

## TC-P\_15 Animal feeding strategies to abate nitrous oxide and ammonia emission from surface applied slurry to a grassland soil

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### Objectives

The main objective of this study was to evaluate the effect of five different feeds, in terms of protein content, on the emissions of ammonia (NH<sub>3</sub>), nitrous oxide (N<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>) from a grassland soil fertilized with pig slurries.

### Methodology

A greenhouse experiment was carried out in which five types of pig slurry (Table) were surface-applied in a randomized complete plot design with three replicates to a grassland (*Lolium perenne*) soil (*Calcic Haploxerepts*), previously collected from the field, air dried and sieved (2 mm). This soil has a clayey loam texture (28% clay, 17% silt, and 55% sand) in the upper horizon (0-28 cm). A soil with no fertilizer applied was used as a control. Samples of GHG were taken following the procedure of Abalos et al. (2013) from a closed static chamber (7.96 l). Concentrations of GHG were determined by gas chromatography. Ammonia emissions were measured by a dynamic chamber connected to a chemiluminescence analyser.

Treatment	N applied (kg N ha <sup>-1</sup> )	Total N (g kg <sup>-1</sup> )	Ammonium N (g kg <sup>-1</sup> )	pH
PSControl	100	9.91	5.32	8.89
Ga 7.5	100	7.97	3.75	8.38
Ga 15	100	9.72	4.35	8.2
Pn 7.5	100	8.71	4.53	7.93
Pn 15	100	7.84	3.41	8.08

Table: N applied, N content and pH of applied slurries. "PSControl" refers to a slurry coming from pigs fed with barley (40%), wheat (45%) and soybean (10.30%); "Ga" refers to slurries produced by pigs fed with a mixture of "Garrofa" a by-product of the Carob tree (*Ceratonia siliqua*) (7.5 and 15% for Ga7.5 and Ga15, respectively); wheat (45%); barley (28.17 and 16.34% for Ga7.5 and Ga15, respectively) and soybean (13.21 and 16.12% for Ga7.5 and Ga15, respectively). "Pn" refers to slurries produced by pigs fed with a mixture of orange pulp (7.5 and 15% for Pn7.5 and Pn15, respectively); wheat (45%); barley (30.09 and 20.19%, respectively) and soybean (12.18 and 14.06% for Pn7.5 and Pn15, respectively).

### Results

Application of slurries increased N<sub>2</sub>O emission in all cases compared to the control (from 98.2% to 96% for PSControl and Pn7.5, respectively). The type of pig slurry had an effect on these emissions. Incorporation of by-products in the animals' diet decreased N<sub>2</sub>O emissions from applied slurry by 36.6 and 55.6% for Ga and Pn, respectively. This was probably related to the higher NH<sub>4</sub><sup>+</sup>-N of PSControl (Table 1). Application of slurries enhanced soil respiration (i.e. CO<sub>2</sub> fluxes) in all cases (64% on average), being this increase lower for PSControl (34.6%), possibly due to a reduction of plant biomass as a result of foliar damage following slurry application.

### Conclusion

Partial substitution of soybean and barley by "garrofa" and orange pulp in the diet of pigs reduced NH<sub>3</sub> and N<sub>2</sub>O from slurry application under controlled conditions. These preliminary results may show the potential of alternative feeding strategies for the reduction of environmental problems associated with agriculture and for decreasing the external dependency of N imports for feeding animals in Spain. Further research under real conditions is needed to confirm these results.

### References

- [1] Abalos D., Sanz-Cobefia A., Garcia-Torres L., van Groenigen J.W., Vallejo A., 2013. Role of maize stover incorporation on nitrogen oxide emissions in a non-irrigated Mediterranean barley field. *Plant and Soil* 364, 357–371.