technically easy way to obtain more arable land.

Indirect factors which have increased clearing:

- Need to improve the economic profitability of a farm through existing or increased production capacity.
- Rapid growth of livestock farms in areas where national aids for livestock production are higher than in southern Finland, especially area C2 – often the share of peaty lands is also higher in this area.
- Environmental protection legislation and environment payments require larger areas for manure spreading as the maximum amount of manure to be spread per hectare decreases.
- Hopes that the newly cleared arable lands are eligible for all types of area-related payments (land cleared after 2004 has not been eligible for natural handicap and agri-environment payments).

Measures

33) Measure of the Rural Development Programme: agri-environment-climate payment and payment to areas facing natural and other specific constraints.

These measures under the Rural Development Programme restrict the clearing of arable land as no payments are granted for land cleared after 2004.

In the basic payments of the direct payment scheme the possibility to grant payment entitlements to all areas where these are lacking in 2015 will not be used because entitlements would also be granted to newly cleared lands.

(According to EU legislation, in the case of young farmers and those setting up in farming payment entitlements must

be given to all areas where these are lacking, including newly cleared lands. On the grounds of EU rules a farmer who has extra payment entitlements or who purchases or leases these may activate these on newly cleared areas as well.)

(Payment entitlements are a condition for eligibility for greening payment and support for young farmers.)

34) Promoting land consolidation through advice, communication and national aid.

6. Energy efficiency in agriculture

Incentives to energy savings in agriculture are offered by the farm energy programme launched in2010, as well as the high energy prices. The voluntary farm energy programme is one way to reach the objectives of the EU Energy Services Directive (2006/32/EC) and Energy Efficiency Directive (2012/27/EU).

The energy savings objective for Finland set in the directive is 9% of energy end-use during the period 2008–2016. The initial objective of the farm energy programme was that the farms participating in the programme would represent at least 80% of the use of energy in agriculture and farm forestry. (MENO 2009). This programme objective was not reached, however, as by the end of 2013 only 392 farms had joined the programme (MENO 2014).

The most important service for farms in the programme has been the state-subsidised energy plan, which has been prepared for 248 farms. From the beginning of 2015 the plans and related payments will be included in the Rural Development Programme for Mainland Finland 2014–2020 as part of the farm advisory scheme. The farms may commission an adviser specialised in energy issues to draw up an energy plan for the farm, including an account of the current energy use and points where energy savings can be achieved. The potential for increasing the use and production of renewable energy is also assessed. Possible measures to be implemented on the farms within the limits of available resources are listed in the plan.

For energy inspection the energy use of the farm and possibilities to improve energy efficiency are examined more broadly than for the energy plan, and in the next programming period its implementation is envisaged to be supported through the farm investment aid scheme.

The implementation of the energy programme continues until the end of 2015 by means of national funding, but many of the actions under the programme were included in the Rural Development Programme in the beginning of 2015. The sectoral agreement between the Ministry of Agriculture and Forestry and national producer organisations for agriculture and horticulture on which the energy programme is based needs to be revised in line with the new situation. The means by which the objectives of the Energy Efficiency Directive and the Energy Efficiency Act under preparation will be implemented will be written in the sectoral agreement. A national coordination project is being planned to support the energy efficiency actions under the Rural Development Programme, also to function as a link between the local actors and national work on energy efficiency.

Through agricultural building instructions and investment aid the farmers are steered to choose energy efficient solutions in building as well as ways to increase the use of renewable energy. Energy saving impacts in agriculture should also be achieved through land consolidation operations, where energy savings of 156 GWh/a are expected in 2020. The estimated savings to be achieved by the farm energy programme are 228 GWh/a in 2020 (NEEAP-3 2014).

So far the approach to energy efficiency has focused on the energy and material flows within agriculture. In the future research and advice should give more attention to indirect energy consumption in agricultural production and the whole life cycles of agricultural products.

Measures

35) Research, development and cooperation projects to improve energy efficiency in agriculture.

36) Developing agricultural investment aid in a way that financing could be made available to individual energy efficiency projects.

37) Revision of the sectoral agreement concerning farms in winter 2014–2015.

38) Launch of the farm energy inspection scheme.

39) Informing farmers about the indirect energy impacts of agricultural production e.g. when making farm-specific energy plans and inspections.

40) Launch of a national coordination project on energy efficiency under the Rural Development Programme.

7. Energy production and use in agriculture

Energy production in agriculture

In agriculture energy can be produced from arable biomass or raw materials created in agriculture such as manure and other by-product streams of the production or food industry by-products. The food chain offers a broad range of raw materials for direct combustion, biogas and ethanol production, and liquid products to be used as engine fuel. In promoting and developing the use of biomass derived from agriculture the focus must be on materials other than biomass to be used as food.

In Finland arable bioenergy could be produced up to 12–22 TWh, which is 3–6% of the energy consumption in Finland in 2012. Most of the arable energy would be straw (8 TWh, decrease in organic matter on arable lands not taken into account) and biomass cultivated for energy use such as reed canary grass (12 TWh, gross energy). However, reed canary grass is difficult to use for energy production as there are problems relating to the combustion technique. At the moment 0.5 TWh of the potential arable energy is being produced. (Mikkola 2012). When utilising agricultural biomass, comprehensive consideration of the whole chain is needed, also taking account of the possible decrease in the soil organic matter.

In Finland it is difficult to produce energy from biomass derived from annual plants in a way that greenhouse gases would be reduced because of the low yields, energy needed for drying grain and need for liming on arable lands. (MTT Report 9).

Farms have potential for the production of solar and wind energy, while geothermal heat can be used so supplement the energy solutions applied on farms. In June-July a solar energy system installed on a farm may produce up to 70% of the electricity needed on the farm. (Ilmase 2013).

Biogasification

Emissions from the handling and treatment of manure can be reduced by biogasification if the whole chain from the biogas process to storage of the digestion residue and use of arable land works properly. This requires that the biogas plant itself is gastight and the retention period is long enough in order that no significant amounts of methane are produced in storage after the process. A substitution impact with regard to fossil fuels which is shown in the energy sector can be calculated for manure biogas.

