Interactive comment on “Farm nitrogen balances in six European agricultural landscapes – a method for farming system assessment, emission hotspot identification, and mitigation measure evaluation” by T. Dalgaard et al.

Sissel Hansen (Referee)

sissel.hansen@bioforsk.no

GENERAL COMMENTS

Increasing loads of nitrogen in soil, air and water with the following locally and globally pollution problems do make mitigation strategies urgently needed. To facilitate mitigation, tools are helpful to identify hot spots of nitrogen and possibilities to reduce N-surplus and increase N-efficiency. This paper, focusing on the possibilities and challenges with farm gate N-balances on commercial farms, is therefore an important contribution. Farm gate N-balances is a simple, but rough tool. The paper gives a good overview on the method, and how they used it across a range of European agricultural landscapes. This method has been used for a long time in Denmark. New is that the farm gate N-balances is simultaneously estimated on highly diverse agricultural landscapes, and related to ammonia concentrations in air and nitrate levels in soil and groundwater in the same landscapes.

The paper is interesting, well written and the language is easy to read. However, it could have been more concise if the structure of the paper was stricter. The figures are illustrative and good.

SPECIFIC COMMENTS

LOCAL FOCUS ONLY? The purpose of the present study is not clear. Is the purpose only to address nitrogen surplus causing local problems, or is globally consequences of Nitrogen surplus also an issue.

If the first is the case, N-surplus in the present landscape is what matters, and N-efficiency should only be used as a tool to identify mitigation possibilities. A surplus of nitrogen brought out of the landscape in i.e. dried manure should not be included.

If the latter is the case, N-efficiency, or even better, the N-cost must be included (Bleken et. al. 2005). It is in then important also to include estimates of the nitrogen costs of fodder and dressing imported to the farm. As there are records of what is imported in the present investigation, this should be possible using literature values. In page 8882 the authors state “the systems with the highest N inputs are also those which are most N-efficient”. They found the highest N-efficiency in the French agricultural landscape and the lowest in the Scottish. However, the French farms had the highest fodder import and the Scottish the lowest (Fig.4). If the N-costs of imports were included, I assume the

conclusions would have been different. In calculation of global consequences of nitrogen use, manure nitrogen brought out of the landscape should be a part of the surplus and not calculated as N in products.

N-FIXATION: In low input systems the quality of assessments of nitrogen fixation will have a large impact on the accuracy of the N-balance. One level for nitrogen fixed via pulses (100 kg N $ha^{-1}yr^{-1}$) and two N levels for legumes in grassland (150 or 20 kg N $ha^{-1}yr^{-1}$) are very inaccurate, as stated by the authors. In such a rough study it is not easy to get good estimates of the roughage yields or the proportion of legumes, neither in the harvested roughage nor in the grazed areas. However, this large uncertainty should be accounted for when estimated surpluses and N-efficiency are discussed.

STANDARD VALUES FOR N: The option to exchange the standard N-content with local values was only used in a few cases by the local partners. The authors stated “From this we concluded that there is no reason to expect a systematic over- or underestimation from using the current method,..”. I would like some more arguments for this statement. The largest fodder import is in France, the Netherlands and Poland. Therefore inaccuracy in N content from fodder import would have the largest impact in these three cases. For these agricultural landscapes it should be stated if local values were used. If not, it should be stated why. The same should be done if large amounts of manure are exported or imported.

UNCERTAINTY: Uncertainty in the estimates is a challenge when farm gate balances are used to identify hot spots of nitrogen surplus and efficiency. To facilitate that other studies can use the method developed in the present study, there should be more discussion on the uncertainty of the results and how to judge the uncertainty. To better show the estimated uncertainty the illustrative fig. 4 may be used. The arrows showing the estimated surplus for each agricultural landscape can be supplemented with for instance a grey colour in the arrows showing the estimated interval of uncertainty.

In addition to each value of net fodder, net dressing etc. an uncertainty is given as (±) in the present manuscript. However, it is not explained what this is. It should be stated if this is only variation (standard deviation) caused by differences in the farms within the landscape areas, or if also uncertainties in the estimates are included.

STRUCTURE: The agricultural landscapes are described in M&M, in results and in discussion. To make this shorter and easier to read, the descriptions should be concentrated on the information needed to understand the differences among the systems. I would have preferred to have all this information gathered in M&M, and to refer to this later in the manuscript. All methods should be placed under M&M including definition of N-efficiency.

TECHNICAL CORRECTIONS

Page 8870. The term meat is used also for eggs and wool and I assume also live cattle, but it is not stated. I suggest using the term animal products instead and defining what is included.

Table 2. This table is confusing. I suggest sorting the manure according to animal species.

COMMENTS TO THE COMMENTS FROM M. Volk: I do not disagree with any of the comments. Following the suggested ideas will improve the manuscript.

REFERENCE: Bleken, M.A., Steinshamn, H., Hansen, S., 2005. High nitrogen costs of dairy production in Europe: Worsened by intensification. Ambio 34, 598-606.