

Nitrogen fertiliser replacement value of cow slurry for herbage production

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Introduction

Farmers are under increasing pressure to reduce environmental pollution when applying slurry to land. There is also economic pressure to make most efficient use of the plant nutrients in the slurry. Applying slurry can reduce the reliance on inorganic N and capture the economic value of slurry. However, efficient use of nutrients in slurry, particularly nitrogen (N), relies on matching the requirements of the crop to the quantity and time of application. As part of an experimental programme at this Institute a small plot experiment was carried out to investigate the inorganic N fertiliser replacement value of cow slurry for herbage production.

Materials and methods

Following a silage cut from an established perennial ryegrass sward in June 2003, a small plot experiment was laid down. All treatments were designed to supply the same total levels of available nitrogen either in the form of inorganic fertiliser (27.5% calcium ammonium nitrate; CAN), cow slurry or as a 50:50 combination of inorganic fertiliser and cow slurry. Inorganic fertiliser N (F treatments) was applied at rates equivalent to 60, 90, 120, 150 and 180 kg N/ha. Based on soil analysis, F treatment plots, including a zero N treatment, received P and K in accordance with MAFF (2002) recommendations. Cow slurry (S treatments) was applied at rates that supplied equivalent levels of available N as NH₃-N. No P or K was applied to plots receiving cow slurry. Treatments supplying the same total level of available N, half from inorganic fertiliser and half from cow slurry (FS treatments), including the zero N (FS0 treatment), received half the recommended level of P and K. Plot size was 5.0m x 2.0 m and the 18 treatment combinations were fully randomised and replicated 3 times. Inorganic fertiliser was applied by hand. Slurry was applied using a 15 l watering can fitted with a trailing-shoe to simulate slurry application by the trailing-shoe technique. A

wooden frame with equally spaced strings was used to guide slurry application. Herbage mass was estimated by cutting a 1.5 m wide strip, the entire length of the plot, with a Haldrup plot harvester. Herbage was harvested 47 days after slurry and inorganic fertiliser application. Differences between treatments on herbage DM yield and N offtake were tested by analysis of variance using Genstat5.

Results and Discussion

The slurry applied had a mean DM concentration of 89.1 g DM/kg, pH of 7.91, ash concentration of 21.4 g/kg, total N concentration of 4.09 g/kg and a NH₃-N concentration of 2.01 g/kg. Source and level of applied N had a significant (P<0.001) effect on both herbage mass and N offtake. At all 6 levels of applied N, F treatments produced a greater (P<0.05) herbage mass than the corresponding S treatment. However, at N levels greater than 120 kg N/ha the difference in herbage mass between S and FS treatments was not significant. From the data presented in Table 1 it was calculated that to obtain a herbage mass of 5 t DM/ha would require 61.6, 92.5 or 156 kg N/ha supplied as CAN, 50:50 CAN and slurry or slurry respectively. The latter would have required an application of 77.6 t/ha of slurry supplying 317 kg of total N. Under present recommendations the maximum slurry application of 50 t/ha would have supplied 100 kg available N/ha (205 kg/ha total N). N offtake increased with increasing level of applied N from all three sources, being consistently greatest in F treatments and lowest in S treatments. However, the differences between N offtake within any one N level were not always significant.

Conclusion

Compared to N in inorganic fertiliser, the NH₃-N and total N in slurry were not used efficiently. However, the data do indicate that N from slurry effectively replaced part of the N supplied by inorganic fertiliser.

References

MAFF (2002) Fertiliser Recommendations (RB209). 7th Edition, London, HMSO.

Table 1. Effect of level and source of nitrogen on herbage mass (t DM/ha) and nitrogen offtake (kg N/ha).

	N source	Nitrogen level (kg/ha)						s.e.
		0	60	90	120	150	180	
DM yield (t/ha)	S	2.85	3.33	4.04	4.29	5.22	5.25	0.188
	FS	2.90	4.43	4.82	5.48	5.59	5.55	
	F	3.66	4.97	5.56	5.70	5.94	6.2	
N offtake (kg/ha)	S	45.6	62.5	79.9	88.1	104.0	110.5	4.65
	FS	53.3	80.5	96.2	102.4	113.0	116.0	
	F	66.9	89.4	101.9	113.2	130.3	137.5	