Nitrogen balance and soil nitrates in suckler cow pastures fertilised with mineral fertiliser, pig slurry or cattle compost

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Introduction A code of good practice was established by each European member state according to the EU Nitrate Directive. In Belgium, the nitrogen (N) inputs on pastures from slurry or compost are limited to 210 kg N/ha. Bigger quantities can be applied if the farmer follows a programme of additional measurements, including soil nitrate (NO3) analysis. This investigation aimed to measure animal performance, N balance and soil NO_3 in pastures fertilised with mineral N, pig slurry or cattle compost, the pastures being grazed by Belgian Blue cows and their calves.

Materials and methods During two consecutive years, two blocks of pasture were divided into three plots each. One plot of each block was fertilised with cattle compost (C), the second one with pig slurry (S) and the third one with mineral N (min N). Grass was analysed for chemical and botanical composition. The animals were weighed at regularly intervals and a blood sample was taken in order to measure plasma urea. Soil cores were taken up to 60 cm depth (0-30 and 30-60 cm) in November and March in order to determine the soil NO_3 content. N inputs consisted of biological fixation, atmospheric N (35 kg/ha) and N from fertilisation. N in live weight gains and in grass silage represented N outputs.

Results N inputs by fertilisation were 166, 161 and 80 kg N/ha in C, S and min N plots, respectively. In terms of N efficiency (30 % in C and 50 % in S), N inputs were 54 kg in C and 76 kg in S. The types of fertilisation did not significantly affect animal performance. Plasma urea did not differ significantly, so N excretions by the cows were probably similar in the three groups (Table 1; Ciszuk & Gebrekziabher, 1994). N surplus was lower in min N. By calculating the inputs on the basis of N efficiency in compost and slurry, the surpluses were slightly lower in C and L than in min N. The apparent N efficiency (N output/N input) was higher in C. NO_3 contents in soil were generally lower than 20 kg/ha except in S and min N at the autumn of the first year (Figure 1). There were no significant differences between methods of fertilisation in NO_3 content

Table 1 Plasma urea concentration and N Balance

	Compost	Slurry	Mineral nitrogen
Plasma urea (mg N/l)	195	200	188
Nitrogen balance (kg N/ha)			
Atmospheric	35	35	35
Legume fixation	78	71	73
Fertiliser input	165	161	80
Total input	279	266	188
Output	37	38	38
Surplus Balance	242	228	150
Surplus (efficient N)	131	144	150
Apparent N efficiency (%)	13	14	21

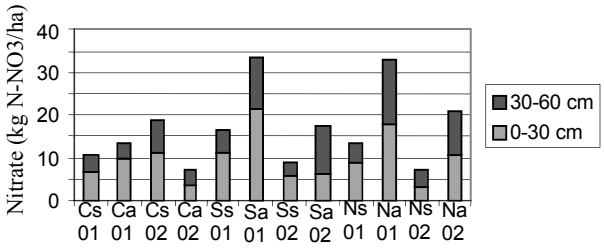

Figure 1 NO_3 content in soil of grazed pastures fertilised with cattle compost, pig slurry or mineral N fertiliser. (C: compost, S: slurry, N: mineral N fertiliser, S: spring; a: autumn, 01: first year; 02: second year)

Conclusion The use of pig slurry and cattle compost as compared with mineral N allowed identical animal performance but increased N balance and reduced apparent N efficiency. However the NO_3 content in soil and N excretion by animals were not increased by the use of slurry or compost. The low NO_3 contents suggested low NO_3 leaching with the three types of fertilisation.

Reference

Ciszuk P. & T. Gebrekziabher (1994). Milk urea as an estimate of urine nitrogen of dairy cows and goats. *Acta Agriculturae Scandinavica,* 44 , 87-95.