

Reference 38

Basche, AD; Miguez, FE; Kaspar, TC; Castellano, MJ; 2014 Do cover crops increase or decrease nitrous oxide emissions? A meta-analysis JOURNAL OF SOIL AND WATER CONSERVATION, 69, 471-482. 10.2489/jswc.69.6.471

Background and objective

There are many environmental benefits to incorporating cover crops into crop rotations, such as their potential to decrease soil erosion, reduce nitrate (NO₃) leaching, and increase soil organic matter. Some of these benefits impact other agroecosystem processes, such as greenhouse gas emissions. In particular, there is not a consensus in the literature regarding the effect of cover crops on nitrous oxide (N₂O) emissions. The objectives of this study were to use a meta-analysis approach to: 1) examine the relative impact of cover crops on N₂O emissions; 2) determine what management and environmental factors contribute to variability in cover crop effects on N₂O emissions. Here, only results regarding the effect of green manures on N₂O emissions are reported.

Search strategy and selection criteria

A literature review utilizing electronic databases Google Scholar and Web of Science was conducted with the following search string: "nitrous oxide emissions or greenhouse gas emissions and cover crops or green manures or catch crops." This combination of key terms resulted in approximately five thousand papers. To reduce the number of papers included in the meta-analysis, the following criteria were applied: 1) Studies in which the cover crop is not harvested and is grown between the harvest and planting of cash crops. 2) Studies reporting N₂O measurements. 3) Studies with a control treatment varying only in the inclusion of a cover crop and keeping all other management practices such as tillage and N additions equal. 4) Studies that provided enough information (standard errors, standard deviations, coefficients of variation, etc.) about experimental error either in the published paper or in information that was provided by the authors when contacted to allow for an estimate of within study variance. 5) Studies published before December of 2012.

Data and analysis

The statistical analysis was performed using the MIXED procedures of SAS (SAS Institute 2010). Finally, a sensitivity analysis was performed in order to test the robustness of the data-base and overall conclusions.

| Number of papers | Population | Intervention | Comparator | Outcome | Quality score |
|------------------|--------------|---|---|---|---------------|
| 26 | Arable crops | Cover crops (legume/non-legume; incorporated/surface) | Bare soil with the same treatments than in the intervention | Metric: Soil nitrate leaching; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control | 81.25 |

Results

- NO₃ loss with a cover crop was significantly lower than with bare soil.
- NULL
- NULL
- NULL
- NULL

Factors influencing effect sizes

- No factor reported : NA

Conclusion

NO₃ loss with a cover crop was significantly lower than with bare soil.