The Effect of Soil Disturbance and Organic Matter Inputs on Net Nitrogen Mineralization

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INTRODUCTION

- Only nitrogen that has been mineralized can be used by plants[1]
- Reduced soil disturbance can increase nitrogen mineralization[2,4]
- Increased organic matter inputs can increase nitrogen mineralization, particularly if the C/N ratio is less than 15[3]

MATERIALS & METHODS

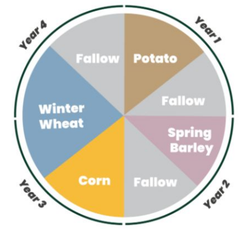
1. Soil samples were taken with a step probe from each plot in a long-term experiment with a gradient of disturbance and organic matter inputs
2. Soil samples were incubated for four months at 60% of the saturated water content and representative field temperatures
3. Nitrate and ammonium were extracted each month using 100 mL of 2M KCl and a 20 g subsample of the incubated soil
4. The extract was mixed with NH_4^+ and NO_3^- reagents and analyzed in a spectrophotometer to measure NH_4^+ and NO_3^- concentrations

Treatment 1

High disturbance and removal of crop residue

Baling and removing crop residue

Full tillage between crops

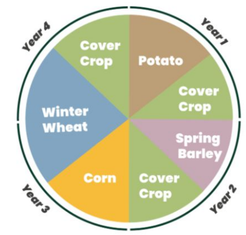


Treatment 2

High disturbance while leaving crop residue with annual cover crops

Leave crop residue after grain crops

Full tillage between crops



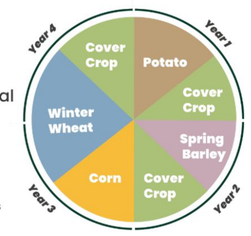
Treatment 3

Reduced disturbance while leaving crop residue with annual cover crops and external soil amendments

Leave crop residue after grain crops

Both full and reduced tillage practices

External soil amendments incorporated



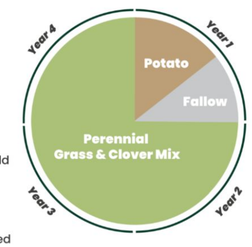
Treatment 4

Infrequent tillage with perennial cover crops and external soil amendments

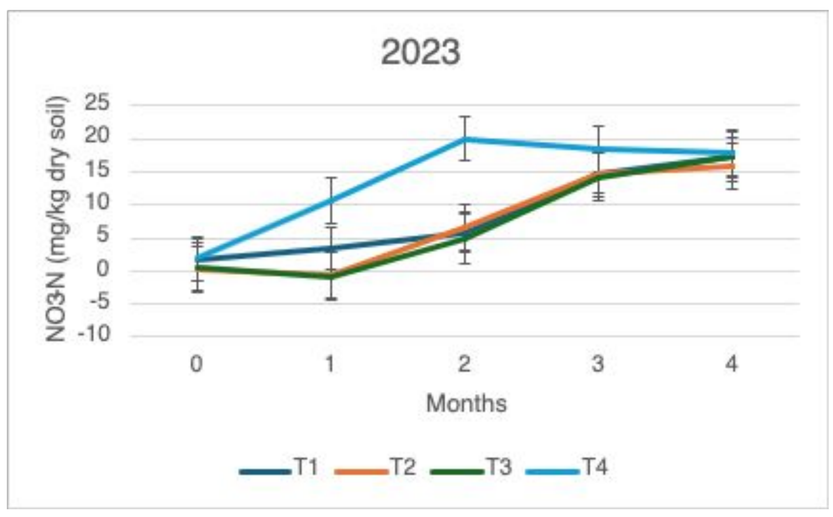
Perennial cover crop residue left in field

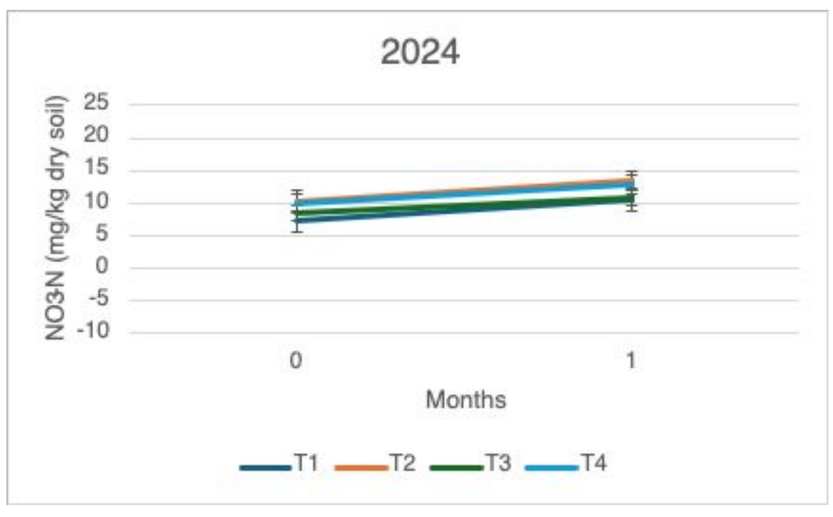
Full tillage before and after potatoes

External soil amendments incorporated



RESULTS





CONCLUSIONS

- Treatment 4 had the most rapid net N mineralization, which is important for matching N supply with crop demand
- Further research should replicate this trial in different locations, and the incubation should be repeated periodically throughout the course of the long-term experiment, since results are expected to change over time

ACKNOWLEDGMENTS

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REFERENCES

1) Brady, N. C., & Weil, R. R. (2010). *Elements of the Nature and Properties of Soils*. Pearson Prentice Hall.
2) Brangarí, A. C., Lyonnard, B., & Rousk, J. (2022). Soil depth and tillage can characterize the soil microbial responses to drying-rewetting. *Soil Biology and Biochemistry*, *173*. https://doi.org/10.1016/j.soilbio.2022.108806
3) Brust, G. E. (2019). Chapter 9 - Management Strategies for Organic Vegetable Fertility. In D. Biswas & S. A. Micallef (Eds.), *Safety and Practice for Organic Food*. https://doi.org/10.1016/B978-0-12-812060-6.00009-X
4) Canisares, L. P., Grove, J., Miguez, F., & Poffenbarger, H. (2021). Long-term no-till increases soil nitrogen mineralization but does not affect optimal corn nitrogen fertilization practices relative to inversion tillage. *Soil and Tillage Research*, *213*. https://doi.org/10.1016/j.still.2021.105080