The main challenge for biogas production linked to farming has been its weak profitability. According to studies made so far in Finland, it seems that in the current circumstances biogasification of manure may be profitable on large farms or joint digestion plants of several farms if certain conditions are met (the minimum of 100 dairy cows, 1 000 fattening pigs, 330 sows, 24 000 laying hens or 60 000 broilers). However, the profitability can also be improved through processing of manure together with other suitable organic materials. (MTT Report 127). Producing electricity for own use to substitute for purchased electricity is more profitable than producing electricity for the public electricity grid. The profitability is even better if biogas is used as transport biofuel. (MTT Report 103).

Photo: Ville Pyykkönen, MTT

Electricity produced by means of equipment with a maximum nominal power of 50 kVA is exempt from electricity tax and strategic stockpile fee. If a biogas plant produces electricity using a generator with a higher power than this and part of the electricity produced is used, for example, on a farm in the same location as the plant and part is fed into the electricity grid, tax is collected on the electricity used on the farm. This is the case even if no compensation were paid for the electricity fed to the grid, which means that electricity produced from biogas is not always tax-free. (MTT Report 103). Electricity produced using equipment with a maximum nominal power of 50 kVA for own use is always free from tax, but that produced in plants of 50–2 000 kVA only during the months when no electricity is fed to the grid. The tax on the electricity fed to the grid is always paid by the electricity user, not the producer.

Measures

41) Taxation of bioenergy production and consumption should be clarified.

42) Small-scale energy production is promoted (working group of the Ministry of Employment and the Economy January–November 2014).

43) Ensuring sufficient financial and support tools for prompting decentralised renewable energy production. A suitable financing channel must be found for the establishment and/or production of a renewable energy plant that is sensible from the sustainability and economic perspective, independent of the production sector and scale.

44) Measure of the Rural Development Programme: agricultural investments.

45) The advantages and disadvantages that would result if a similar distribution obligation were laid down for the gas sector as we have for the distribution of liquid biofuels are studied (measure of the working group of the Ministry of Transport and Communication “Alternative propulsion for the transport of the future”).

46) Targeting of available support also to demonstrations of means of transportation that increase the share of second-generation biofuels and utilise emissions-free electricity (measure of the working group of the Ministry of Transport and Communication “Alternative propulsion for the transport of the future”).

47) Seeing to the consistency of general energy policy steering instruments and taxation to ensure low-carbon transportation (measure of the working group of the Ministry of Transport and Communication “Alternative propulsion for the transport of the future”).

48) A plan is drawn up on the extent of the distribution infrastructure of alternative propulsion to achieve sufficient coverage in a cost-efficient way and ensuring its implementation to the extent that this is not market-driven (measure of the working group of the Ministry of Transport and Communication “Alternative propulsion for the transport of the future”).

49) Taxation of biogas electricity should be clarified so that the use of self-produced electricity is always tax free.

Energy use in agriculture

In the on-farm heat plants fossil fuels can be replaced by biofuels produced on the farm. According to the agricultural census 2013, wood and arable biomass based fuels represented 45% of the energy use on farms (including all fuel for heating and machinery but not e.g. energy for preparing fertilisers). In 2013 the total energy consumption of agriculture and horticulture enterprises was 10 TWh, which is about the same as in 2010 when the previous census was made. (Tike 2014a). There is no data for horticultural production only but in greenhouses, for example, the share of renewable energy is lower than in the agriculture sector as a whole. This is because a lot of electricity is needed to light the greenhouses.

Energy consumption depends on how the machinery and implements are used in various circumstances. It is important to take advantage of automation and guidance applications from the planning of cultivation to daily operations, working methods and process management.

Production of liquid and gas biofuels and their use in agricultural machinery

The options available to farms at the moment are either biogas or biodiesel derived from by-product streams. However, the price of biodiesel manufactured from turnip rape, for example, rises above the price for fossil fuel oil. There are no statistics on the use of liquid and gas biofuels in agriculture. So far very little biofuel is being used in agricultural machinery, as shown by the tax refunds concerning energy tax on bio-oils applied for with regard to just 0.5 million litres (including both heating and fuel oil). There have been some encouraging pilot experiments on the use of wood gasification for electricity and heat production on farms. (Ek 2014).

Measures

50) Measures of the Rural Development Programme: investments in establishing non-agricultural businesses in rural areas and non-agricultural activities. Through these measures funding is available for the use and production of renewable energy.

51) Measure of the Rural Development Programme: Through agricultural building instructions and investment aid the farmers are steered to choose energy efficient solutions in building as well as ways to increase the use of renewable energy.

52) Research, development and cooperation projects to increase the production and use of renewable energy in agriculture.

53) The distribution network of alternative transport fuels (e.g. biogas) is developed.

54) More efficient use of energy through automation and intelligent technology.

Lifecycle assessment of biofuels

In the lifecycle assessment of bioenergy a certain amount of emissions is divided among the different products derived from the same production chain. There are various methods to be used in targeting the emissions. In line with the RES Directive (2009/28/EC, at the moment the emissions are allocated based on energy, i.e. the division is based on the energy content share of the products. This means that all the emissions of the biogas production chain are allocated to the energy obtained from biogas as the processing residue is wet and cannot be utilised for energy production.

Measures

55) The impacts of the different ways of allocating the emissions on biofuel production in Finland should be assessed. The assessment is used for influencing the reform of the RES Directive with regard to the grounds for allocation.

8. State of energy and nutrient self-sufficiency

With regard to emergency supplies we should aim for the best possible energy and nutrient self-sufficiency. The carbon footprint of farms that are more self-sufficient in energy and nutrients is smaller than that of farms using a lot of external inputs. Farms should be considered in a comprehensive way. Most Finnish farmers own forest as well, which offers opportunities for the production of energy and various ecosystem services. When considering all impacts of the farm on greenhouse gas emissions we may achieve a state when the farm as a whole in fact functions as a carbon sink.

Measures

56) A calculation model for the farm-specific greenhouse gas balance is developed.

57) A project is launched to create an energy and nutrient self-sufficient farm model.

58) Possibilities are examined to introduce a strategic stockpile compensation payment for farms that have achieved a high level of energy and nutrient self-sufficiency.

