

Preface

Background

The environmental co-operatives 'Vereniging Eastermar's Lânsdouwe' (VEL) and 'Vereniging Agrarisch Natuur- en Landschapsbeheer Achtkarspelen' (VANLA) are among the first environmental co-operatives in the Netherlands. An environmental co-operative is a regional co-operation of mostly agricultural entrepreneurs who aim to integrate environment, nature and landscape objectives into their farming practices.

VEL and VANLA are located in the northern Frisian Woodlands and were founded in 1992. The co-operatives developed region-specific strategies to reach national and provincial policy goals concerning nature development, landscape preservation and ecological sustainability.

Having started with nature development and landscape preservation projects in 1992, VEL and VANLA commenced with a Nutrient Management Project in 1998. For the latter they could build upon 6 years of co-operative experience and the social network constructed for the 'nature and landscape' track (i.e., the regional farmers' association, the Frisian environmental association, the provincial and local authorities, the regional office of the Ministry of Agriculture, Nature and Food Quality and Wageningen University and Research Centre (WUR). The Nutrient Management Project includes 60 dairy farmers, 2400 hectares of land and a milk quota of 30 million litres per year. As nutrient problems in dairy farming are predominantly a nitrogen (N) problem, the project focuses primarily on the reduction of N losses. With the Nutrient Management Project the farmers aim to realize the Dutch policy norms for N losses set for 2003 (i.e., no more than 180 kg N ha⁻¹ year⁻¹ on sandy grassland soils) in a cost-effective way, while maintaining the same level of milk production per hectare.

In 1998, a research council consisting of farmers and scientists was established to design, govern and monitor the first phase (1998–2000) of the Nutrient Management Project of VEL and VANLA. Within this research council it are predominantly the farmers that raise research questions and thereby set the research agenda. The first phase of the Nutrient Management Project ended in 2000. Promising results in terms of achieving environmental objectives and fruitful collaboration between farmers and researchers encouraged the research council to apply for funding for a second phase of the nutrient project. After a long period of negotiations between farmers, researchers and the Ministry of Agriculture, Nature and Food Quality, the environmental co-operatives and the researchers involved obtained sufficient funding to implement an ambitious second phase of the project, which started in September 2001 and will last till the end of 2003. The contributions to this special issue cover the results of the first phase and approximately the first one and a half years of the second phase of the Nutrient Management Project.

Approach and drivers of change

Aim of the project is to gain a better understanding of ways to improve N efficiency at farm level, and in that way decrease the loss of N (as nitrate and ammonia) in cost-effective ways. Designing successful strategies to improve the nutrient efficiency of the total farming system thus became the central approach of the Nutrient Management Project. Based on an explorative analysis of nutrient balances of 92 VEL and VANLA farms and on trials on two experimental farms of Wageningen University and Research Centre (the A.P. Minderhoudhoeve and De Ossenkampen) farmers and scientists concluded that improving the N efficiency of the soil would be most beneficial to reduce the loss of N at farm level.

Starting point for improving the N efficiency of the soil was considered to be a stepwise reduction of the inorganic fertilizer input. Simultaneously this implied the need for a gradual improvement of the cattle slurry manure quality, i.e., slurry manure with relatively low N content and a high percentage of organically bound N. In order to improve the quality of the slurry manure the feeding strategy had to be altered towards high-fibre and low-protein diets. Reducing the inorganic fertilizer input and changing the feeding strategy are considered to be the two key drivers of change that characterize the VEL & VANLA approach to nutrient management. However, in order to improve N efficiency at farm level, additional changes and adjustments in the farming system are required. Yet, which (combinations of) nutrient management measures are required and to which extent and why they are effective in reducing nutrient losses was largely unknown and is still subject of on-farm experimentation and scientific research.

Research topics

In the Nutrient Management Project of VEL and VANLA the farmers implement and test a range of nutrient management measures. Through a process of learning-by-doing and mutual exchange of experiences and knowledge the farmers involved (aim to) develop integrated sets of effective nutrient management measures. The researchers involved attempt to develop the scientific foundations for different (combinations of) nutrient management measures. Topics addressed (with in parentheses the reference to the papers in this special issue dealing with these topics) are:

- The effect of different feeding strategies on the quality of cattle slurry manure and resulting herbage growth (Reijs *et al.*);
- Effects of different treatments of cattle slurry manure on water-extractable phosphorus (Chapuis-Lardy *et al.*);
- The impact of different cattle slurry manure management approaches on soil biota, soil respiration and nitrogen mineralization (De Goede *et al.*);
- The effects of application method, cattle slurry manure type and additive use on grassland performance (Schils & Kok);
- Effects of different combinations of land use history and nitrogen application on nitrate concentration in the groundwater (Sonneveld & Bouma);

- The impact of different nutrient management strategies on nitrogen losses at farm level (Verhoeven *et al.*);
- Exploration of the potential impact of internal nutrient cycling in dairy farms on nitrogen efficiency at farm level (Groot *et al.*).

In addition to the natural science research topics mentioned above, the VEL & VANLA Nutrient Management Project also raises issues relevant to the social sciences:

- The potentials and constraints of self-regulation as a new approach to governing sustainable agricultural and rural development (Wiskerke *et al.*);
- VEL and VANLA as field laboratories for the co-production of knowledge between farmers and scientists (Stuiver *et al.*);
- The strengths, weaknesses, pros and cons of the VEL & VANLA approach for designing and managing processes of technical-institutional change (Roep *et al.*).

