

NITROUS OXIDE AND DENITRIFICATION N-LOSSES FROM AN IRRIGATED SANDY LOAM SOIL FERTILISED WITH ORGANIC N FERTILISERS IN CENTRAL SPAIN

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EXTENDED ABSTRACT

Denitrification losses and N₂O emissions were rarely measured in irrigated crops in Southern European countries despite the fact that the surface areas used for such crops are important. The aim of this study was to quantify the nitrous oxide (N₂O) and the denitrification losses that occur in irrigated crops in Central Spain and at the same time to evaluate the effect of different organic fertilisers.

The field experiment was carried out at La Poveda Field Station (30 km south-east of Madrid, Spain) on corn crop in 2001. The corn was irrigated 10 times in doses varying from 32 to 52 mm per session. The soil is a *Calcaric Fluvisol* and has a sandy-loam texture (13% clay) and pH=8.1. Fertiliser treatments were: Surface-applied pig slurry (SPS), immediately incorporated pig slurry (IPS), sheep manure (SM), urea (U) and a control treatment (Control) without any fertiliser. All the fertilisers were applied using the same N-dose (200 kg N ha⁻¹). The N₂O was sampled by means of the closed chamber method. Denitrification was also estimated in the field with a core incubation method in the presence acetylene (C₂H₂).

With all the treatments, high N₂O emission occurred in the first month following the administration of fertilizers (April). Also during the whole irrigation period, the emission was activated very considerably and reached maximum values for the SM and ISP treatment after the 3rd irrigation (11 July) of 16.1 and 14.1 mg N m⁻² d⁻¹, respectively. The U treatment had a flow of 4.8 mg N m⁻² d⁻¹, while the SSP and the control treatment had similar flows (1.8 and 2.4 mg N m⁻² d⁻¹, respectively). In the period of May-June and in September-October emission of N₂O was very low and took basically place via the nitrification process as the water filled pore space (WFPS) did not surpass the denitrification threshold activation value, which was 63% in this soil. The percentage of N₂O lost with regard to the N applied during the whole period (200 d) varied between 1.27 and 1.46 % according to the type of treatment.

The denitrification rate (DR) differences between samples of each treatment could be explained with the WFPS evolution and the soil temperature during the maize growing season. Denitrification losses in the top 10 cm layer soil from the control, U, SM, SPS and IPS were, respectively, 13.1, 27.2, 49.7, 35.1 and 42.2 kg N ha⁻¹ during the whole period (200d).

Key words: pig slurry, nitrous oxide, denitrification and emission