9. Food consumption

A quarter of the climate impact of the consumption by the Finns is created by food. Greenhouse gas emissions can be influenced by sustainable food choices. It is important to make it as easy as possible for the consumer to choose food raw materials and meals with the lowest possible climate impacts. What is decisive for the environment footprint of eating is the choice of raw materials, while the impacts of processing, transportation and packaging are small.

Measures

59) Research on the environmental impacts of food raw materials is increased.

60) Consumer-driven advice is developed which brings together the available information on sustainable food choices and facilitates sustainable choices and finding services and tools that promote energy and material efficiency (in line with the Government Resolution on the Programme to Promote Sustainable Consumption and Production “More from Less – Wisely”

Food loss

Throwing away food that is fit for eating is a great economic and ecological burden. Every year the Finns throw away 20–30 kg of food per capita, which is about 5% of the food purchased by households. When converted into greenhouse gas emissions this corresponds to the annual carbon dioxide emissions of about 100 000 passenger cars in Finland. Of all the discarded food as much as 40% could have been eaten but people just rejected it for one reason or another. (MTT Report 41, Katajajuuri et al. 2014).

In catering services the share of food loss is about a fifth of the food intended to be consumed, which gives a total estimated food loss of 75–85 million kilos a year. Most of the loss is waste from the food served, especially in buffets. The main reason for the losses is the difficulty in estimating the consumption.

There are no statistics available on the losses in the wholesale and retail trade of food in Finland, but these are estimated at 65–75 million kilos a year.

Only a rough estimate, between 75 and 140 million kilos a year, can be given of the loss of food fit for eating in the food industry. The peeling and sorting residue in the processing of fruit and vegetables, bran and hulls in the milling industry and by-products from slaughtering are not included in the losses.

The side-streams and losses in primary production depend on numerous factors, including the weather conditions, quality requirements, markets, profitability, conditions for support payments to plant production, production conditions, plant diseases, pests, cultivation techniques and workforce. According to preliminary results, 83% of the wheat crop, for example, ends up in food use and 14% of the side-steam, i.e. part of the production intended for food but is not used as such, ends up as feed for animals. (Foodspill 2, 2014).

Food losses can be influenced by legislation as well. For example, the sanctions against western food imports to Russia put a sudden end to exports to Russia by Finnish food operators. By a decision of the Finnish Food Safety Authority Evira foods requiring cold storage intended for the Russian market were authorized to be sold in Finland without the statutory package labels in the Finnish and Swedish language. (Evira 2014a).

Measures

61) Developing a statistics and follow-up system for food loss.

62) Advance prevention and reduction of food loss all through the food chain through research, quality management and anticipation.

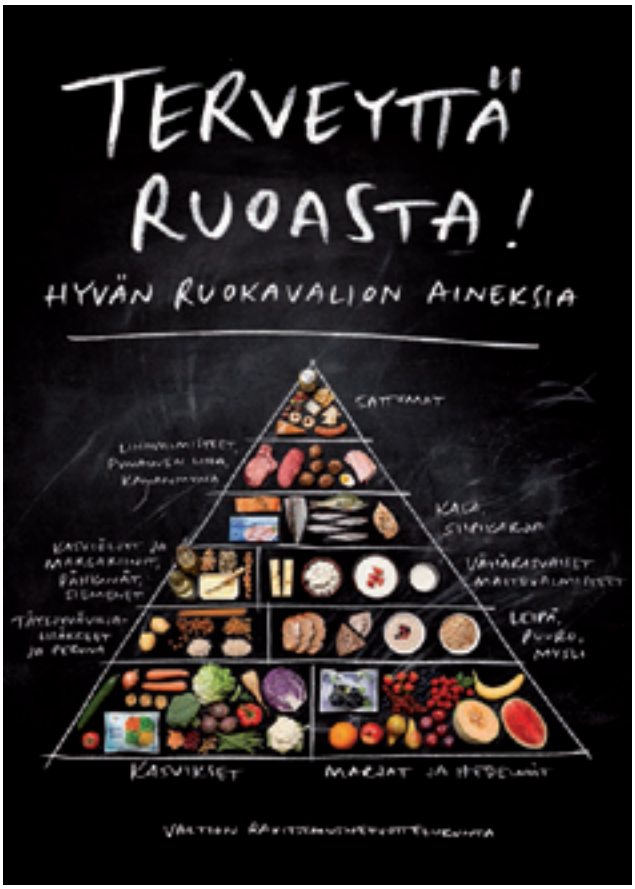
63) Side-streams created in the primary production and further processing of food are primarily utilised as food, then as high value added products and, lastly, in energy production.

    Measure of the Rural Development Programme: aid for investments in non-agricultural activities. Through the measure funding may be available for business activities based on environmental technology and recycling.

64) Increased information, awareness and advice on the impacts of food loss and possibilities to reduce it.

Nutrition recommendations

The National Nutrition Council published the new Finnish Nutrition Recommendations in 2014. The recommendations aim for a health-promoting diet that is also as environmentally sustainable as possible. Sustainable development involves various perspectives, of which the recommendations address just a few. The recommendations encourage to reduce the use of processed meats and red meat from the current levels and to increase the use of vegetables, especially leguminous plants. If the meals were compiled in a way that the share of plant products (vegetables, root plants, cereals, leguminous plants, berries and fruit) and the remedial actions already available were implemented in the food chain, the climate impact of the diet could be reduced by more than 20% during the present decade. (Nutrition Recommendations 2014).



Health from Food. Finnish Nutrition Recommendations 2014. © National Nutrition Council

The implementation of the Nutrition Recommendations is promoted, among other things, by the Government Resolution on promoting new and sustainable environment and energy solutions (Cleantech solutions) in public procurement. According to the resolution, institutional kitchens and catering services should purchase foods that meet the recommendations, as well as organic, vegetarian or seasonal food. The aim should be, to a growing extent, that food choices would contribute to multiple objectives at the same time, including the health, safety and environmental aspects.

Reducing meat consumption

Lower meat consumption is the main means for reducing greenhouse gas emissions from food consumption. Over the past decade, however, the total meat consumption has grown. The consumption of beef has stayed about the same but the consumption of pigmeat and poultry meat has grown.

