How far can cycles be closed in organic dairy farming?

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Abstract **- Dutch organic dairy farmers asked for a tool to get insight in the ecological sustainabilty of their farms. For that purpose, the area used for milk production outside the farm was calculated for 17 farmers. As expected, a high variation in external input was found, since diversity in farming was one of the selection criteria for involving the project.**
Management factors as selling manure and crop rotation resulted in a smaller total area used per kg produced milk. A deep litter stable and a low clover percentage in the grassland fields caused on the other hand an increasment in total area used per kg milk and thereby a lower degree of closeness of nutrient cycles. The calculation of external hectares (ha) gave the farmers insight in the total area that they used for milk production. The degree of closeness varied per farm, which means that improvement on this issue is possible. A few Bioveem-farmers have almost closed their cycles; these farmers used no, or even a negative amount of external ha. This means that closing nutrient cycles is possible in organic dairy farming. And that in some cases even space is created for other more demanding types of land use such arable farming.[1]

Introduction

One of the values of organic farming, as described in the principle of ecology, is to reduce inputs by reuse, recycling and efficient management of materials and energy (IFOAM, 2005). Most dairy farmers in The Netherlands try to reduce inputs and to close their nutrient cycles by growing at least the roughages at their own farm. Some Dutch dairy farmers exchange manure by fodders with arable farmers in the neighbourhood and form so-called partner farmers (Prins et al, 2005). The effect of such management aspects on the degree of closeness of nutrient cycles at the dairy farm are, until now, unknown. Dutch organic dairy farmers involved in the Bioveem project wanted to get insight in the ecological sustainability of their farms and asked for a calculation tool. Earlier studies compared farming systems with each other on aspects as energy use and land use (Iepema and Pijnenburg, 2001; Dijk, 2001). In the present study we calculated the total area of land that was used for milk production at a single farm. This area was divided in internal ha - ha that belonged to the dairy farm - and external ha - ha that were located elsewhere. The aim of this study was to create awareness about the total area of land used for organic dairy farming and to show how management aspects can improve efficiency of land use and thereby closing nutrient cycles as far as possible.

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Methods

The external ha of 17 Dutch organic dairy farmers, involved in the Bioveem project, were calculated for 2001 and 2002. To calculate external ha, the input and output of feed, straw and manure at a farm in one year was expressed in ha. See for the exact calculation method Iepema and Baars (2005). The diversity of the farmers was one of the selection criteria for the project. Therefore, the farmers differed highly in farm management and intensity. The data used for the calculation were taken from the Agricultural Economics Research Institute (LEI) that published a bookkeeping report for each farm (Doornewaard et al, 2004).

Results and discussion

The external ha, expressed as a percentage of the internal ha, varied from minus 27 percent till 117 percent (farm 7 and farm 11 in figure 1).

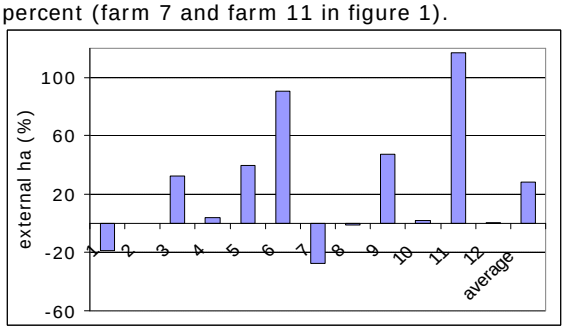

Figure 1. Percentage of external ha at 12 farms and the average of all 17 farms in 2002.

A negative percentage meant in most cases an output of manure larger than the input of feed or straw. Figure 2 shows the same results as figure 1, divided in external ha for manure, concentrates, roughages and straw. To determine the total percentage of external ha as shown in figure 1, the columns below x-axis have to be subtracted from the columns above the x-axis.
Farms 1, 2, 5 and 7 sold in 2002 800 up to 1200 m^3 manure, which corresponded with minus 22 up to 50 minus per cent of the internal ha. Farm 11 bought 600 m^3 manure, which corresponded with 48 per cent of the internal ha. On the other hand, at farm 11 among the same amount of manure was sold.

