----- GENERAL INFORMATION -----

DATA TITLE:   
Soil net nitrogen mineralization and leaching under *Miscanthus* × *giganteus* and *Zea mays*

DATA ABSTRACT:

Research objectives were to compare whether miscanthus (*Miscanthus × giganteus* Greef et Deu.) would leach less nitrogen (N) than continue maize (*Zea mays* L.) and how soil net N mineralization (Nmin) may explain observed leaching. The experiment included three factors: 1) cropping system (maize, juvenile miscanthus = 1-2 y old, mature miscanthus = 3-4 y old); 2) N fertilization (0 and 224 kg N ha-1); and 3) environment (four site-years at two locations in Iowa, USA that differed in climate and soil fertility). During the 2017 and 2018 growing seasons a variety of soil measurements, including inorganic soil N (ammonium + nitrate), *in situ* Nmin, and N leaching were taken to better understand the differences in N cycling dynamics associated with each system.

AUTHORS:

Author: Jacob E. Studt

ORCID:

Institution: Iowa State University

Email: jstudt@iastate.edu

Author: Marshall D. McDaniel

ORCID:

Institution: Iowa State University

Email: marsh@iastate.edu

Author: Emily A. Heaton

ORCID:

Institution: University of Illinois Urbana-Champaign

Email: heaton6@illinois.edu

Corresponding author: Emily Heaton

ASSOCIATED PUBLICATIONS:   
 Publication forthcoming

COLLECTION INFORMATION:

Time period(s): 2017-2018

Location(s): Iowa State University Research Farms: Sorenson, Allee

----- FILE LIST-----

Codebook.csv – Provides brief descriptions, units, and formats of variables.

Ancillary.csv – Provides measurements of bulk density, total nitrogen, total carbon, and pH.

NitrogenLeaching.csv – Provides measurements of leached nitrogen.

Nmin.csv – Provides amount of nitrogen mineralized for given incubation intervals.

SEON\_MBN.csv – Provides the amount of organic nitrogen that was salt extractable and the amount of nitrogen held in microbial biomass.

TimeSeries.csv – Provides vales of nitrate, ammonium, soil temperature, and gravimetric water content.

----- CODEBOOK -----

(Separate file - codebook.csv)

----- METHODS AND MATERIALS -----

----- DATA COLLECTION METHODS -----

Ancillary soil measurements (Anciallary.csv) -   
Soil bulk density was measured (0-0.15 m) from three replicate 5.1-cm diameter cores in each plot. Cores were oven dried for 48 h at 105 °C, and their mass and the volume subsequently used to calculate bulk density. Soil pH was measured using a glass electrode (HQ430D laboratory meter, Hach, Loveland CO, USA) in a 1:1 soil:deionized water slurry while being stirred. Total soil C and N were measured (0-15 cm) by first ball milling the samples to a fine powder followed by oven drying at 105 °C for 48 h. Once oven dried, 5 g of soil was combined with equal parts tungsten oxide catalyst for combustion using an Elementar Vario MACRO (Elementar Americas Inc., Ronkonkoma, New York, USA) to provide elemental soil C and N amounts.

Nitrogen Leaching (NitrogenLeaching.csv) -   
The lysimeters were made of a polyvinyl chloride housing with a cross sectional area of 20 cm2 holding 25 g of Lewatit® NM 60 ion exchange resin (Thermo Fisher Scientific, Waltham, MA, USA) secured in place by 153 µm nylon mesh. Above and below the resin there was a sand layer. Installation of the resin lysimeters began with digging a 60 cm deep pit. Then to avoid any preferential flow of water through the lysimeter from above, horizontal tunnels were carved in the sides of the pit so the top of a lysimeter would be under an undisturbed 50 cm soil profile and ~15 cm away from the original pit. Two lysimeters were installed per pit for a total of two lysimeters per plot. After retrieval, nitrate and ammonium were extracted from the ion exchange resin beads by shaking in 200 mL of 2 M KCl for 1 h. The supernatant was filtered (0.45 µm, EZFlow® Membrane Disc Filter, Nylon, Foxx Life Sciences). Extracts were analyzed colorimetrically using a SynergyTM HTX Multi-Mode Microplate Reader (BioTek Instruments, Winooski, VT, USA) for ammonium using the salicylate and ammonia cyanurate reagent packets (Hach Company, Loveland, Colorado, USA), and for nitrate using the single-reagent method (vanadium III, sulfanilamide and *N*-(1-naphthyl)-ethylenediamine dihydrochloride).