A decrease in beef consumption is mainly reflected in the import volumes, not in the domestic beef production. This is because in Finland 85% of the beef comes from the dairy breeds and the fact that for the consumer dairy products and meat represent closer substitutes than e.g. meat and vegetables. This means that a consumer who reduces the consumption of meat usually increases the consumption of dairy products and there is no decrease in the dairy herd numbers. (MTT Report 127). On the global scale, however, such decrease takes place. The environmental impacts of cattle husbandry vary according to the location and production method. Meat consumption should also be steered towards the most sustainable production practices, where meat derived from combined dairy and meat production may again be a good alternative.

Consumer choices involve great potential for reducing greenhouse gas emissions, if the consumption is targeted to products with a smaller climate impact than that of meat. (Katajajuuri 2014). Using plant-based protein, even partly, to substitute for the use of meat improves the nutritional quality of the diet and reduces its climate impact.

Measures

65) Developing domestic plant-based protein for human nutrition. Research and development of methods for preparing plant products.

66) A study of the meat consumption volumes in institutional kitchens relative to the nutrition recommendations.

67) Increased advice to institutional kitchens concerning sustainable food choices. Developing the design of menus and recipes for institutional kitchens with the focus on diverse use of sustainable raw materials, with due account of seasonal foods and domestic plant-based protein.

68) Changes to taxation practices with the aim to increase the use of domestic berries, fruit and vegetables.

Photo: Marianna Laitinen, MMM

Communication on sustainable food choices

The understanding of sustainable food choices, including environmental impacts of food products and choices one can make, should be promoted through consistent communication efforts and campaigns relating to the core messages. Environment labels and further development of these (including calculation) are one way to improve consumer awareness of the environmental impacts of food and environmentally sustainable consumer choices. By means of the food carbon footprint we can communicate the amount of greenhouse gas emissions created during the whole lifecycle of foodstuffs. As yet there are no internationally approved practical guidelines for calculating the carbon footprint, but Finland has adopted the first practical guideline in the world for calculating the climate impacts. (Foodprint 2012).

Measures

69) Compiling a uniform databank on sustainable food choices and using this as a basis for a communication campaign targeted to consumers

70) Support for supplementary education of teachers and up-to-date learning material production for teaching about the environmental impacts of food production and consumption at different education levels.

71) Developing the calculation of the food carbon print.

Traceability and responsibility systems

The various properties of food, also the intangible ones, must be traceable in a verifiable manner, starting from raw material production and use of production inputs. The aim should be a standardised traceability and responsibility system for the food chain, which would be audited on a regular basis and developed systematically. The traceability and responsibility system provides the consumers with even more accurate information on the origin and production method of food and the consequent, real and verifiable responsibility factors/dimensions relating to food. (Food Policy Report 2010). The seven dimensions of responsibility in the food chain are: environment, product safety, nutrition, occupational welfare, animal welfare, economic responsibility and local origin (MTT 2009).

Measure

72) Developing sector-specific and verifiable responsibility and traceability systems that are based on true information. In preparing these, due account is given, as far as possible, to all the dimensions of responsibility relevant for the specific sector.

Local food

A Government Resolution was issued in May 2013 on the Government Programme on Local Food to 2020. For the purposes of the programme local food means, in particular, food that promotes the local economies, employment and food culture of the regions and that is produced and processed from local raw materials and marketed and consumed locally. In this context “local” refers to a region (“maakunta”) or a corresponding or smaller area. (Local Food 2013).

The climate impact of local food depends on the product and production method as well as logistics. According to studies of the Agrifood Research Finland, in the case of local food the share of transportation in the climate load may be as high as 20–30%. This is the case, for example, when small lots are transported separately to the consumers. In other respects, too, local food does not necessarily involve any major reductions in greenhouse gas emissions but the climate impact of food depends largely on production efficiency, optimising the use of fertilisers, growth potential of the land and soil type. (Roininen & Katajajuuri 2014). However, it is possible for the consumers to get information on the climate impact of local food from the producers, which also makes it possible for them to contribute to reducing the load through their choices.

Measure

73) Research on the climate and other environmental impacts of local food and reducing negative climate impacts.

10. Potential future measures

Various means have been studied to reduce greenhouse gas emissions from agriculture. Some of these are applicable already at present, as also described above. Some of the means call for further study or implementing them is not considered feasible, at least for the time being.

Adding turnip rape oil to animal feed

The possibility to add turnip rape oil to animal feed has been studied as a mitigating action relating to animal feed. The obstacle to implementing this measure is the high costs relative to the reduction in the carbon dioxide equivalent per tonne (43 €7CO2 eqv t). Another problem is the supply of turnip rape and rape. (MTT Report 127).

Afforestation

Afforestation reduces carbon dioxide emissions and the growing stock increases the carbon sink in the biomass. Afforestation of peatlands reduces carbon dioxide emissions in the long term, even if they stay on a high level for decades after the afforestation. The

reason for this may be the groundwater level relative to land surface in afforested arable lands which may in some cases be optimal for N2O production. The calculated benefit of afforestation is realised only after decades as the arable land gradually turns into a carbon sink. (MTT Report 127). In Finland, however, there is very little arable land, about 8% of the surface area (Tike 2014b and Statistics Finland 2014a), while there is forest land in abundance, 86% (Metla 2013). Agricultural lands that have been cultivated for a long time create open farming landscape and produce important benefits with regard to biodiversity. In Finland arable lands have been cleared where this has been possible considering the topographic factors and what is the most sensible for practising agriculture. In the Finnish conditions afforesting the already scarce arable land areas is also not on a sustainable basis in terms of the security of supply.

11. Compatibility of different steering instruments

In general policy coherence means that the various policies and steering instruments are compatible with each other. This means that the signals and incentives given by the steering measures of the public power do not conflict with each other but that they contribute to achieving the objectives set in the society. Policy coherence is important with regard to economic efficiency and effectiveness of the policies. Because of the large number of varying social policy objectives it is impossible to achieve full coherence between all policy instruments, but potential problems with regard to coherence should be identified and, a far as possible, removed or restricted. The issue of policy coherence continues to be highly topical due to the new cross-sectoral social challenges. Climate change and adaptation to it is a good example of a policy issue which cannot be addressed from the perspective of just one or two sectors. (Ilpokohe 2012)

Measures

74) Coordination of the agricultural, environmental, climate and energy policies.

