

Management affects nitrate leaching from organic farms

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Implications

Management decisions significantly affect nitrate-N leaching (N-leaching) from comparable organic fields. The main concern is field management during autumn and the management of grass leys. After ploughing-in fertility building crops, like grass-clover leys, effective catch crops are important during autumn and winter for at least two years on sandy soils. On farms with grazing animals the occurrence of "hot spots" should be avoided. These hot spots develop with uneven concentrations of animal manure combined with limited N-uptake in the ley. Management measures to minimize N-leaching may conflict with the farmers aim to produce high quality feed and/or to combat yield limiting perennial weeds. It may also conflict with the organic regulations for the grazing period of cows.

Background and objectives

The Danish action plans for the aquatic environment include organic farming as one of several measures to reduce the N-leaching from cropped land. The selection of this specific measure of action is based on studies of farm nitrogen balances and scenario calculations using dynamic models. However, these calculations do not include whether a field is bare or covered by an effective catch crop during autumn and winter. And they do not include the grazing strategy and actual manure application to the leys. Both factors have major influence on the actual N-leaching risk. The aims of organic farming to optimize yield, minimize negative environmental effects and improve animal welfare lead to dilemmas because the management measures may be contradictory.

This paper, partly based on studies of Askegaard et al. (2004, 2011) and Eriksen et al. (2004, 2008, 2011), extract the most important management measures, which can reduce N-leaching further from organic farms. Also it points out the challenges and barriers for a full implementation of these measures.

Key results and discussion

Table 1 lists different managements with potential for reduction of the N-leaching. A main challenge in organic arable farming is control of perennial weeds (managements 1, 2 and 7) especially in crop rotations with a high proportion of catch crops where autumn harrowing is not possible. However, the problem can be reduced if the selection of species in the crop rotation is prioritized towards robustness including competition against weeds (Askegaard 2008). Two other major concerns are the autumn grazing of grass-clover leys on sandy soils (management 3) and the application of slurry to leys used only for grazing (management 4). Investigations have shown that it is possible to maintain autumn grazing without increases in the N-leaching provided a large grazing area (Eriksen et. al 2008). When grass-clover leys are used only for grazing, slurry should not be applied when on sandy soils (Eriksen et al. 2011). In this case slurry has resulted in increasing in N-leaching and only modest yield response.

Table 1. Managements for reducing N-leaching from organic arable, dairy and pig farms, and the barriers or dilemmas that follows.

Management	Barriers and/or dilemmas
Arable farms	
1 Effective cover crops/catch crops in autumn and winter on sandy soils	Removes the possibility for mechanical weed control. Costs on seed and sowing
2 Always catch crops undersown in faba bean and lupin	Removes the possibility for mechanical weed control. Costs on seed and sowing
Dairy farms	
3 Reduced grazing period for milking cows in the autumn	Conflicts with the regulations for organic farming
4 Omit application of slurry to grazed grass-clover leys	Potassium must be imported from other sources
5 Increased age of the grass-clover ley	Yield decrease over the years
6 No ploughing-in of grass-clover leys in autumn/winter on sandy soils	No winter cereals at this position in the crop rotation
7 Effective catch crops 1 st and 2 nd year after grass-clover cultivation	Removes the possibility for mechanical treatment against perennial weeds
8 Avoid maize 1 st and 2 nd year after grass-clover	Reduces the feed quality. Increase costs on imported feed

How work was carried out?

The N-leaching was measured in two or three factorial long-term organic arable and mixed dairy field trials by means of ceramic suction cups installed at 1 m depth. Management factors like manure application, catch crops and grazing was included. The specific experimental designs are described in details in the mentioned papers.

References

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