

2017 LTER Standard Sampling Report

Main Cropping System Experiment (MCSE)

Soil

Soil was regularly sampled on the LTER to a depth of 25 cm at each of 5 stations in all replicates (R) of all treatments (T) 1-8, CF, DF, and SF. Samples were taken once or twice each month, for a total of twelve times between March 28 and November 6. Soil was sampled using a $\frac{3}{4}$ " diameter push corer. Two cores were taken from each station with all 10 cores composited for each plot. Inorganic nitrogen extractions and soil moisture determinations were done on subsamples from all soil sampled. Analysis of the extracts for nitrate and ammonium will be completed by Cathy McMinn during winter 2017-2018.

The April 11 soil samples were air-dried and archived. A subsample, from each of the June 26 samples, was incubated in the field for 21 days and then inorganic nitrogen extracted to evaluate mineralization potential.

A post-harvest extensive grid soil sampling was done in all replicates of T1-6 and T8NT on November 3. This soil was air-dried and sent to the MSU Soil and Plant Nutrient Lab for standard analysis which includes pH, lime requirement, P, K, Ca, and Mg.

Gas

This was the third year that the LTER field-season gas sampling was done with the same round chambers as on the GLBRC. The round chambers had been used for winter sampling only on the LTER prior to 2015. Gas was sampled throughout the LTER using round static chambers between April 10 and November 14. Main site plots that were sampled include T1-7 R1-4, as well as the fertilized, untilled microplots in T7 R1-4. Static chambers were also sampled in T8 R1-4 and all replicates of successional and forested sites, CF, DF, and SF. Sampling in the forest sites included the nitrogen deposition study microplots. With a sample frequency of about twice each month, gas samples were taken thirteen times during the 2017 field season. The main site (including T8) was sampled in the morning and forest sites sampled in the afternoon of the same day. Winter sampling began on December 20 and should continue monthly through March 2018. This sampling includes T1-7 and DF. All gas samples were analyzed for nitrous oxide, carbon dioxide and methane by Kevin Kahmark using the Agilent/Gerstel automated GC in Academic 330.

Soil temperature and soil samples to determine moisture content were taken near each chamber when gas was sampled during the field season. Air temperature was logged both inside and outside, while light was measured outside, of some chambers using HOBO dataloggers.

Water

Soil water samplers were used to sample water from the soil in T1-7 R2-4 and all replicates of CF, DF, and SF. Samplers were evacuated and leachate collected about twice a month. Fourteen collections were made between March 8 and November 20. The volume of

leachate collected was recorded. When 20mL or more of leachate was collected, the sample was filtered and frozen for analysis and archive. Analysis for nitrate and ammonium of all leachate samples taken should be completed by Cathy McMinn during winter 2017-2018.

Plants

Plant biomass samples were taken from plots prior to tillage or harvest in T1-6, or at peak biomass in T7, 8 and SF, and species separations completed. Plant sampling in 2017 began with cover crop samples taken in T3 (May 8-10) and T4 (May 16-18), prior to tillage and corn planting. Alfalfa was sampled in T6 three times in 2017 – June 9-12, July 13-14 and September 1-5, just prior to machine cutting each time. In T5, understory samples were taken on July 26-27. Leaves were collected in ground traps as they fell from the trees in T5 between July 26 and November 22. Leaf litter was collected in traps in CF, DF, and SF between August 18 and December 15. Typically, leaf litter traps were checked and leaves collected bi-weekly. At peak biomass, early August through early September, plant samples were taken from T7, T8, and SF. Corn samples were taken from T1-4 October 16-18, just prior to machine harvest. On November 8, post-frost biomass samples were taken from T7. Species separations were not made on post-frost biomass, but surface litter was collected. All plant material from all samplings was dried at 60°C for at least 48 hours. All dried biomass will be weighed, ground and archived. Subsamples will be analyzed for carbon and nitrogen by Stacey VanderWulp.

To assess the health of the T5 poplar stand, stand counts were completed July 14-26 in all six replicates. Trees were recorded as alive, dead or absent.

In CF and DF, all trees with a DBH (diameter at breast height) greater than or equal to 5cm were measured in January. The diameter of poplar trees in T5 main and microplots were measured at 15cm above the ground on November 20, 21 and 27.