75) The realisation of cross-cutting themes (environment, climate, innovation) is ensured in the implementation of the Rural Development Programme.

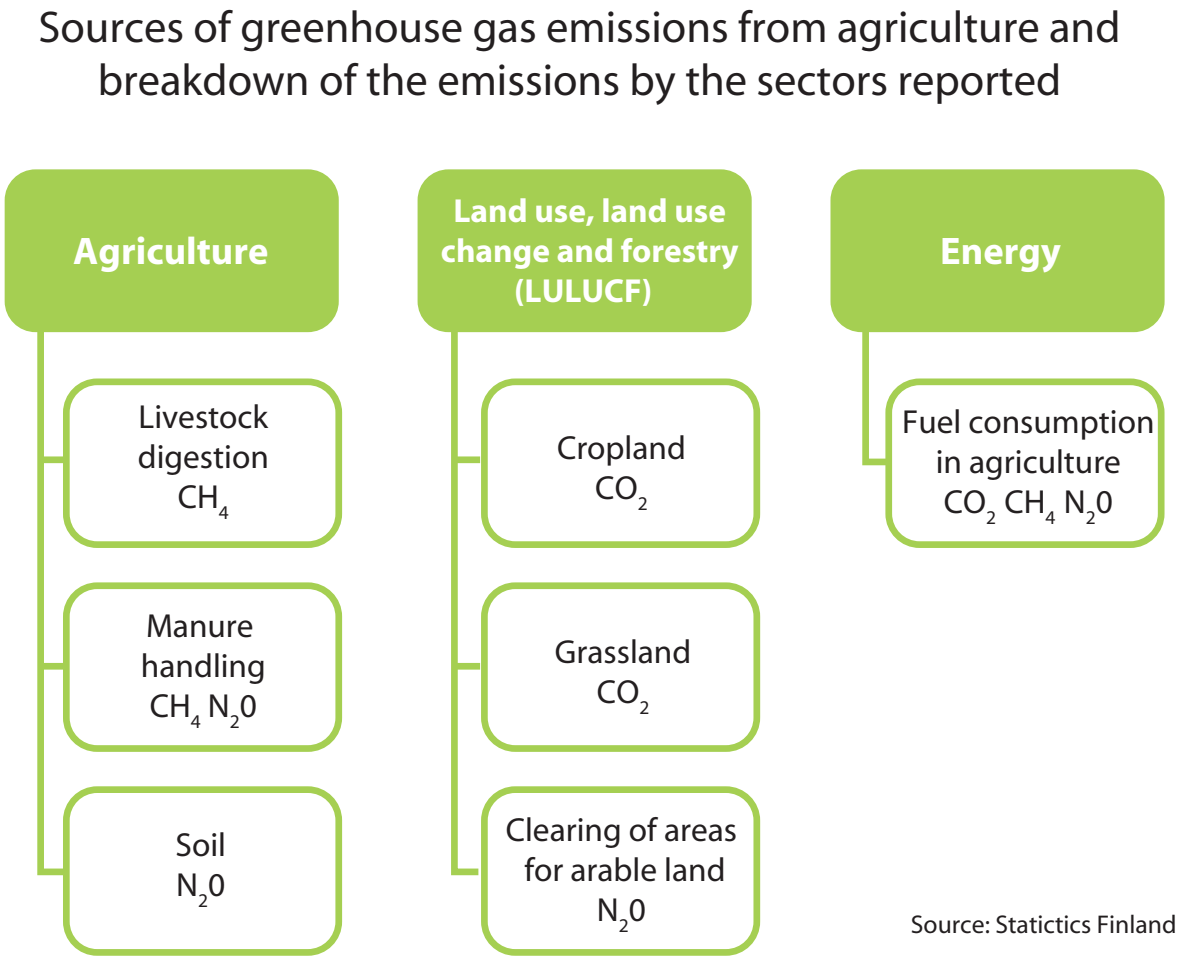


Figure: Sources of greenhouse gas emissions from agriculture and breakdown of the emissions by the sectors reported.

