

Nitrogen fertilizer rate to corn can affect N₂O emissions from the following soybean crop in a corn-soybean rotation

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Introduction

- Greenhouse gas emissions from intensively managed agroecosystems are dominated by N₂O, a potent greenhouse gas that also destroys ozone in the stratosphere.
- In the Midwest US, most research on N₂O emissions has focused on corn (*Zea Mays* L.) due to large N fertilizer inputs that promote N₂O emissions. Little information exists on the potential for N application to corn to affect N₂O emissions during subsequent unfertilized crops in the rotation.
- The objectives of this study were to investigate the impact of a winter rye cover crop and three N fertilizer rates on soil N₂O emissions from corn and soybean phases of a corn-soybean rotation. Two key questions were addressed:
 - (1) Do cover crops and N fertilizer rate interact to affect N₂O emissions from the corn-soybean rotation?
 - (2) Does N application to corn greater than optimal affect N₂O emissions from the subsequent unfertilized soybean phase of the crop rotation?

Methods

- Plots in split plot design with and without cover crop in a corn-soybean rotation
- Three N fertilizer rates applied to corn only at
 - Control, 0 lb N/acre,
 - A recommended rate of 120 lb N/acre (135 kg N/ha), and
 - Greater than optimal rate of 200 lb N/acre (225 kg N/ha).
- N₂O emissions were measured during growing season of 2011, 2012, and 2013, using photoacoustic Infrared gas analyzer and gas chromatography



Results

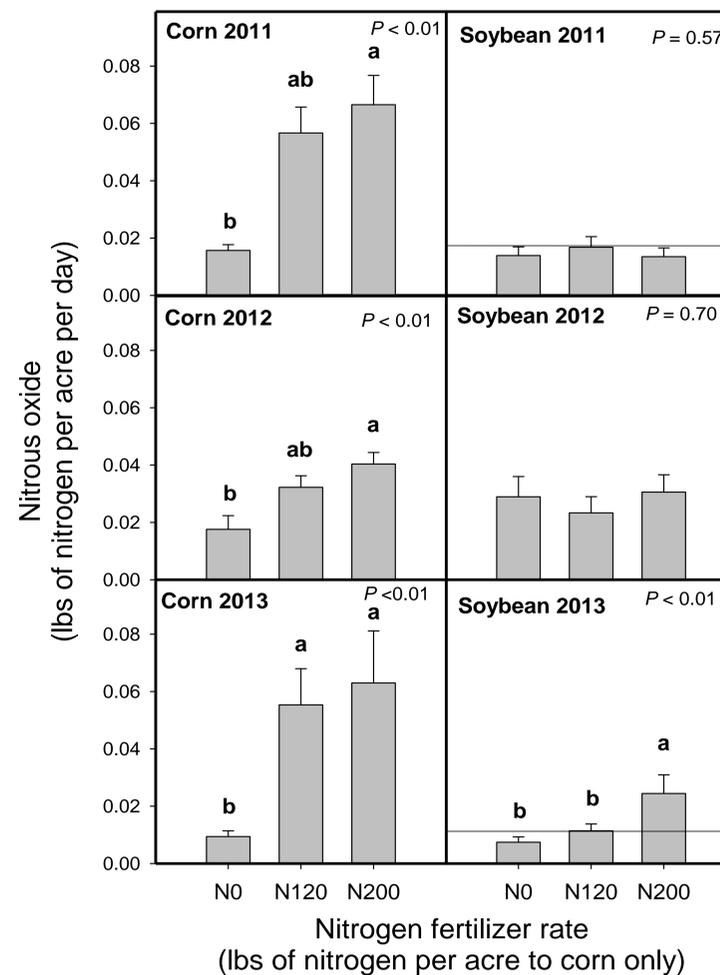


Fig. 1. Mean soil nitrous oxide emissions. Different letters indicate significant difference among treatments ($P \leq 0.05$)

- In corn, an increase in nitrogen fertilizer rate from N120 to N200 increased N₂O emissions by 16% accompanied by a 6% increase in corn yield.
- In two of three years, N₂O emissions from soybean was not different across N fertilizer treatments.
- In soybean following the drought year 2012, mean N₂O emission rates from N120 and N200 were 35% and 70% greater than the zero N rate.
- Cover crop effects on N₂O emissions were not consistent across years or N fertilizer treatments.

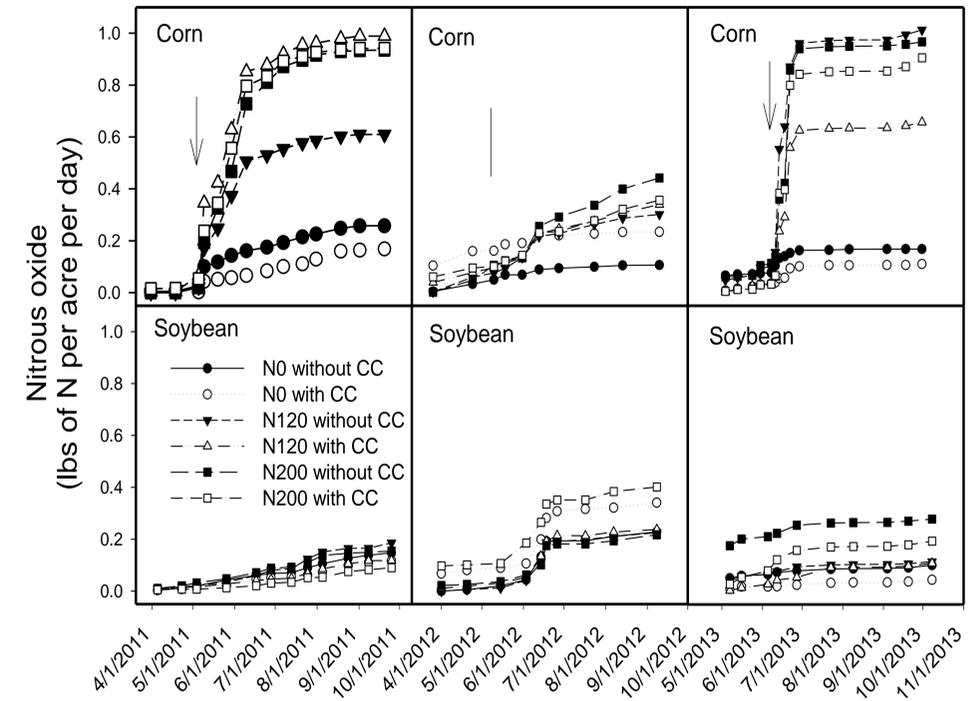


Fig. 2. Cumulative mean nitrous oxide emissions with 0 (N0), 120 (N120) and 200 (N200) lbs nitrogen fertilizer per acre with and without rye cover crop (CC). Arrows indicate date of nitrogen fertilizer application which is applied to corn only.

Conclusions

- Under certain weather conditions, greater than optimal nitrogen fertilization in corn can affect N₂O emissions from subsequent unfertilized soybean.
- Using recommended rate of N fertilizer could decrease the N₂O emissions in a crop rotation.
- Cover crops do not consistently affect N₂O emissions.

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