Comparison of N_2O emission factors after organic or synthetic fertilization in Mediterranean cropped soils

E. Aguilera-Fernández[1], L. Lassaletta [2,3], A. Sanz-Cobena[4]

[1] Spanish Society of Organic Farming (SEAE) Camí del Port, S/N. Edificio ECA Patio Interior 1º - (Apartado 397) 46470 Catarroja (Valencia, España)

[2] Department of Ecology, Universidad Complutense de Madrid, c/Jose´ Antonio Novais 2, 28040 Madrid, Spain

[3] Ecotoxicology of Air Pollution, CIEMAT (ed. 70), Avda. Complutense 22, 28040 Madrid, Spain

[4] Technical University of Madrid, School of Agriculture. Avda. Complutense s/n, 28040 Madrid, Spain

Type and composition of fertilizers have been shown to affect N_2O emissions from cropped soils (Stehfest and Bowman, 2006), although differences between organic and synthetic fertilizers are still not clear. In Mediterranean climate regions, both climatic and ecological features are clearly distinct from those of other climates where most of these studies have been performed (e.g. temperate). There is an increasing amount of information about the effect of N fertilizing over N_2O fluxes under Mediterranean conditions, but the findings are sometimes contradictory. In this context, we have analyzed the scientific information with the objective of comparing the emission factor between two different types of N fertilization (organic and synthetic).

We have selected studies comparing field emissions from organic and synthetic fertilizers, excluding treatments in which organic and synthetic N sources have been mixed, and those where additives as nitrification inhibitors have been applied. The high variability of the considered data, which did not fit normal distribution, led us to select a pairwise comparison statistical method. Wilcoxon non parametric test for dependent samples has been chosen for this task.

We have found 26 studies measuring N_2O emissions under Mediterranean conditions, 6 of which compare the effect of organic and synthetic fertilization, comprising a number of treatments that allows 25 pairwise comparisons. Repeated measurements comparison reveals significant differences ($N = 25$; $p < 0.01$) in N_2O emission factor between the 2 types of fertilizers (Fig. 1). By contrast, the default factor proposed in IPCC Tier 1 is the same (1%) for both types of fertilizers (Intergovernmental Panel on Climate Change, 2006). Organic fertilization emission factor is significantly lower than that of synthetic (0.66 % N-N_2O and 1.12 %, respectively). However, the emission factor is very variable for organic and synthetic fertilizers depending on the type and amount of fertilizer, on environmental

and agronomic conditions. Emission factor is higher for synthetic fertilizers in 72 % of the cases but lower in the other 28 %.

These results suggest that Mediterranean climatic conditions have a different influence on N_2O production from soil after organic or synthetic fertilization. There still exists, however, a small data set supporting this assumption, and more information is required to understand the high differences found among studies. Moreover, sampling and emission factor calculation methodologies are sometimes heterogeneous. All these aspects point at the need for more research to understand the mechanisms underlying N_2O production under Mediterranean conditions. Additionally, since indirect emissions can represent a significant fraction of direct agricultural emissions (Garnier et al., 2009), further research should be done in order to consider the influence of N fertilising over the N pools (i.e. NH_3, NH_4^+, NO_3^-) affecting N_2O emission outside the cropping system.

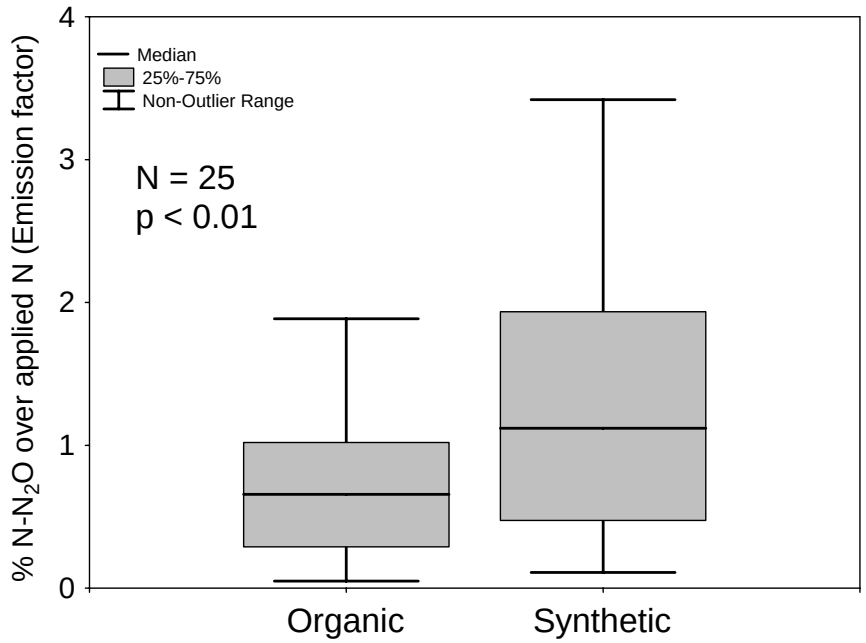

Fig. 1. Comparison of N2O emission factor between organic and synthetic fertilizer treatments. P value corresponds to the Wilcoxon test for dependent samples.

References

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