**Title: Data from: A grass-legume cover crop maintains nitrogen inputs and nitrous oxide fluxes from an organic agroecosystem**

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Accompanying Dataset: Bressler, A., Blesh, J. *Data from: A grass-legume cover crop maintains nitrogen inputs and nitrous oxide fluxes from an organic agroecosystem* [Data set], University of Michigan - Deep Blue Data. <https://doi.org/10.7302/zqyt-gz14>

A complete description of the project can be found in Bressler, A., and J. Blesh. 2023. A grass-legume cover crop maintains nitrogen inputs and nitrous oxide fluxes from an organic agroecosystem. Ecosphere.

**Research Overview:**

Legume-grass cover crop mixtures diversify cropping systems while serving as an ecological nutrient management practice that reduces nitrogen (N) losses from farms. In Summer 2019, the Blesh Soil and Agroecosystems Lab established four winter cover crop treatments (crimson clover, cereal rye, clover-rye mixture, and weedy fallow control) in an organic grain agroecosystem within the Main Cropping System Experiment at the Kellogg Biological Station Long Term Ecological Research Network site in Michigan. This site had been managed for 30 years with a legume cover crop as the only external N source. We sampled and incorporated the cover crops in May 2020 and planted grain corn. We measured nitrous oxide (N2O) flux rates through Summer 2020 and harvested corn in Fall 2020. This research was funded by the United States Department of Agriculture (Award #: 2019-67019-29460).

**Methodology:**

Baseline characterization of soil properties was conducted in June 2019 prior to planting cover crops. Four cover crop treatments were planted on 31 July 2019 in a randomized complete block design within the Main Cropping System Experiment at the Kellogg Biological Station Long Term Ecological Research Network site in Michigan. Cover crop aboveground biomass, carbon, and nitrogen were measured on 26 May 2020. Legume nitrogen fixation was measured using stable isotope methods. Organic corn was planted on 1 June 2020. From 26 May to 27 August 2020, soil N2O emissions were measured every few days-weeks using the static chamber method, and soil inorganic N was measured every two weeks. Corn grain yield, and grain carbon and nitrogen content, were measured on 28 October 2020.

**File Inventory:**

This dataset contains three data files and three corresponding metadata files used in Bressler, A., and J. Blesh. 2023. A grass-legume cover crop maintains nitrogen inputs and nitrous oxide fluxes from an organic agroecosystem. Ecosphere.

* “N2O\_Flux.xls” contains daily nitrous oxide data organized by replicate block, treatment, and date. This file contains all N2O data collected throughout the summer study period.
* “Soil\_N.xls” contains nitrate and ammonium data organized by replicate block, treatment, and date. The dates in this file correspond with the dates in “N2O\_Flux.xls,” representing soil N data collected every 2 weeks during the summer study period.
* “Cover\_crop\_corn\_soil.xls” contains: I) baseline soil fertility characteristics including carbon, nitrogen, phosphorus, potassium, magnesium, calcium, pH, organic matter, cation exchange capacity; 2) cover crop and corn biomass, and biomass nitrogen and carbon content; 3) legume nitrogen fixation data; and 4) cumulative N2O emissions organized by replicate block and treatment.
* The corresponding metadata files: “N2O\_Flux\_metadata.xls”, “Soil\_N\_metadata.xls”, and “Cover\_crop\_corn\_soil\_metadata.xls” provide detailed descriptions of all variables in each data set and any abbreviations used.

**Definition of Variables:**

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| **Variable**  | **Description** |
| Block | Replicate block, categorical, 4 levels |
| Treatment | ID of the treatment, categorical, 4 levels; T1 = cereal rye; T2 = crimson clover; T3 = cereal rye/crimson clover mix; T4 = weedy control |
| Date | day, month, and year of N2O sampling |
| N2O.d | Daily N2O flux in g N2O-N/(ha\*day) |
| NH4 | Ammonium concentration (mg N/kg soil) |
| NO3 | Nitrate concentration (mg N/kg soil) |
| C.stock | Mg of C in soil per ha (pool size) |
| N.stock | Mg of N in soil per ha (pool size) |
| PMN | Potentially mineralizable N (kg of ammonium per hectare per week (kg NH4 N/ha/week)) |
| pH.1.1 | pH of the soil solution |
| OM.LOI | % organic matter in soil sample |
| P.ppm | Soil phosphorus concentration (Bray 1- P) |
| K.ppm | Soil potassium concentration |
| Mg.ppm | Soil magnesium concentration |
| Ca.ppm | Soil calcium concentration |
| CEC | Cation exchange capacity (meq/100g) |
| N2O.c | Cumulative N2O flux in g N2O-N/(ha) |
| Sbio | Total aboveground cover crop biomass (kg/ha) including weeds for spring sampling |
| Sclobio | Clover aboveground biomass (kg/ha) for spring sampling |
| Sclo.perN | % N in spring clover  |
| Sclo.perC | % C in spring clover |
| ScloN | Clover aboveground biomass N (kg N/ha) for spring sampling |
| %Ndfa | Percent nitrogen derived from fixation in clover |
| Sclo.Ndfa | N (kg N/ha) derived from biological nitrogen fixation in clover biomass |
| ScloC | Clover aboveground biomass C (kg C/ha) for spring sampling |
| Sryebio | Rye aboveground biomass (kg/ha) for spring sampling |
| Srye.perN | % N in spring rye |
| Srye.perC | % C in spring rye |
| SryeN | Rye aboveground biomass N (kg N/ha) for spring sampling |
| SryeC | Rye aboveground biomass C (kg C/ha) for spring sampling |
| Sweedbio | All species of weeds aboveground biomass (kg/ha) for spring sampling |
| Sweed.perN | % N in spring weeds |
| Sweed.perC | % C in spring weeds |
| SweedN | All species of weeds aboveground biomass N (kg N/ha) for spring sampling |
| SweedC | All species of weeds aboveground biomass C (kg C/ha) for spring sampling |
| StotalN | Total aboveground cover crop biomass N (kg N/ha) for spring sampling |
| StotalC | Total aboveground cover crop biomass C (kg C/ha) for spring sampling |
| Sbio.no.weeds | Total aboveground cover crop biomass (kg/ha) excluding weeds for spring sampling |
| StotalN.no.weeds | Total aboveground cover crop biomass N (kg N/ha) excluding weeds for spring sampling |
| StotalC.no.weeds | Total aboveground cover crop biomass C (kg C/ha) excluding weeds for spring sampling |
| Sper.rye | Rye aboveground biomass as a percentage of total aboveground biomass sampled in the spring (excluding weeds) |
| Sper.clover | Clover aboveground biomass as a percentage of total aboveground biomass sampled in the spring (excluding weeds) |
| Corn.grain g/ha | Biomass of harvested corn grain (kg/ha) |
| Corn.grain.Nper | % N in corn grain  |
| Corn.grain.Cper | % C in corn grain |
| Corn.grain.N | Corn grain biomass N (kg N/ha) |
| Corn.grain.C | Corn grain biomass C (kg C/ha) |