doi:http://dx.doi.org/10.15414/afz.2015.18.si.113-115

Weak point analyze of nutrient cycles in organic dairy farms

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The aim of the current study is to clarify if weak points analyze of nutrient cycles in organic dairy farms enables farm managers to identify the points in the farm nutrient cycle at which nitrogen leaching is most critical. Different nutrient cylce system levels of the Educational and Research Farm at the Justus-Liebig-University Gießen, Gladbacherhof have been observed. The weak point at this farm was localised at the cropland level with an nitrogen efficiency of only 49 %. In the present study it can be resumed that weak points analyse is able to identify critical points in the nitrogen cycle of a farm system. The analyse has to go on „deeper" levels of the nutrient cycle.

Keywords: dairy production, nitrogen leaching, nutrient cycle

1 Introduction

Organic dairy farms are forced due to a low milk price level on the one side and rising production costs on the other side to improve their management system. Typically, a decline in profit margins due to an increasing competition and lower revenues (Becker et al., 2004) as well as cost increases for labor and input use (Sanftleben, 2004) are to be expected. One possibility is to optimize company resources, especially the nutrient cycle management. Rising nitrogen balances lead to endangered sustainability and environmental safety in the farm cycle system. The aim of the current study is to clarify if weak point analyze of nutrient cycles in organic dairy farms enables farm managers to identify the points in the farm nutrient cycle at which nitrogen leaching is most critical.

2 Material and Methods

2.1 Material

The subject of the investigation is of the Educational and Research Farm at the Justus-Liebig-University Gießen, Gladbacherhof. The investigation period was from 1993 to 2006. The corresponding data basis were the farm accountancy, the Acreage index, the milk recording data, feed analyzes and yield.

2.2 Methods

Different nutrient cylce system levels have been observed. The different levels are shown in figure one. Every level was analyzed by special nutrient balances. The balance methods are described at Sommer (2010). The efficiency is expressed as Input:Ouput-ratio in percent. If one level has an input of 100 units nitrogen and an usable output of 50 units nitrogen it means an N efficiency of 50 %. Based on a top down decision tree the weak points were systematically identified.

3 Results and Discussion

Based on the farm gate balance a nitrogen efficiency of 53 % in the average of three years was observed. In the next step the livestock level was analyzed. Because the investigated

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farm did not keep pigs and poultry only the dairy system was balanced. The nitrogen efficiency on the dairy production level (feedstuff input to the stable vs. milk,meat and pasture output) amounted 98 %. So this level was excluded as weak point in this farm system. The analyze of the cropland and grassland balance confirmed a nitrogen efficiency of 75 % on grassland, but only 49 % on the cropland.

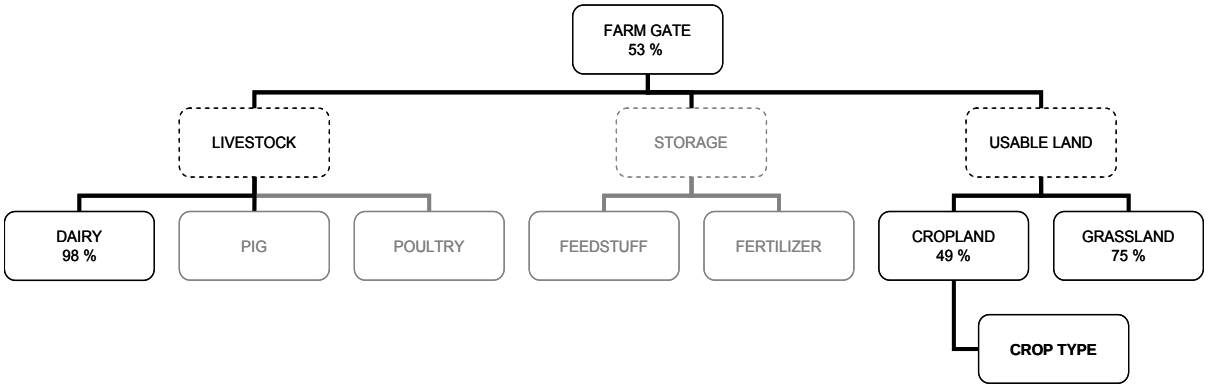

Figure 1 Nutrient cycle levels in a farm system. Grey levels were not included

While at the dairy production the nitrogen utilisation is very good, the success stayed on the cropland off yet. The low nitrogen efficiency of only 49 % is associated with a lost amount of reactive nitrogen (Leithold 1991).

As a result the sustainability and environmental impact of the production process decreases. It is therefore for the future the task of improving the utilization of nutrients on the plant area. Here it is important to delineate the responsible factors (Eltun, 1995). Using optimized production technology, customized fertilizer application rates (Nieder and Richter, 1999) and a good crop rotation can reduce N losses (Ruhe et al., 2003) and so presumably convert into additional yield.

4 Conclusions

In the present study it can be resumed that weak points analyze is able to identify critical points in the nitrogen cycle of a farm system. The analyse has to go on “deeper“ levels of the nutrient cycle. In the current case as next step the single crop types have to be balanced.

5 Acknowledgements

A special thanks to the Team of the Educational and Research Farm at the Justus-Liebig-University Gießen, Gladbacherhof.

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