

Research Program for Organic Food and Farming in Finland

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Abstract

The Finnish Ministry of Agriculture and Forestry started a three-year Research Programme on Organic Food and Farming in 2003. The programme consists of 15 projects on different themes covering the whole food chain and has an annual budget of about 2.2 MEUR. All ongoing projects on organic food and farming in Finland can be found at the web site <http://www.agronet.fi/luotu/eng/index.htm>

Introduction

In Finland, 7.6 % of the total arable area and 6.9 % of the farms were fully organic or in conversion in 2004, with 12.8 % of the organic farms having animal production. The Finnish Ministry of Agriculture and Forestry (MAF) has set a target to increase the area under organic farming to 15 % of the total area of arable land by 2010.

The volume of research in organic agriculture has been at the level of 2.5 MEUR annually in recent years. The main financial efforts in organic farming research has been supported by the Finnish Ministry of Agriculture and Forestry (MAF) either through the budgets of its research institutes (mainly MTT Agrifood Research Finland) or by financing research projects from its non-preallocated research budget. The Academy of Finland and Tekes - the National Technology Agency - have also supported research in organic farming, but only in a small number of projects.

Main research centres carrying out research on Organic Food and Farming in Finland are MTT Agrifood Research Finland (www.mtt.fi/english/), Helsinki University (www.helsinki.fi/university/), National Consumer Research Centre (www.kuluttajatutkimuskeskus.fi/english/index.html) and VTT Technical Research Centre of Finland (www.vtt.fi/vtt/inbrief/).

In 2003, MAF started a three-year Research Programme on Organic Food and Farming with 15 projects on the topics: Quality and risks of organic food, Consumer oriented product development, Maintenance of soil fertility, Safe recycling of organic waste, Improved production of organic milk and meat, Animal welfare and organic farming, Local food systems, and Role of organic farming in multifunctional and pluriactive agriculture. The annual budget for this programme is about 1.1 MEUR from MAF with a further estimated 1.1 MEUR coming from the budgets of the institutes involved in these projects.

Plant production and soil quality

Under this theme, there are six projects: 'Control of potato late blight by caraway oil in organic farming', 'Disease management in organic seed potato production', 'Red clover efficiently into organically produced milk', 'Development of meat-bone meal as organic fertilizer', 'Waste composts in organic crop production – future risks and possibilities' and 'On-farm soil quality assessment'.

Potato late blight, caused by the oomycete *Phytophthora infestans* (P.i), is the main factor determining the length of the growing season for organic potato, by killing the canopy. In Finland there are currently no compounds available for direct blight control in organic production. Caraway (*Carum carvi*) seeds contain biologically active essential oils, which have shown potential as a biocontrol against potato late blight. The project includes experiments on the extraction of caraway oil, formulation and efficiency. In field conditions, caraway oil has delayed the onset of late blight for about 10-14 days. Changing towards more diverse crop rotations and better control of nitrogen release

can delay the onset of blight epidemics considerably. Increasing row spacing and mechanical defoliation have very limited value in blight control.

Red clover (*Trifolium pratense*) is the most common fodder legume in Finnish organic grasslands. The persistence of clover is often poor after the second production year. The focus in the project is to provide tools for farmers to choose the best red clover varieties for their fields, based on yield production, resistance to pathogens and over-wintering. Plant physiological, molecular biological and statistical methods are used. The spatial variation of soil characteristics, nitrogen fixation of red clover and yield of clover-grass leys are studied also. The over-wintering of a red clover variety seems to be essential for persistence of a red clover sward. A variety which might not be the most productive at the beginning of growth but accumulates nitrogen and carbon in its roots, seems to be the most persistent and most productive in the long run. Fourteen *Fusarium* strains were collected from swards and only one could infect red clover, being able to penetrate the clover cells. The variation within a field of the yield and clover content of a red clover-grass sward can be surprisingly high. Very preliminary results show a slight correlation between sward yield and some soil characteristics, such as pH, potassium, manganese, cobalt, copper, molybdenum and iron.