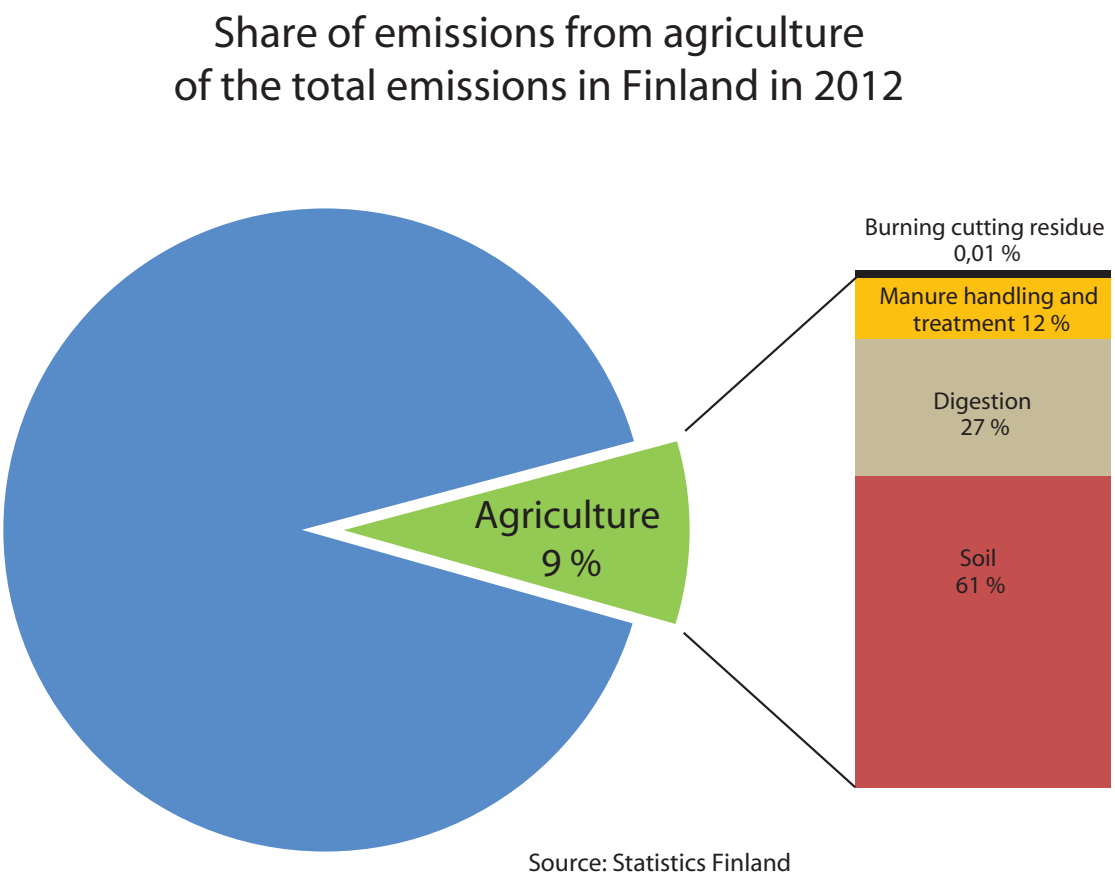


Figure: Share of emissions from agriculture of the total emissions in Finland in 2012.

6. Greenhouse gas emissions from agriculture

1. Reporting of greenhouse gas emissions

As a party to the UN Convention on Climate Change and the Kyoto Protocol, Finland is committed to annual reporting of the information on greenhouse gas emissions to the international climate convention. The Statistics Finland is the national responsible body with regard to the greenhouse gas inventory. The calculation of the inventory is based on guidelines issued by the Intergovernmental Panel on Climate Change. Emissions can be calculated using the default coefficient of the IPCC or by national methods. (MTT Report 127).

Greenhouse gas emissions created in agriculture are reported for the agriculture, land use (LULUCF, i.e. land use, land use change and forestry) and energy sectors. The sum of the emissions reported for these three sectors represent about 20% of the total emissions in Finland. In addition to this, the emissions from the manufacture of fertilisers relating to agricultural production are reported as emissions from the manufacturing industry. (MTT Report 127). At the Yara nitric acid plant which manufactures fertilisers in Finland a catalytic nitrogen removal system was installed in 2009, resulting in almost 90% lower nitrous oxide emissions from the manufacture of nitric acid than before. With regard to the total emissions from the manufacture of fertilisers this means a reduction of 40–50%. (MTT Report 9). We should also bear in mind that chemical nitrogen fertilisers are manufactured from unrenewable energy, mainly natural gas.

In 2012 the imports of feed materials, feed additives and premixtures to Finland totalled about 320 million kg. These import statistics do not include the oilseed and beans imported by oil pressing mills. (Evira 2014b). The growing demand for soya for protein feed creates pressures to clear rainforests for soya production especially in Brazil, which means that the import of protein feed has significant indirect climate impacts.

The emissions from agriculture are composed of scattered biological emission sources that are very difficult to measure and report. It is important to develop calculation models for the reporting to reduce the uncertainty involved in the reporting and calculation of greenhouse gases and to take account of the special national characteristics.

Measure

76) Developing calculation methods for emissions and removals in agriculture relating to the climate.

2. Greenhouse gas emissions with climate impact and trend in these until 2035

Agriculture sector

Reporting on the agriculture sector covers the methane (CH4) and nitrous oxide (N2O) emissions. Methane emissions are created in the metabolism of domestic animals (27% of the emissions of the agriculture sector). Microorganisms in the abdomen of ruminants produce methane as they decompose feed. Ruminants are the greatest source of emissions, but these are also produced in the metabolism of other animals. (MTT Report 127).

Handling and treatment of manure (animal housing and manure stores) causes CH4 and N2O emissions as the gases in manure are released into the air and the organic matter in manure decomposes during storage (12% of the emissions of the agriculture sector). There are N2O emissions from the soil produced by soil microbes due to all nitrogen added to the soil (industrial fertilisers, manure, sewage sludge), fixing of nitrogen by plants, plant residue and decomposition of organic matter in organic soil. These are called the direct emission sources. Indirect N2O emissions are created by nitrogen leaching and fallout of ammonia emissions. Emissions from the soil represent about 60% of the total emissions from agriculture (does not include soil carbon dioxide emissions). (MTT Report 127).

Land use sector

Reporting on the land use (LULUCF) sector covers carbon dioxide emissions and sinks (CO2) relating to land use and changes in land use. For reporting purposes the surface area of Finland is divided into six land use categories (forest land, cropland, grassland, wetlands, settlements and other land). Of these, emissions related to agriculture are created on cropland and grassland. Most of the grassland is abandoned arable land, but the area of over 5-year old grasses has been added to this. The surface areas of all land categories are obtained from the national forest inventory (NFI).

Croplands and grasslands are further divided into sub-categories for emission calculations using the statistics of the Information Centre of the Ministry of Agriculture and Forestry (Tike). For croplands sub-categories are needed e.g. to divide arable lands with organic soil into those under grass and arable lands with mineral soil into several sub-categories according to the tillage method. The calculated carbon dioxide emissions from land use are caused by changes in the carbon stocks in mineral soil, decomposition of organic matter in drained organic soil, and liming (in 2013–2020, however, the emissions from liming are included in the reporting on the agriculture sector). In addition, the calculations include a small amount of N2O emissions from land clearing on mineral soil as the decomposing matter includes nitrogen as well.

In 2012 the emissions of the LULUCF sector relating to agriculture represented about 12% of the total greenhouse gas emissions in Finland.

Energy sector

Emissions from the energy sector relating to agriculture include the use of fuel in agricultural machinery and heating of agricultural buildings (e.g. drying of cereals). Plants producing more than 20 MW (e.g. heat plants of certain greenhouses) are included in the emissions trading sector. Because the emissions from the use of energy in agriculture are only a small share of the emissions of the energy sector, any energy savings in agriculture and increased use of renewable energy may go unnoticed and may not be considered achievements of the agricultural sector in particular. (MTT Report 127).

In 2012 the emissions from the use of energy in agriculture represented about 2% of the total greenhouse gas emissions in Finland. (Statistics Finland 2014b).

