Effects of cattle slurry, their solid and liquid fractions and mineral N fertilizers on Italian ryegrass and maize forage yield

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Introduction Solid-liquid slurry separation techniques expand possibilities to improve slurry use efficiency and to reduce its negative environmental impact. These possibilities arise from the different behaviour of the two fractions concerning the release of nutrients, namely nitrogen (N), due to different C:N ratios (≈30 for the solid fraction and ≈7 for the liquid fraction).
The aim of this work was to evaluate the effect of cattle-slurry and their solid and liquid fractions applied at sowing time of Italian ryegrass (*Lolium multiflorum* cv. Andrea) and forage maize on crop dry matter (DM) yield. In the NW region of Portugal these two crops are the bases of an intensive double forage cropping system with silage maize grown from May to October and Italian ryegrass during the winter season.

Materials and methods The experiment was carried out in the NW region of Portugal between October 2002 and October 2003. The soil was a deep sandy loam derived from granite and classified as dystric cambisol. The trial was laid out as a 2 factor factorial design with three replications and a strip-plot layout. Five fertiliser treatments (main plots) consisting of the application at sowing of Italian ryegrass + maize, were 48 + 56 t/ha of dairy cattle slurry (S), 40 + 56 t/ha of slurry-liquid fraction (LF), 30 + 30 t/ha of slurry-solid fraction (SF), 70 + 140 kg N/ha of N mineral fertiliser (M) and a non-fertilised control (C). These were factorially combined with the top-dressing of mineral N fertiliser (strip plots) at the rate of 0 and 50 kg N/ha on the Italian ryegrass and 0 and 100 kg N/ha on the maize crop. Ammonium nitrate was used as mineral fertiliser and both crops were harvested in a single cut.

Results Crop DM yields were significantly ($p<0.01$) affected by both factors under study (Table 1). There was no interaction between the factors. On the Italian ryegrass crop, treatments S and LF with 50 kg N/ha as mineral fertiliser top-dressed gave the highest DM yields. Lowest DM yields were obtained from treatments SF, M and C when no fertiliser N was applied as top-dressing. On Italian ryegrass top-dressing of N increased DM yield, on average, by 2.2 t DM/ha. On the maize crop, the highest DM yield was obtained with the treatment LF. Top-dressing of 100 kg N/ha allowed only a further increase in forage yield of less than 1 t DM/ha of the LF treatment.

Table 1 Effect of fertiliser treatment at sowing and rate of mineral N top-dressed on forage DM yield (t DM/ha) of Italian ryegrass and maize

	Italian ryegrasss			Maize		
	N top-dressed (kg N/ha)		Average	N top-dressed (kg N/ha)		Average
	0	50	yield	0	100	yield
Fertiliser treatments at sowing:						
Control not fertilised (C)	4.1	6.2	5.1 b	12.6	14.2	13.4 b
Cattle-slurry (S)	5.9	9.4	7.6 a	19.8	18.6	19.2 a
Slurry liquid Fraction (LF)	7.0	8.4	7.7 a	21.3	22.5	21.9 a
Slurry solid fraction (SF)	4.1	5.3	4.7 b	16.5	20.5	18.5 ab
Mineral N fertiliser (M)	4.0	6.7	5.4 b	19.5	18.4	18.9 ab

Data within a column followed by the same letters do not differ at P<0.05 level, Tukey test

Conclusions As expected, the two slurry fractions showed different agronomic effects. Slurry-liquid fraction showed a high fertiliser value possibly due to its N content and fast release of N. If slurry-solid fraction promotes the temporary N immobilisation, as was found in a laboratory experiment for 2-3 months (results not shown here), its application at sowing of the Italian ryegrass crop may contribute to the reduction of N losses by leaching and denitrification during the winter period. Further work studying these aspects is in progress.