Effects on Nitrogen and Phosphorus Availability in Agricultural Soils Following the Application of Slurry Amended with Additives

Vito Abbruzzese

v.abbruzzese@lancs.ac.uk

Lancaster Environment Centre, Lancaster University, UK
Supervisors: Dr. Ben Surridge, Prof. Phil Haygarth

1 INTRODUCTION

- This poster describes the experiments related to the first objective of a PhD focussed on the use of amended organic fertilisers (manures/slurries) in agricultural soils.
- Nitrogen (N) and phosphorus (P) are the most yield-limiting nutrients in many soils (Goulding et al., 2008).
- Manures and slurries could represent valid alternatives to inorganic fertilisers to replenish nutrient offtake via harvested crops (Vitale et al., 2011).
- Inoculation of slurry using additives, such as Slurrybugs™ and Slurrybooster™, can enhance the nutrient value of slurry, due to the action of microorganism and enzymes within the additives.

2 AIM

To understand how slurry inoculated with the Slurrybugs™-Slurrybooster™ additive affects N and P availability in three soil types.

LIVESTOCK

3 METHODOLOGY

Slurry experiment

- Analysis of total P, total N, ammonium-N (NH₄-N), total Mg, total Na, total K, pH and dry solids in slurry incubated for 9 weeks to evaluate the impact of the Slurrybugs™-Slurrybooster™ inoculation against a control livestock slurry.

Soil experiment

- Analysis of soil total P, Olsen-P, total N, mineral-N, extractable Mg, K, Na, and soil pH to determine the effect of applying slurry inoculated with Slurrybugs™ and Slurrybooster™ against i) control slurry and ii) inorganic fertiliser treatments, within organic-rich, clay-loam and sandy-loam grassland soils. Soils will be analysed on multiple dates throughout a 85-day incubation.

CROP

SOIL

MANURE/SLURRY

4 SLURRY EXPERIMENT

Little difference in total N between control and amended slurries, until week 8 (Figure 1).

Figure 1. Total N within control and inoculated slurry over 9-week incubation period.

Figure 2. NH₄ within control and inoculated slurry over 9-week incubation period.

Little difference in NH₄ between control and amended slurries, until week 8 (Figure 2).

Figure 3. Total P within control and inoculated slurry over 9-week incubation period.

Little difference in total P between control and amended slurries, until week 8 (Figure 3).

5 SOIL EXPERIMENT

Figure 4. NH₄-N within control and sandy-loam soil amended with different additives over 85-day incubation period.

Peak of NH₄-N across treatments for sandy-loam soil due to the N added by slurry. NH₄-N release from inorganic fertiliser (Urea-N). NH₄-N mobilisation from soil after 15 days of incubation in all treatments (Figure 4).

Figure 5. NO₃-N within control and sandy-loam soil amended with different additives over 85-day incubation period.

Rapid nitrification over the first 5 days following NH₄-N input in all treatments. Further increase in NO₃-N from day 15 due to nitrification (Figure 5).

Figure 6. Olsen-P within control and sandy-loam soil amended with different additives over 85-day incubation period.

Little difference in Olsen-P between treatments for sandy-loam soil. All treatments enriched at day = 0.

6 FURTHER WORK

The soil experiment described in the poster is the first part of a broader PhD research project investigating the effect of the application of inoculated slurry on soil quality.

Future aspects of the research will examine:

- the mechanism through which the enhancement of P bioavailability in soil is linked with the turnover of SOM and microbial activity and how to increase the P bioavailability in soil following the application of different mixtures of inoculants.
- the effect of inoculated versus non-inoculated livestock slurries on the soil microbial community composition and enzyme activity.

REFERENCES

- Goulding, K., Jarvis, S. and Whitmore, A. 2008. Optimizing nutrient management for farm systems. *Phil. Trans. R. Soc. B*, 363, 667-680.
- Vitale, J.D., Penn, C., Park, S., Payne, J., Hattey, J. & Warren, J. 2011. Animal Manure as Alternatives to Commercial Fertilizers in the Southern High Plains of the United States: How Oklahoma Can Manage Animal Waste, Integrated Waste Management. In: KUMAR, S. (ed.) Integrated Waste Management. InTech.