Estimated trend in emissions from agriculture

In the baseline scenario for the agriculture sector the emissions are expected to grow by 4.2% in 2005–2020. The trend for 2020–2030 shows a slight decrease and in 2030 there is again some growth. Between 2011 and 2035 the emissions are estimated to grow by 0.2 Mt CO2 eqv. In 2012 the emissions from agriculture totalled 5.7 Mt CO2 eqv. The increase in the emissions is due to the growth in the size of animals and in their productivity, increased sales of mineral fertilisers and growth in the area of peatlands used for cultivation. (GAF 2013).

Some increase, 0.8 Mt CO2 eqv, is expected in the emissions of the LULUCF sector related to agriculture by 2025. In 2012 these emissions totalled 7.3 Mt CO2 eqv. The growth is mainly due to the increased cultivation of peatlands. (GAF 2013).

7. Climate policy objectives of agriculture

1. International climate policy

The aim of the UN Framework Convention on Climate Change, adopted in 1994, was to bring the emissions of industrialised countries (listed in Annex I to the agreement) back to the 1990 level by the turn of the millennium. The parties to the agreement were obliged to establish their greenhouse gas emissions and removals due to the sinks. The Kyoto Protocol obliges the industrialised countries to reduce the emissions of six greenhouse gases or groups of gases by the average of 5.2% from the 1990 level in 2008–2012, i.e. the first compliance period. The aim of Finland was to bring the emissions down to the 1990 level in 2008–2012. (UNFCCC 1994). This emission reduction target was reached and, in fact, exceeded (Statistics Finland 2014c). The emissions obligations also take account of the impact of sinks (forests, soil).

The second compliance period of the Kyoto protocol covers the years 2013–2020 and the number of participating countries is smaller than in the first compliance period. The protocol specifies individual emission reduction targets for the parties. During the period the allowable emission levels are cut if they exceed the realised emissions of 2008–2010. The current emissions reduction actions will not be sufficient to stop global warming at below 2 degrees, which means that in the negotiations concerning the post 2020 climate agreement means are being sought to tighten the emission reductions already before 2020 (MTT Report 127).

2. EU climate policy

The aim of the 2020 Climate and Energy Package adopted by the EU in 2008 is to reduce the total greenhouse gas emissions by 20% from the level of 1990. The share of renewable energy in the EU should be raised to 20% of the end-consumption of energy (the objective for Finland decided by the EU is 38%) and energy efficiency should be increased by 20% compared to the baseline trend. The share of transportation biofuels should be raised to 10%. (Ministry of Employment and the Economy 2008). About 60% of the greenhouse gas emissions in the EU come from sectors not covered by the EU emissions trading scheme. The decision on burden sharing concerning sectors excluded from emissions trading (No 406/2009/EC) specifies binding obligations for emissions excluded from the trading scheme in the whole EU. According to the burden-sharing decision, by 2020 Finland has to reduce the emissions of sectors excluded from the trading scheme by a total of 16% from the 2005 level.

In 2012 the greenhouse gas emissions in Finland totalled 61 million tonnes CO2 eqv, of which 29.5 million tonnes CO2 eqv came from the sectors covered by emissions trading. The EU emissions trading scheme covers the carbon dioxide emissions of large industrial plants and installations with a rated thermal input exceeding 20 MW. In Finland the scheme also covers installations producing district heat up to 20 MW or less. (Statistics Finland 2014d).

The Communication of the European Commission "A Roadmap for moving to a competitive low carbon economy in 2050" (COM (2012 112) specifies ways to reduce emissions by 80% by 2050.

The Decision of the European Commission and of the Council No 529/2013/EU changed the reporting on the LULUCF sector. Reporting on the emissions and sinks relating to the management of croplands and pastures is mandatory within the EU as from 2021. The Member States were also obliged to report to the Commission on their LULUCF actions by July 2014.

Ammonia emissions are not greenhouse gas emissions but they impact on air quality. Ammonia emissions are regulated by the National Emission Ceiling Directive (2001/81/EC). The ammonia emission ceiling set for Finland in the directive for 2010 is 31 kilotonnes, which corresponds to an 11% reduction in ammonia emissions from the level in 1990. In 2011 the emissions totalled 37.1 kilotonnes, which exceeds the target by almost 20%. The reasons for exceeding the ammonia emissions ceiling include more advanced inventory method and the fact that the necessary measures were not taken in the agriculture sector, which accounts for about 90% of the ammonia emissions. (Grönroos 2014). The so-called climate protection package issued by the European Commission to the European Parliament and Council on 18 December 2013 (Commission 2013a) includes a proposal to amend the Emission Ceiling Directive (Commission 2013b), but the proposal would not change the target set for Finland.

According to the Commission Communication "Towards a circular economy: A zero waste programme for Europe" issued on 2 July 2014, changing Europe into a circular economy involves more efficient nutrient recycling, creation of new jobs and adoption of new business models as well as reducing the environmental impacts of greenhouse gas emissions. (Commission 2014a).

Climate and energy policy framework until 2030

The European Council adopted a framework for the EU climate and energy policy in October 2014. The binding emission reduction target for greenhouse gases within the EU was set at 40% from the 1990 level until 2030. The lower emission reduction potential of agriculture compared to other sectors is recognized in the Council conclusions, which also stress the importance of ensuring the reconciliation of the objectives concerning food security and climate change. The European Council requests the Commission to examine the best ways of increasing food production in a sustainable manner. (EC 2014).

3. National climate and energy policy

The Long-term Climate and Energy Strategy 2008 (Ministry of Employment and the Economy 2008) allocates the greenhouse gas emission reduction target for individual countries in the non-emissions trading sector established in the EU climate and energy package as targets for specific sectors. According to these, the emissions from the agriculture sector should be reduced by 13% from the 2005 level until 2020 (the means are listed in Annex 1). The Government updated the strategy on 20 March 2013 (Ministry of Employment and the Economy 2013) and submitted it to the Parliament as a Government Report.

The Government Foresight Report on Long-term Climate and Energy Policy presents a vision for the national policy until 2050.

In June 2014 the Government gave a legislative proposal to the Parliament concerning a new Climate Act. This is a target-oriented framework act concerning the state authorities, mainly applicable to emissions excluded from emissions trading.