Recirculation of nutrients from municipalities back to the fields is one aim of organic farming. Organic wastes such as composted waste from municipalities and meat/bone meal are often considered unwanted material because of possible contamination by heavy metals and microbiological risks. In Finland it is not permitted to use them in organic production at the moment, but their fertilizer value and risks of use are being studied in two projects. Biowaste composts were tested in one field experiment as a fertilizer for potato and cereals. The microbiological quality (*Salmonella*, Coliforms, Colifages, Clostridia) of the composts was analysed as well as the nutrients and heavy metals. Meat/bone meal was studied as a fertilizer for cereals on farms. According to the microbiological and chemical analyses, all the tested composts were suitable for use as plant fertilizers. However, quite large amounts of compost are needed to satisfy the nutritional demands of plants. Farmers who used meat/bone meal as a fertilizer for cereals were quite satisfied with it, but spreading the greasy and fine material was problematic on many farms. Farmers would have liked a pelleted or pilled form of the meat/bone meal. The fertilization effect was clearly visible on their fields.

At present, testing of soil fertility is based on chemical analysis. Organic farming is dependent on biologically-mediated processes and the function of the whole soil system. Therefore soil quality should be seen as the soil's ability to function, depending on the intended usage. A practical soil quality test for on-farm use is being developed by modifying an existing soil quality test kit to make it suitable for Finnish conditions. See more: Nykänen et al. 2005a.

Animal husbandry and food safety

Under this theme, there are five projects: 'Red clover efficiently into organically produced milk', 'Quality beef with efficient suckler cow production', 'Emerging food-borne pathogens (EHEC) in primary production', 'Risk assessment on food safety risks in organic pork production: pathogenic *Yersinia* and *Listeria monocytogenes*' and 'Organic egg production: management of animal welfare and food safety'.

Organic milk production is largely dependent on the supply of nutrients from forage. The most important forage legume in Finland is red clover (*Trifolium pratense*). More information is needed to improve the determination of the energy and protein values of red clover and to measure the nutrient supply and milk production responses of dairy cows on diets containing red clover. The energy and protein values of red clover were measured *in vivo* with sheep and using the omasal sampling technique with rumen-cannulated dairy cows. Red clovers' content of indigestible neutral detergent fibre challenged the traditional rumen liquor or commercial cellulase-based laboratory methods successfully in estimating the digestibility of red clover silage. Contrary to pure grass silage, delayed harvest of pure red clover silage did not decrease the supply of nutrients to dairy cows. The main reason was the decreased intake of early-cut red clover silage. An Internet service which presents red clover and grass digestibility (using separate equations for each species) based on cumulative temperature and geographical location within Finland has been developed to assist in correct timing of forage harvest. The optimal harvesting time for a mixed ley with 50 % red clover was approximately one week later than that for a pure grass ley.

Suckler cow production suits organic meat production well and has not reached the demand volume of consumers in Finland. To improve the narrow profit margin of cattle and sheep enterprises, it is necessary to develop methods to increase the efficiency of forage use. In the project, feeding experiments with suckler cows and bulls were carried out to evaluate different feeding strategies and the effect of forage digestibility on meat production. The results suggest that suckler cows can be fed every third day without harmful effects on the performance, thus reducing the labour requirement and improving better profitability. The performance of growing bulls was greatly affected by the digestibility of the grass silage offered, while the protein content of the concentrate had no effect. An increase in fodder digestibility of 5 % points increased the meat production of beef bulls by about 190 g day⁻¹. Mixed grazing of suckler cows and sheep proved to be a promising way to intensify pasture utilization. Calves of suckler cows grew 10-15 kg per animal more if there were no sheep with them on pasture. The sheep produced 19 kg of meat each when they were on the same pasture with suckler cows and their calves. This can be considered as extra production from the pasture. Also, white clover grew better and weeds like Rumex were controlled better if sheep were together with suckler cows.

It has been suggested that due to different husbandry practices in organic and conventional farming, differences may exist between them in microbiological food safety. As food safety starts on the farm, a simple but comprehensive method for evaluation of farm level hygiene is needed. An ideal method would be objective, feasible and applicable to different production types and farm sizes, and should help to identify dubious husbandry practices on individual farms. The method being developed is based on an enquiry about hygienic practices at the farm level. The method of assessing farm hygiene proficiency will be connected to the detected prevalences of pathogens (*Yersinia enterocolitica*, *Yersinia pseudotuberculosis* and *Listeria monocytogenes*). Cattle are now widely accepted as a major reservoir of E. coli O157:H7 (EHEC). The prevalence of EHEC is not well known in Finland and the effects of different farming systems on the prevalence are not known. In the project, the prevalence of E. coli O157:H7 on conventional and organic cattle farms was investigated with test samples from farms. Faecal samples and barn surface samples were collected from 126 cattle farms, of which 54 were organic. E. coli O157 was found on seven farms, of which two were organic. See more: Nykänen et al. 2005b.

