The use of nitrification inhibitors as a strategy for increasing grass yields: can this environmental tool also benefit agronomic efficiency?

D. Devaney[1], E. Cahalan[1,2], K. G. Richards[1], C. Mueller[2], R. Laughlin[3], C. Watson[3], D. Hennessy[4]
[1]Teagasc, Johnstown Castle, Co. Wexford, Ireland, [2]University College Dublin, Dublin, Ireland, [3]AFBI, Belfast, Ireland, [4]Teagasc, Moorepark, Co. Cork, Ireland
Email: enda.cahalan@teagasc.ie

Introduction Nitrogen is an essential element for plant growth, and is often the key limiting nutrient in grazed pasture systems. DCD (dicyandiamide) is a nitrification inhibitor that acts by specifically inhibiting ammonium oxidation, thus help keeping nitrogen in the ammonium form. Nitrate unlike ammonium is more prone to leaching and also denitrification which both result in a loss of nitrogen from the soil system through transport in soil solution and gaseous emissions respectively. DCD has been reported to reduce denitrification of excess nitrate within the soil by up to 73% (Di and Cameron, 2006) and increase herbage yield (Zaman *et al.*, 2009). With increased nitrogen retention in the soil there is in theory going to be more available to aid plant growth. Higher herbage yields as a result of improved nutrient efficiency will allow for lower fertiliser application rates and a reduction in input costs. The objective of this project is to evaluate the role of DCD in increasing herbage production.

Material and methods There were 5 treatments, with two spreading methods 1. Cattle slurry (CS) splashplate (SP) and 2. CS Bandspread (BS) both ± DCD and a control. The experiment was conducted over three sites – (JC) Johnstown Castle, Co. Wexford, (HB) Hillsborough, Co. Down and (MP) Moorepark, Co. Cork. The three sites were arranged in a randomised block design with 6 replicates per treatment. Plot size measured 5 x 2 m. Cattle slurry was applied at a rate of 33 m^3 ha^{-1} in March, June and October which are typically important dates for slurry application before/after winter and after first cut silage. DCD was mixed with the slurry at a rate of 15% of the slurry NH_4-N content (10 kg DCD ha^{-1} avg.). The herbage was harvested from the October application in February, harvesting of the February and June applications took place 8 – 10 weeks post amendment. Harvesting was carried out using a Haldrup plot harvester which had a cutting width of 1.5 m and cut a central strip through each plot. Sub-samples of the herbage were taken for DM% (dry matter) determination and from the dried sample chemical analyses was carried out for %N, P, K, S, Mg, Ca & Na determination. Statistics were carried out using SAS v. 9.1 and an ANOVA was carried out to test for significant differences ($p<0.05$) between treatments. The factors in the model were spreading method, DCD, site and their interaction.

Results The results below show total DM% yield and the total nitrogen uptake, from slurry applied on 9 March 2009 and the control. (Figure 1).

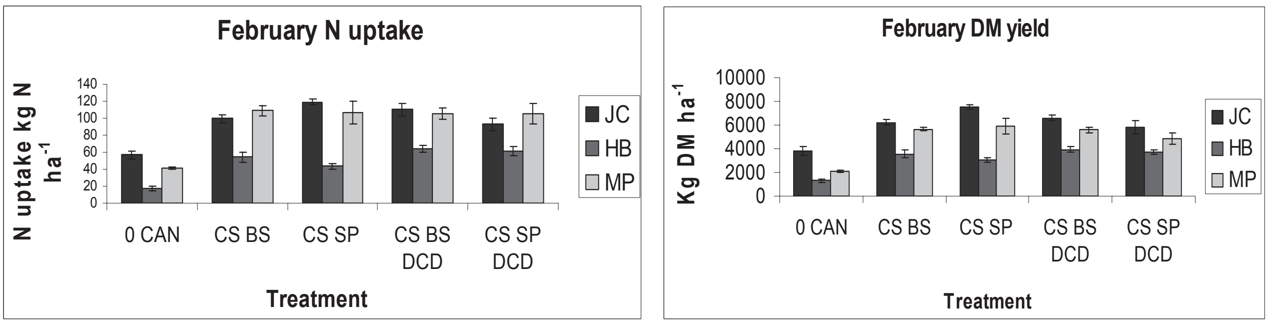

Figure 1 Total DM% yield and total nitrogen uptake from slurry applied in March. Error bars indicate SEM.

For both DM yield and nitrogen uptake there was a lot of variation between the different sites. The HB site had lower DM yield and N uptake for each treatment compared to JC and MP. The slurry applied at all three sites did have a large positive effect on herbage yield, relative to the control. Bandspread and splashplate slurry application methods did not appear to differ in terms of herbage yield produced or in nitrogen removed in the herbage.

Conclusions The success of each of the slurry treatments regardless of spreading method or DCD content was dependent upon the site on which it was applied. More data will be needed in order to further investigate the effect of site, DCD and slurry application method on herbage production.

Acknowledgements This research is financially supported under the National Development Plan, through the Research Stimulus Fund, administered by the Department of Agriculture and Food, Ireland.

References

Zaman, M., Saggar, S., Blennerhassett, J. D. & Singh, J. 2009. Soil Biology and Biochemistry. 41, 1270-1280.
Di, H.J. & Cameron, K.C. 2006. Biology and Fertility of Soils. 42, 472-480

https://doi.org/10.1017/S2040470010004620 Published online by Cambridge University Press