Net Nitrogen Mineralization (Nmin.csv) -   
An in-situ, sequential buried bag method was used to measure soil net N mineralization. Sampled soils were placed in 2.4-mil thick polyethylene bags and buried, spanning 5 to 15 cm below the soil surface to incubate. Once the incubated soils were recovered and returned to the lab the soils were sieved (< 2 mm at field moisture). A 5 g subsample of field-moist soil was extracted for ammonium and nitrate analyses by adding 25 ml of 2 M KCl and shaking for an hour. This was followed by filtration of the supernatant through Whatman filter paper No. 1 (VWR International, LLC, Radnor, PA, USA). Extracts were analyzed colorimetrically using a SynergyTM HTX Multi-Mode Microplate Reader (BioTek Instruments, Winooski, VT, USA) for ammonium using the salicylate and ammonia cyanurate reagent packets (Hach Company, Loveland, Colorado, USA), and for nitrate using the single-reagent method (vanadium III, sulfanilamide and *N*-(1-naphthyl)-ethylenediamine dihydrochloride). Taking the difference between the ammonium and nitrate in nonincubated soils compared to the incubated soils equaled the amount mineralized.

Salt extractable organic nitrogen and microbial biomass nitrogen (SEON\_MBN.csv) -   
Five grams of field-moist, < 2 mm-sieved soil was fumigated with ethanol-free chloroform in a desiccator for 24 h in the dark. A matching set of samples were not fumigated but placed nearby in similar temperature and light conditions. Both the fumigated and non-fumigated samples were extracted with 25 mL of 0.5 M K2SO4. Total dissolved N in both the fumigated and unfumigated samples was measured using a Shimadzu TOC-L TNM analyzer (Shimadzu Corporation, Columbia, Maryland, USA). To calculate microbial biomass N, we subtracted the total dissolved N of the non-fumigated from the fumigated and applied an extraction efficiency constant of KEN = 0.54. Salt extractable organic N was calculated by subtracting salt extractable inorganic N (ammonium + nitrate) from the total dissolved nitrogen of non-fumigated samples.

Soil nitrate, ammonium, gravimetric water content, and temperature (timeseries.csv) -  
Soil temperature was randomly taken in four points per plot with a digital stem thermometer (0-0.1 m). Soils were sieved (< 2 mm at field moisture) and a sub-sample was used to determine gravimetric water content by comparing the fresh mass of the soils to the final mass after being dried at 105° C for 24 hours. A separate 5 g subsample of field-moist soil was extracted for ammonium and nitrate analyses by adding 25 ml of 2 M KCl and shaking for an hour. This was followed by filtration of the supernatant through Whatman filter paper No. 1 (VWR International, LLC, Radnor, PA, USA). Extracts were analyzed colorimetrically using a SynergyTM HTX Multi-Mode Microplate Reader (BioTek Instruments, Winooski, VT, USA) for ammonium using the salicylate and ammonia cyanurate reagent packets (Hach Company, Loveland, Colorado, USA), and for nitrate using the single-reagent method (vanadium III, sulfanilamide and *N*-(1-naphthyl)-ethylenediamine dihydrochloride).

------- LICENSING -------

This work is licensed under the Creative Commons Attribution (CC-BY) 4.0 International License. For more information visit: <https://creativecommons.org/licenses/by/4.0>