Economics, food and markets

Under themes, there are five projects: ‘Local food system: impacts and learning challenges’, ‘Consumers, decision makers and local or organic food. Possibilities of SMEs’, ‘Interaction between actors of organic demand-supply chain’, ‘Specialisation of organic farms through co-operation’, ‘Frontiers of organic and conventional farming technologies – environmental efficiency, productivity and learning’ and ‘Quality beef with efficient suckler cow production’.

Concurrent with globalisation is a growing interest in local food; this is also the case in Finland. It is assumed that increasing use of local food, either conventional or organic, has impacts on the environment, landscape and economics. This is studied by using and developing agri-environmental and regional economic models. For the investigation of learning challenges, selected food chains and their networks are qualitatively analyzed by interviews and an actor meeting. All data are centred around a rural municipality case and its region. The environmental impact of various dietary options relying on local food is assessed in terms of nutrient balance, greenhouse gas emissions and the landscape. In the area studied there is enough agricultural land to supply all the food needed for local consumption even if the food is produced organically. Preliminary results suggest that the socio-economic changes as well as the environmental and landscape impacts of increasing local food are rather small. On the national level, greenhouse gas emissions could be markedly reduced if, e.g., imported vegetables were replaced by domestic produce.

The attitudes of consumers and local decision makers to local and organic food are of interest and important when markets for organic food and the functioning of demand supply chain are developed. Local and organic food offers alternatives and opportunities for consumers, actors of food systems and local SMEs. The attitudes and views on local and organic food as well as the demand-supply chain of the organic food system were studied using qualitative and quantitative methods. Different types of interviews, questionnaires and focus group discussions with consumers, decision makers and actors at different levels of the food chain were applied. According to the preliminary results, both consumers

and decision makers have a better understanding of organic food than of local food. Organic food production is defined by legislation. In general, attitudes are quite positive to both local and organic food. Organic food was associated with cleanness or purity, referring to the method of production, not so much to the product itself. Surveys of consumers and supply chain actors indicate that the changes in the conventional food system have had an impact on the organic chain too. Other obstacles to the optimisation of the organic food chain are the unbalanced power structures between actors of the chain who have divergent objectives, and poor communication between the end consumers and the actors of the chain.

In organic production, specialisation has been feasible only up to a certain point. Co-operation can bring even larger benefits in organic production than in conventional production. On animal and cereal farms it would allow farmers to specialise in their respective lines while safeguarding a sufficient nutrient rotation. This would be highly sensible also in terms of environmental impact. The first stage of the study has studied existing co-operation models in five co-operating rings of farms and the second stage will create co-operation models between different lines of production. The models aim at optimising production environmentally, economically and functionally compared to farms operating alone. The benefits of the co-operation were experienced as lower production costs, specialisation of professional skills, more free time, better or wider crop rotation, more efficient use of green manure as fodder and better use of manure as fertilizer and better profitability.

The environmental efficiency of farms is one way to measure the environmental impact of agricultural production. The trade-offs between conventional production (in)efficiency and environmental (in)efficiency are identified to recognize potentially contradictory targets implemented in agricultural-environmental policy. Another way to assess the environmental impact of agricultural production is determination of shadow prices for environmentally detrimental outputs. The shadow values derived reflect the costs of the negative environmental effects of agriculture. The results of environmental efficiency show that public goods produced by organic farming have to be added to the efficiency of input-output calculations. The theoretical model also shows that if the payment of organic subsidy is to be explained by the public goods produced by organic farming, the subsidy must be based on the value of the public goods, not the market share of organic products. When comparing how efficiently livestock farms use their resources, our preliminary results indicate that the representative organic farm is found to be technically more efficient relative to its own technological frontier than is the representative conventional farm.

Suckler cow production is a branch of livestock farming which may increase strongly in Finland, because the Finnish EU quota for suckler cows is not fully utilised. This could especially increase organic beef production. The low interest in suckler cow production is mainly due to the low profitability of this line of production. The economic return on suckler cow production is studied with model calculations and on the basis of data from actual suckler cow farms. The profitability of investments is calculated using the real option method. There are opportunities to improve the economic performance of Finnish suckler cow farms by increasing the unit size, utilizing effectively the low-price fodder from pasture and decreasing the labour input with rational feeding and handling systems, for example. Besides, low capital costs can help to achieve an economic return that is competitive with other lines of production. See more: Nykänen et al. 2005c.

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