This output was however booked in 2003 and therefore not included in the calculation for 2002.

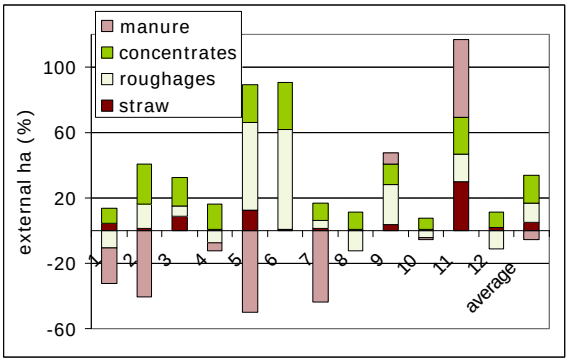

Figure 2. Percentage external ha divided in manure, concentrates, roughages and straw at 12 organic dairy farms in 2002.

Farm 5 and 11 had a deep litter stable for the milking cows. The input of straw, respectively 105 and 183 ton, enlarged the amount of external ha with 5 and 9 ha (13 respectively 30 percent, figure 2).
Farm 5 worked closely together with an arable farmer. The arable farmer cultivated roughages for the dairy farmer in exchange for manure. Farm 6 was an intensive dairy farm with more than two livestock unites per ha. Therefore a large amount of roughages - corresponding with 117 ha, 60 percent of the internal ha - had to be imported.
The percentage of external ha showed which part of the area used for milk production was situated outside the farm. For comparing the results of the individual farms, the total milk production was taken into account as well. It was assumed that the more milk produced, the more area was used for feed production for the animals. Due to the diversity of the farms involved, a high variation in percentage external ha was found in relation with milk production (figure 3).

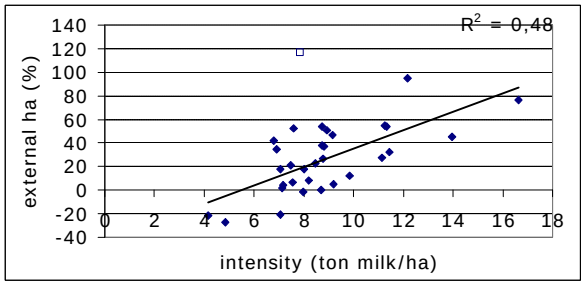

Figure 3. Percentage of external ha in relation to milk production at the farms in 2001 and 2002.

The dots below the line in figure 3 represent farms that needed a smaller area per ton milk than the average farm. These were the farms with an intensive crop rotation and the farms with a relative high percentage of clover in their grassland fields. The dots above the line - farms that needed a larger area per ton milk than the average farm - were farms with a deep litter stable and farms without crop rotation that grew only grass with no or a low percentage of clover at their farms.
Farm 11 - open dot in figure 2 - was excluded in the calculation of the regression line since the input of manure on this farm was compensated by an output of manure in the following year. When the input of manure was excluded in the calculation, the results of farm 11 fitted better in the results of the rest of the farms. The high input of straw for the deep litter stable at this farm caused however still a relative high percentage of external ha in relation to the milk production.

Conclusions

Some of the organic dairy farms in the Bioveem-project were heavily reliant on external ha, thereby not complying with the value of minimizing external input. However, variation was high, indicating possibilities for improvement.
The possibility for closing nutrient cycles depended on management factors as crop rotation and selling manure as well as percentage of clover in grassland fields. High use of external ha was associated with large inputs of straw for deep litter stables. External land requirements for straw production were not counteracted by a land productivity increase due to an improvement of manure quality. This was caused by the fact that at these farms the manure of high quality was sold in exchange for roughage (farm 5) or manure with a lower quality (farm 11).
A few Bioveem-farmers have almost closed their cycles. These farmers used no, or even a negative amount of external ha. This means that closing nutrient cycles is possible in organic dairy farming and that in some cases even space is created for other, more demanding types of land use such as arable farming.

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