1. INTRODUCTION

Conservation tillage is being promoted as a means of carbon sequestration. There is currently some debate of the effects of no-till on nitrous oxide (N$_2$O) emissions. Mummey et al. (1998) noted that N$_2$O emissions increased with no-till while Kessavalou et al. (1998) found N$_2$O emissions to decrease with no-till. Increases in N$_2$O emissions with minimum tillage would counter benefits to carbon sequestration.

Possible mitigation strategies for reduction of N$_2$O emissions therefore need to be investigated. Understanding the factors controlling N$_2$O release will help predict and explain the final outcome of this study. Management practices influencing the nitrification and denitrification processes are of particular importance as they are the main source of N$_2$O in agricultural soils.

Micrometeorological methods are preferred in principle as they do not disturb the environment in which the emissions are studied. In addition, it is possible to take rapid, continuous measurements, providing an average flux integrated over a large area and permitting the study of gas fluxes with varying atmospheric and surface conditions (Fowler and Duyzer 1989).

The objectives of this study were to compare nitrous oxide fluxes from two different agricultural management systems (conventional and best management) and to quantify the differences between the two systems.

2. MATERIALS AND METHODS

2.1 Site description

Flux measurements were performed at the Elora Research Station (43°9'N, 80°25'W, 376 m elev.), Ontario, Canada, since January 2000. The soil at the site is classified as a Woolwich Silt Loam (Typic Hapludalf) (29% sand, 52% silt, 19% clay), pH of 7.66, 2.69 % total organic C and 0.24 % total organic N.

The experiment is designed as a split plot with four locations with subsampling at each location. The four plots monitored were of 150 m by 100 m (1.5 ha) in size. The fluxes were measured in a corn/soybean/winter wheat rotation.

The experiment was comprised of two treatments: conventional practices and best management practices. The best management system included such practices as no-till, fertilizing as recommended by soil samples. The conventional treatment involved spring ploughing, fertilizing as recommended for the crop and fall discing when possible.

In the spring of 2000, corn was planted. The conventional plots were broadcast fertilized at a rate of 150 kg N ha\(^{-1}\) at planting. The best management plots were fertilizer injected at a rate of 50 kg N ha\(^{-1}\) at the 6 leaf stage. No N fertilizer was applied the following year on the soybean crop. The conventional plots were disced in the fall with one exception. Because of time and weather constraints, it was impossible to disc the plots in the fall of 2000. Best management practices employed a no-till strategy. For weed control, pesticides were used in both treatments.

3. RESULTS AND DISCUSSION

During the first year of the rotation (year 2000), highest fluxes were associated with spring thaw (day 60) and fertilizer application (day 160) (Fig. 1). Despite a difference of 100 kg N ha\(^{-1}\) applied between the two treatments, preliminary statistical analysis resulted in no significant differences between treatments. Total annual N$_2$O-N emissions were 4.82 kg N ha\(^{-1}\) for the conventional treatment and 4.17 kg N ha\(^{-1}\) for the best management treatment.

During the second year of the experiment (year 2001), peak fluxes occurred at spring thaw (day 100) (Fig. 2). Preliminary statistical analysis suggests that the fluxes from the conventional treatment are significantly higher than the fluxes from the best management treatment. The higher annual losses to N$_2$O emissions in conventional plots (3.25 kg N ha\(^{-1}\) vs. 1.82 kg N ha\(^{-1}\) in
High fluxes corresponding to spring thaw and fertilization have been well documented (Wagner-Riddle et al. 1997, Wagner-Riddle and Thurtell 1998, van Bochove et al. 2001).

The preliminary data analysis suggests that there are significant differences between the two management systems in certain years of a rotation. Further research and analysis is necessary for a more detailed explanation of the results.

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5. REFERENCES


