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NITRATE LEACHING LOSSES FOLLOWING APPLICATION OF CATTLE SLURRY AND MINERAL FERTILISERS TO SOIL

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SUMMARY

The use of slurries as fertiliser may have important effects both on crop yields and environmental quality. In this sense, one concern regards the risk of N losses to surface and subsurface waters. Incorrect fertilisations promoting N leaching are often more common with the application of slurries than with mineral fertilisers, because the former present higher variability in composition and may require to be spread on the fields in periods of lower needs of crops.
This paper presents the first results on N leaching losses measured in a two year plot experiment, still running, having the aim of comparing two sources of N (chemical fertilisers and cattle slurry) at four N inputs as far as regards crop response and environmental impact.
Methods: a 3-year plot experiment began in 2000 at the experimental farm of the Padova University, Faculty of Agricultural Science. The experiment is conducted in 48 field plots and in a same number of growth boxes (2x2m sided) installed with the top at 1,3 meters above the field level and the open. During 2000 the experiment was a factorial combination of two types of fertilisation (mineral and organic cattle slurry), four nitrogen rates (0,113, 226 and 340 kg/ha) and two water table deep (the normal one of the experimental site and that obtained rising up 1,3 m the field level). In 2001 the plots of one of the two controls were treated with 680 kg/ha of nitrogen (half from cattle slurry and half from mineral fertilisers). The plots were cultivated with maize, harvested to make silage. The soil is loam (bulk density 1.3 t m^{-3}) with the following mean hydrologic characteristics: field capacity (10 KPa) = 32 % vol., wilting point (1500 KPa) = 8 % vol., saturated hydraulic conductivity *higher* then 1 m d^{-1}. Nitrate leaching losses are measured using an automatic equilibrium tension microlysimeter system (ETML; Morari et al., 2001) operative, since October 2000, into 16 of 48 growing boxes. 16 porous ceramic plates (Ø27 cm) were buried into the boxes at 90 cm deep, preserving the vertical profile of the soil, and were connected with a vacuum pump to crate the suction necessary to sample the percolating waters. The suction is regulated according to the matric soil potential measured with three couples of electronic tensiometers (in a first phase we used mercury tensiometers). The tensiometers of each couple were placed one just above the ceramic plate and one 1m from the plate, at the same deep. Samples are collected daily with a couple of bottles (1 L each) for every plate. In the same boxes, moisture of soil is measured, ones a week, by 48 one-diode probe (TDR MP-917 ESI), placed at three different layers (0-20, 25-45, 60-80 cm).
Results: since the ETML system was operative (October '00), a long period of exceptionally high rainfall occurred, so about 900 percolation water samples were

collected until the end of July '01. Because of the high rainfall, the volumetric moisture of the soil increased rapidly to values higher than 35% into all the plots and for all the three horizons measured, after, hit maintained this values till the following spring. The N-NO_3^- concentration data available at this moment are till the end of January '001. On the average of the two N sources, they show the following median values of N-NO_3^- concentration: 3.70, 5.18, 7.13 and 11.91, respectively for 0, 113, 226, 340 kg/ha of N distributed. The nitric nitrogen leached, at the end of this period, varies from 17,8 kg/ha of the control treatments to the 25,2 kg/ha of the plots most fertilised. The percolated volumes of water decrease with the increasing doses of nitrogen supplied.