Innovativeness and uniqueness

The VEL & VANLA Nutrient Management Project is innovative and unique for several reasons:

1. The regional approach in combination with the, albeit temporary, national status of ‘governance experiment’, enabling farmers to deviate from generic rules and regulations and thereby develop a region-specific approach to comply with national policy objectives regarding nutrient losses.
2. The involvement of a group of researchers who are willing to address questions and issues raised by farmers next to those raised by the scientific community itself or by policy-makers.
3. The close collaboration between farmers and scientists in developing new insights, knowledge, practices and technologies.
4. The use of diversity as a source of information through the participation of farmers who represent different dairy farming styles and thereby different approaches to and results in nutrient management.
5. The multi-disciplinary character of the research through the involvement of scientists from a variety of scientific fields, such as agronomy, soil science (pedology, soil biology, soil chemistry), animal nutrition, animal production systems, plant production systems, rural sociology, agricultural economics and science & technology studies.
6. The variety of organizations funding (parts of) the project, such as the Ministry of Agriculture, Nature and Food Quality, the Ministry of Public Housing, Spatial Planning & Environment, the province of Friesland, the Northern Farmers Association, the Netherlands Organisation for Scientific Research, Wageningen University and Research Centre and the Foundation for Soil Knowledge Development and Transfer.
7. The different types of publications (i.e., PhD theses, scientific articles, professional publications, a farmers’ guideline for sustainable dairy farming, VEL and VANLA magazine, newsletters) in combination with other dissemination activities, such as a website, excursions, lectures, courses, conferences and debates in different public media (newspapers, radio, television).

For an innovative, unique and farmer-driven multi-disciplinary research project it often remains difficult to find a scientific platform to present and discuss research findings. The research council of the VEL & VANLA Nutrient Management Project is therefore indebted to the Royal Netherlands Society for Agricultural Sciences (KLV) for creating this opportunity by means of a special issue of NJAS – Wageningen Journal of Life Sciences.

Results and additional research questions

The VEL & VANLA approach to nutrient management has proven to be an effective trajectory to realize (or even go beyond) Dutch policy goals, i.e., the norms for maximum nutrient losses entailed in the MINeral Accounting System (MINAS). The farmers involved have all been able to reduce N losses substantially: from an average surplus of 270 kg N ha⁻¹ year⁻¹ in 1997 to 172 kg N ha⁻¹ year⁻¹ in 2001. According to the Environmental Balance 2003, published by the National Institute of Public Health and the Environment (RIVM), the average surplus on Dutch dairy farms was approximately 200 kg N ha⁻¹ year⁻¹ in 2001. The substantial reduction of N losses has resulted in a situation whereby the majority (67%) of the farmers participating in the Nutrient Management Project complied with the MINAS 2003 norms in 2001. A first analysis of nutrient balances shows that approximately 90% of the farmers involved in the Nutrient Management Project succeeded to comply with the MINAS 2003 norms in 2002.

The different research projects that compose the Nutrient Management Project have been able to provide important scientific building blocks for this innovative approach. However, whether or not there is scientific evidence for the added value of the VEL & VANLA approach to nutrient management is a matter of ongoing debate. The experiment examining the effects of cattle slurry manure type, use of additives and slurry-application method on grassland performance is a case in point (see Verhoeven *et al.* versus Schils & Kok). The debate focuses on the question whether scientific analysis should emphasize main effects of treatments (with due attention to interactions among treatments) or on farm-characteristic management combinations (with due attention to deviations from such combinations). These different starting points lead to different approaches of data analysis and, indeed, to different interpretations, which are hampered in both cases by the limitations of an on-farm experiment. Debates like this are inherent to the nature of this project and point to an important challenge for the agricultural sciences, i.e., how to design experiments, collect data and analyse results to come to grips with the effects of interactions and combinations of management measures at different levels of aggregation (i.e., field, farm and region).

In addition to these fundamental methodological questions, the research council of the Nutrient Management Project has concluded that several 'pieces of the puzzle' are still missing. Therefore the following research questions still need to be addressed:

- What are the political implications of the VEL & VANLA Nutrient Management Project in terms of the process of agri-environmental and rural policy-making (i.e., the role of stakeholder participation), the contents of policies (i.e., goals, norms and

means) and the implementation of policies (i.e., generic rules and prescriptions versus room for self-regulation)?

- What are the economic effects of the VEL & VANLA approach at farm and regional level?
- What are the governance requirements and sustainability effects of incorporating new activities such as water management, tourism, quality production and green energy into the VEL & VANLA approach?
- What soil biology knowledge do we need to improve N efficiency in the soil and how can such knowledge be operationalized in management options?
- How is animal health affected by changing to high-fibre and low-protein diets?
- Can explorative farm and regional models be developed that include all research findings (i.e., feeding strategies, cattle slurry manure quality, slurry-application method, land use history, economic performance) and take diversity in farming styles into account?

Some of these questions will (partly) be dealt with during the second phase of the Nutrient Management Project, other ones demonstrate the need for a continuation of the research to provide solid scientific foundations for the VEL & VANLA approach to sustainable dairy farming.

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