Can chemical fertilizer use be reduced by separating cattle slurry?

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Summary

- We explored if distribution of N and P over farmland can be improved by using thin and thick fraction, produced by separating cattle slurry.
- In this research at farm level we separated 35% of our cattle slurry with a screw press.
- The mismatch between the fertilizer requirement of each field and the applied fertilizers could roughly be halved as compared to the situation without separation.
- The N/P-ratio of the liquid fraction was too low to meet the requirements in permanent grassland and separation resulted in lower amounts of thick fraction than we expected.
- This approach requires sufficient good facilities to store the different organic fertilizers

Background

Dairy farmers commonly use artificial fertilizers in addition to farm slurry to meet crop nitrogen (N) and phosphorus (P) requirements. The N and P requirements depend of the crops used and soil P-status. Hence, the ratio of N/P required is variable. It is hard to meet these requirements with only farm slurry because its N/P ratio is more or less fixed. Mineral fertilizers are used to correct for this. The question is to what extend the use of mineral fertilizers can be reduced by separating farm slurry in a liquid fraction high in N/P-ratio and a solid fraction low in N/P-ratio. Our objective was to match N and P needs of crops with separation products to reduce the use of chemical fertilizer.

Methods

On experimental dairy farm De Marke the following steps where carried out:

1. Quantify the N and P requirements per parcel
2. Calculate the optimal distribution of slurry, liquid fraction and solid fraction over the fields
3. Calculate how much of each product is required (based on tests carried out beforehand)
4. Make required products by separation
5. Store products and carry out the fertilization plan

In step 2, P requirements were differentiated for different crops and the soil P status (Figure 1). N requirements were based on the fertilizer recommendations adjusted to the objectives of De Marke.

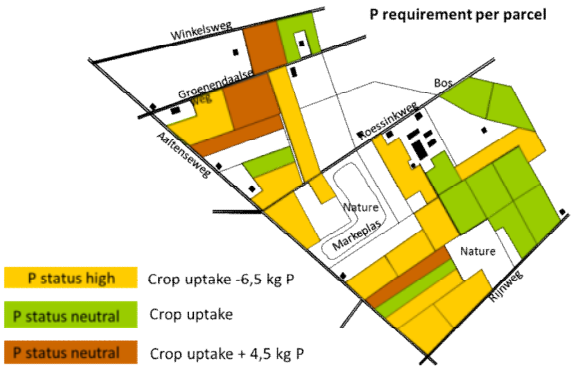

Figure 1: Target P surplus tuned to P status.

Results

Table 1 presents the N/P ratio that we observed in the different products in this test. The N/P ratio in the thin fraction was much lower than expected. The distribution of slurry over thin and thick fraction was not in agreement with the expectations based on tests carried out beforehand (Table 1). Per ton slurry, more thin fraction was produced and less thick fraction. This resulted in a shortage of thick fraction which had to be anticipated by adjusting the fertilization plan. About 35% of the total amount of slurry that is produced by the cattle in stable and stored in the pit was used for separation.

Table 1: Realized and expected results of separation (expected between brackets).

	Slurry	Thin	Thick
N/P-ratios	7,1 (8,4)	10,2 (16,7)	3,3 (3,5)
Slurry separated (tonnes)	1170 (1177)		
Thick fraction produced (tonnes)		1036 (937)	
Thin fraction produced (tonnes)			135 (240)

The mismatch between the needs of the fields and the applied fertilizers by slurry could roughly be halved by separating part of the slurry. The N/P-ratio of the liquid fraction was too low to meet the requirements in permanent grassland completely (Figure 2).

It was no problem to handle, store and apply the thick fraction (Figure 4). The same holds for storage and application of thin fraction. However, it is important to have sufficient good storage facilities to be able to carry out the planned manure management without logistic problems.

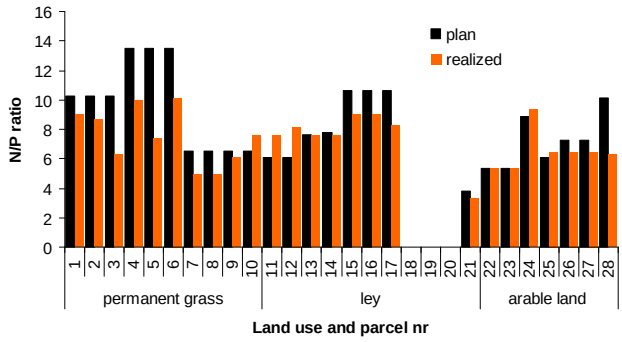

Figure 3: Planned and realized N/P ratios (rates based on use of organic fertilizer (kg per ha).

Figure 4: Application of thick fraction on arable land.

Implications and recommendations

- In practice, it is possible to separate, store and distribute slurry and separation products on a dairy farm, but it is important to have sufficient storage facilities.
- It may also be useful to apply this approach to optimize the distribution of organic matter over the farmland.
- The performance of our approach very much relies on the results of the separation. This should be tested well beforehand.
- Probably, the decanter separator would have performed better for this objective, because the variation of N/P ratios in its separation products is higher. However, a decanter is more expensive and its maintenance and repair requires more technical skills.