Based on research (GAF 2013) the maximum total technical emission reduction potential in the agriculture sector (methane and nitrous oxide) without reducing the production volumes would be 9.5%. This could be achieved if all of the following emission reduction actions were implemented at the same time:

- Increase in the use of turnip rape oil in the feeding of dairy cattle by 0.5 kg a day (would reduce emissions from agriculture sector by 1.1% by 2035).
- Biogas produced on half of the total number of large farms (would reduce emissions from agriculture sector by 2.8% by 2035).
- Cultivation practices for organic soil and restraining land clearing: afforestation of 3 000 ha of arable land per year, increasing grassland area from 40% to 80%, controlled subsurface drainage for the whole grassland area (would reduce emissions from agriculture sector by 15% by 2035).

It should be noted that the scale of the impact of the different measures with regard to achieving the emission reduction potential varies a great deal.

8. International climate initiatives

Several climate-related initiatives concerning agriculture have also been introduced outside the international climate negotiations. Finland is a party to the Global Methane Initiative GMI, Climate and Clean Air Coalition CCAC and Global Research Alliance on Agricultural Greenhouse Gases GRA.

The various initiatives should not be overlapping with the existing initiatives and work that is already being done. Special attention should be drawn to the mutual complementarity of the initiatives and the national benefit and added value to be derived from them.

Global Methane Initiative GMI

The Global Methane Initiative, launched in 2010, is a voluntary multilateral cooperation initiative which aims for a reduction in methane emissions on the global scale. Besides reducing emissions the initiative aims to increase the use of methane as a source of energy. GMI promotes the creation of markets for renewable energy, disseminates information on various technologies, and aims to remove the obstacles to reducing methane in the partner countries.

Climate and Clean Air Coalition CCAC

The Climate and Clean Air Coalition established in 2012 aims to increase the awareness and research relating to the impact of factors that influence the climate on a short term and support processes by which such emissions can be reduced. CCAC functions mainly through precisely targeted initiatives.

Global Research Alliance on Agricultural Greenhouse Gases GRA

The Global Research Alliance GRA was established in 2009 and Finland joined the alliance in 2010. The purpose of GRA is to promote research collaboration concerning the climate impacts of agriculture and reduction potential of greenhouse gas emissions. The leading idea in the GRA work is to create a research network that functions as freely and without limitations as possible for global-scale collaboration between researchers working on greenhouse gas emissions from agriculture. The Finnish liaison organization in the GRA is Agrifood Research Finland MTT.

9. Steps towards a productive and sustainable food system

A climate-wise production system is one that is productive relative to the surface area used and the fossil and other unrenewable energy resources and resilient and adaptive in changing climate conditions, as well as minimizes the emissions relative to a kilo of raw material produced. The steps towards sustainable consumption include the application of the new national nutrition recommendations, reducing meat consumption, preference for local and seasonal food produced in a sustainable manner and avoiding losses all through the food chain.

Climate change is a great challenge for all sectors of the society, also for agriculture, which is why climate change adaptation and mitigation must be taken into account at all stages of our food system. For agricultural production there are technical solutions to improve production efficiency, facilitate adaptation to climate change and restrain the creation of greenhouse gas emissions. In all this best possible use should be made of the knowledge and skills of the farmers. There may also be conflicts between the production and environmental objectives.

Well-managed soil is highly productive and capable of adapting, thanks to the better water retention capacity. Seeing to the good growth potential of the land also supports the carbon objectives as more carbon is sequestered into the soil. Appropriate use of plant nutrients improves productivity and contributes to mitigation, while diverse crop rotations reduce the risks to farmers and enhance their adaptation capacity. Promoting domestic feed production improves the security of supply and makes us less dependent on the volatile world markets, as well as reduces the negative climate impacts of agricultural production.

Coordinated and consistent communication and increased awareness relating to the climate impacts of food choices steers the consumption into a more sustainable direction. Compliance with the national nutrition recommendations increases vegetable consumption and reduces the demand for meat, which diversifies the domestic consumption patterns and allows for higher self-sufficiency with regard to meat. In the future the consumers will be steered towards even more sustainable consumption. In this context Finnish food derived from sustainable production is well placed on the market.

By implementing the measures proposed in the Climate Programme for Agriculture we can promote a sustainable and productive agriculture through all the available means. Strong inputs in the implementation of the Rural Development Programme, projects promoting the functioning of the food chain, activating the operators, and research and development offer excellent opportunities to promote sustainable and productive food production and consumption.

Annex: Means of the National Climate and Energy Strategy for reducing emissions from agriculture

With regard to reducing emissions from agriculture the means listed in the strategy are the following:

- Reducing greenhouse gas emissions and energy savings targets are taken into account in all agricultural support policy planning.
- Manure handling and treatment methods that are beneficial for the environment are promoted. More efficient production and use of energy crops for energy production and use of agricultural side streams and manure especially in biogas production.
- Finland strives to amend the EU State Aid Guidelines to allow the introduction of national measures to restrict greenhouse gas emissions.
- Study of means available for reducing greenhouse gases in organic soils besides cultivation of grass on peatland included in the environment payment.
- Study of measures by which the current livestock production volumes can be achieved with even lower greenhouse gas emissions.
- Research and development of statistical methods concerning uncertainties relating to soil emissions data and for better monitoring of land use changes to allow for correct targeting of emission reduction actions.

In addition, the chapter on bioenergy production includes the objective of promoting the production of energy crops and use of agricultural side streams and bioenergy derived from manure in the form of e.g. biogas so that the amount of renewable energy based on this reaches the level of 4–5 TWh.

The 2008 Climate and Energy Strategy was updated in spring 2013. With regard to agriculture the updated strategy lists the following principles:

- Measures related to climate change mitigation will be planned and implemented so that they do not jeopardise Finnish agriculture or global food security.
- Research on emissions from land use and agriculture, and on efficient ways of reducing emissions, will be increased to facilitate the correct targeting of measures.
- Food waste will be reduced at every stage of the food chain, while emphasizing the importance of food choices in reducing greenhouse gas emissions. Consumers, in particular, will play a key role in this.
- In developing and promoting the energy use of biomass of agricultural origin, the focus will be on non-food biomass.
- Measures to develop closed nutrient and material cycles in agriculture-based energy production will be promoted.

In addition, the chapter on bioenergy production includes the objective of promoting energy efficiency on farms.

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