Preface

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Presently, Finnish environmental discussions are strongly focused on relationships between modern agriculture and the quality of surface waters. In the EU countries, public concern about the off-site effects of agriculture has led to the initiation of common legislation, as the Nitrates Directive, against excessive use of fertilizers and manure. More recently, the Water Framework Directive is under execution and a corresponding framework for protection of soils is under preparation. In Finland, however, voluntary adoption of environmentally sound agricultural practices has so far been the main strategy to reduce the negative side-effects of farming. Voluntary measures have been widely supported since 1995 by the Finnish Agri-Environment Program (AEP) with both EU and national funding of approximately 300 million euros per year. By 2006, the program was adopted by 91% of Finnish farms and covered 94% of agricultural land. As agriculture is the largest single source of anthropogenic losses of phosphorus (P, 60%) and nitrogen (N, 50%) to Finnish surface waters, and the costs of AEP have been considerable, there is strong public interest in the actual results of the actions introduced by the program.

This journal issue of Agricultural and Food Science gathers together follow-up studies which were performed to reveal the effects of AEP on nutrient exposure in Finnish waters (MYTVAS 2, 2000–2006). MYTVAS monitoring was a joint project between MTT Agrifood Research Finland and the Finnish Environment Institute and it was financed by the Ministry of Agriculture and Forestry and the Ministry of the Environment. Due to the extent and nature of the different sub-projects, two parallel reports, published in Finnish, summarise all MYTVAS follow-up results obtained from 2000 to 2006. In turn, this journal issue is supplemented with three research articles (Nos. 3–5), where the themes are compatible with those of AEP, but which were funded from other sources.

MYTVAS monitoring revealed clearly decreasing trends since 1990 in both N and P balance values for agricultural land as a whole, mainly due to reductions in the use of commercial fertilizers. The lower average balance values evidently show that the former build-up of P pools in soils is levelling off and in some areas depletion of the soils' nutrient reserves is taking place. Although the decrease in the balance values indicates a decreased potential for nutrient losses to the environment, the actual trend in the losses also depends on many other factors, such as changes in the proportion of annual and perennial crops, changes with time in the content of soil organic matter and in soil structure, and fluctuations in climatic conditions. Moreover, large variations in balance values exist between different parts of the country, different farms and different fields on individual farms. A large part of the variation originates from specialization of the agricultural production and, particularly, concentration of animal produc-

tion in certain areas, causing unbalanced inputs of manure-derived nutrients in these areas. This holds particularly true for the intensive animal production of the near-coastal regions in south-western and western Finland, where the nutrient balances showed smaller decreases in recent years, than in areas with mainly cereal production.

The P status of soils reflects the P loading potential as well as past surpluses in P inputs. The MYTVAS study found the first signs of decreasing P status in the topsoil of Finnish agricultural fields. However, at many sites with a high P status, the P balances are not low enough for a substantial reduction of P loading in the near future. In AEP, the prevailing P status has only been partly considered by the regulations regarding fertilizer and manure inputs, thus leaving the potential for excessive use of P. Farmers also lack information and advice on how to optimize nutrient inputs in plant production and animal nutrition to achieve the best benefit with minimum surplus balances.

Joining the EU in 1995 changed the economic environment of Finnish farms with considerably lower price levels for agricultural products than before, resulting in a rapid increase in both farm size and the share of rented land. These same factors may be responsible for insufficient efforts to maintain the subsurface drainage systems or the optimum pH of soils since 1995, especially on rented land. Increasing farm size and scattering of the fields in the Finnish landscape also creates risks to the soil structure of the distant fields due to occasional traffic on wet soil. There have been only minor efforts in AEP to promote improvement of soil structure or proper drainage of fields. Consequently, the risk of erosion from clayey soils may have increased in southern Finland, in particular. The actions taken to increase the plant cover of cultivated soils outside the growing season for controlling erosion have not been sufficiently effective, either. The development of the farm economy in the past 12 years has contributed to less use of fertilizers in plant production but in animal production intensification has occurred. As animal production is regionally concentrated and the unit sizes have increased, recycling of manure is becoming more and more challenging. Altogether, such important factors behind P and N losses as development of soil structure or trends in animal production have not been sufficiently considered by the AEP.

In line with the results obtained from cultivated soils, MYTVAS monitoring of water bodies showed that there were some, although small changes attributable to AEP measures in P and N load estimates of agriculturally loaded river basins or in the overall quality of surface waters. However, lower nutrient balance values in areas without intensive animal production beyond the near-coastal zone may have contributed to a more positive development than is verified by the monitoring system.

Several conclusions can be drawn from the different MYTVAS follow-up studies regarding future development needs of AEP. The results show that past actions have not been sensitive enough, failing to consider the large variation between different areas, farms or cultivated fields. Therefore, future measures should be principally directed towards fields and management practices responsible for the highest environmental risks. Moreover, the maximum fertilizer and manure amounts allowed by AEP must be set according to the actual need for P inputs, to reduce the P status of soils with high past P inputs. For long-term maintenance of the soils' production capacity, promoting good soil structure and avoiding soil compaction should be emphasized. Adapting nutrient balance limits as farm-specific working tools in the program would probably facilitate solution of some of the problems mentioned above. Before laying down such limits, however, considerable processing of available research and farm data needs to be done, to adequately cover variations due to climatic conditions, soil types and crop rotations. It is most fundamental that the goals of the environmental support system are clearly and specifically stated before designing the system and the individual measures.

Obviously, the challenges encountered in controlling the environmental side-effects of farming originate from a few basic facts associated with modern agriculture and its development. Firstly, cropping systems and agricultural management practices have been principally developed to answer the demands of profitable farming and, until recently, avoidance of harmful side-effects has not been an equally im-

portant objective. Consequently, the practices which can be adopted in systems like AEP are limited in their efficiency and there is an urgent need for new research to improve nutrient cycling in agriculture. Secondly, it takes time to counteract the cumulative effects of past management on cultivated soils, and new management practices must be adopted to reach more environmentally balanced equilibrium levels. Thirdly, discussions between farmers, researchers, advisors, consumers, administrators and politicians is essential to achieve a common understanding and acceptance of the different goals, some of which Finnish agriculture should strive for as a whole and others of which only apply in certain parts of the country. This special journal issue wishes to highlight some important questions to be discussed with the different interest groups. In all, it can be seen that with the wide adoption of AEP and its further improvement, Finnish agriculture is gradually taking steps towards environmentally more balanced production systems.