All replicates of T7 were burned on March 29 to help control woody species.

Yield data was collected from all of the mechanically harvested plots.

Microplot Experiments

Herbicide-free Microplots (T1 R1-6, T2 R1-6): No sampling was done in 2017.

Rainfall Manipulation Experiment (T1 R1-4, T2 R1-4): Two soil water samplers were installed in the northern-most 15m of each of T1, T2 R1-4 in 2014. The frequency of rainfall was manipulated over one sampler (east) in each plot using shelters installed on May 22. Rain water was collected and applied under the shelter every two weeks. The second sampler (west) was left unsheltered as a control. The samplers were evacuated and leachate collected 18 times between March 20 and November 30. Subsamples of the leachate underwent anion and cation analysis by Dave Weed, primarily monitoring a bromide tracer. Cathy McMinn will complete analysis of the leachate for nitrate and ammonium during winter 2017-2018. Shelters were removed from the plots for the winter on December 1.

Weed-control/Fertilization Microplots (T3 R1-6, T4 R1-6): No sampling was done in 2017.

Poplar Fertilization Gradient (T5 R1-6): Beginning in 2011, six levels of nitrogen fertilizer were applied to microplots in the northern-most 15m of each T5 plot. On June 26 – 28, 2017, fifteen green leaf samples were taken from three randomly selected trees near the center of each microplot. The leaves will be ground and analyzed for carbon and nitrogen at KBS. The ground material will also be sent to the Soil and Plant Nutrient Lab on MSU main campus and analyzed for twelve micronutrients. The basal diameters of twelve trees in the center of each microplot were measured on November 20 and 21. The same twelve trees are measured annually in late fall or early winter.

Disturbance/Fertilization Microplots (T7 R1-6): This sampling effort was led by the Lau Lab. Soil samples for inorganic nitrogen, soil moisture, and air-dried archive were collected twice from the T7 microplots in 2017 on July 11 and December 4. Five soil cores were taken to a depth of 10 cm in the 3 x 3 meter center of each experimental plot and composited. Greenhouse gases were sampled thirteen times in the untilled, fertilized microplots of T7 R1-4, as detailed in MCSE Gas section above. The T7 microplot biomass was sampled near its peak in late August for untilled and early-September for tilled, but species were not separated and no grinding or archiving was done.

Nitrogen Deposition Study

Fertilizer solutions were applied to the 1F, 3F and 10F plots in this study on three dates. Urea (46% N) was applied on April 19-20, July 28 and September 29. The type of fertilizer used was dependent on availability. Rates of fertilization are 1g/m²/year for the 1F plots, 3g/m²/year for the 3F plots, and 10g/m²/year for the 10F plots. Gas was sampled on a routine basis in this study; see the Gas section under MCSE.

Biodiversity Study

Yield data was collected from all of the annual crop treatments when harvested mechanically.

Cellulosic Biofuel Experiment

Yield data was collected from all of the treatments when harvested mechanically.

Resource Gradient Experiment

Since January 2017, nearly 300 soil water samples were collected from 42 vacuum lysimeters at the Resource Gradient and have been analyzed for chemistry in the Hamilton lab. The chemistry of these soil water samples is the keystone to Bonnie McGill's dissertation. She used the concentrations of several ions to calculate whether inorganic carbon that entered the soil, as lime or dissolved in groundwater irrigation, results in a source of CO₂ to the atmosphere or stores additional CO₂ in the soil water. Results from this experiment were presented at the 2015 and 2017 American Geophysical Union annual meeting.

Also, Bonnie sampled water from the groundwater well that provides irrigation water to the Resource Gradient for chemistry and dissolved gases. She repeated the sampling 10 times between June and September. These data contributed to her assessment of the global warming impact of irrigation.

Soil samples were taken on October 30 and the field-moist soil analyzed for pH by Cathy McMinn in the Robertson lab. Four cores (0-25cm) were pooled from each plot, two in the row and two between rows.

The LTER Resource Gradient experiment automated trace gas system was dormant in 2017.

Yield data was collected when plots were harvested mechanically.

Scale-up Fields – ended in 2013

Living Field Laboratory – ended in 2014

Written by Stacey VanderWulp (with some information provided by Mark Hammond and Bonnie McGill)