

2009 LTER Baseline Sampling Report

Main Field, Successional, and Forest Sites

Soil was sampled on the LTER to a depth of 25 cm in Treatments (T) 1-8, CF, DF, and SF, all replicates (R). Samples were taken fourteen times between March 18 and November 18. Inorganic nitrogen extractions and soil moisture determinations were done on subsamples from all soil sampled. Analysis of the inorganic nitrogen extracts for nitrate and ammonium was completed by Cathy McMinn during winter 2009-2010. Additionally, pH was measured for soil sampled on April 15, 2009.

Gas was sampled on the main site, as in previous years, using static chambers in T1-7 R1-4. All replicates of unmanaged native sites, CF (added in 2008), DF, and SF (added in 2007), were also sampled using static chambers. Sampling in CF, DF, and SF also included the nitrogen deposition study microplots. Also added in 2008, static chambers were sampled in T8 R1-4 and in the fertilized, untilled microplots in T7 R1-4. Gas samples were taken fourteen times between April 10 and November 11, with the main site sampled in the morning and native sites sampled in the afternoon of the same day. All gas samples were analyzed for nitrous oxide, carbon dioxide and methane using the automated GC system in Academic 330 by Cathy McMinn shortly after sampling.

Quartz lysimeters were used to sample water from the soil in T1-7 R2-4, CF, DF, and SF. Lysimeters were evacuated and leachate collected sixteen times between March 25 and November 9. The volume of leachate collected was recorded and the leachate filtered and frozen. Inorganic nitrogen analysis for these samples will be done by Cathy McMinn during fall/winter 2010. Eleven new lysimeters were installed on July 30, replacing broken lysimeters in the unmanaged sites.

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. In CF and DF, all trees greater than 5cm in diameter were measured in late January and early February. On May 14-21, cover crop (cereal rye) was sampled in T3 and T4 prior to tillage. Alfalfa was sampled on September 3 and 4, just prior to machine cutting. At peak biomass in August, plant samples were taken from T7 (including microplots), T8, and SF. Soybeans were sampled from T1-4 on October 5 and 6, prior to entire plot combine harvest. On November 13, a post-frost biomass sample was taken from T7. Species separations were not made on post-frost biomass, but surface litter was collected. Leaves were collected in traps on the ground as they fell from the trees in CF, DF, and SF (new in 2008), starting August 24 and finishing December 3. Leaf litter was also collected in traps in T5 on the mainsite from September 25 to December 3. All plant material was dried at 60°C for at least 48 hours. All dried biomass will be weighed, ground, archived, and sub sampled for CN analysis by Stacey VanderWulp.

All replicates (1-6) of T7 were burned on March 17.

Scale-up Fields

Yield data was collected from all of the scale-up fields when harvested mechanically.

Biodiversity Study

Carol Baker

Weed biomass was harvested in October in two 0.25 m² areas of each plot. Harvested plants were sorted to weeds and clover, dried and weighed.

Soil was collected to a depth of 25 cm on November 9th. Inorganic nitrogen extractions and soil moisture determinations were completed on sub samples. An air-dried soil sample was archived. On November 17th, soil was collected to a depth of 10 cm in treatments B3, B6, B9, B12, B18-21 of Blocks 2 and 3. Samples were sent to Tom Schmidt and Stuart Grandy on main campus.

Nitrogen Fertility Gradient

Kevin Kahmark

In April, a spatial variability test was started with eight chambers deployed in Block 2, treatment F-4. In the same month, aluminum barriers were installed between the base and chamber lid to test sensitivity, noise, and leakage. Ilya Gelfand and Neville Millar have the results of this test.

On May 20th, the chambers were removed for soybean planting. The chambers were reinstalled in Block 2, F5 for a similar spatial variability test sequence.

In June, the system was installed in treatment F1 and F6 in Blocks 2,4,5,7 to test differences in irrigated versus rainfed nitrous oxide fluxes over the same time frames.

In early November, the system was returned to the standard F1 to F8 (n=1 in each treatment) configuration.

These semi-continuous gas samples were taken using an automated chamber system with on-site GC analysis for nitrous oxide, carbon dioxide and methane. Four samples were collected on six hour increments for eight chambers in each configuration above.

Continuous soil moisture (30cm) and temperature (5cm) probes were installed in Block 2, treatments F1, F5, and F8. Measurements were taken using a CR10 data logger. No soil cores or resin strips were collected during this growing season.

European Corn Borer Study

This study was not sampled.

Gene Transfer Study

This study was not sampled.

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 June 19. Ammonium Nitrate (34% N) was used to fertilize on October 25 and November 16 due to availability. Rates of fertilization are 1g/m²/year for the 1F plots, 3g/m²/yr for the 3F plots, and 10g/m²/yr for the 10F plots.

Living Field Laboratory

John Green

In the spring, just prior to planting, soil was sampled to 25 cm in all 2009 corn plots. Inorganic nitrogen extractions and soil moisture determinations were done on sub samples from the initial sampling, as well as a sub sample that underwent an aerobic nitrogen mineralization potential 28 day assay. Analyses of these inorganic nitrogen extracts were also performed to determine nitrate and ammonium content.

Another measure of nitrogen availability was obtained using ion exchange strips for two week intervals, six times over the growing season. These cation and anion exchange membranes were used in all of the plots. Ion exchange strip extracts were analyzed for nitrate, nitrite, and ammonium.

Cover crop aboveground biomass was sampled just prior to tillage in the continuous corn and the 2 rotational systems for the four crop management regimes (conventional, integrated fertilizer, integrated compost and organic), for a total of 16 treatments, 4 blocks. All treatments were split into cover crop and non-cover crop sub plots. Plant tissues were dried at 60°C, weighed, then ground and analyzed for total C and N. In treatments with corn present, corn chlorophyll measurements were made twice during the growing season, 10-14 days after pollination and 24-28 days after pollination to determine N status. Thirty leaves were measured from each plot and the measurements averaged. The same protocol was used to measure leaf chlorophyll once in soybean, at the late vegetative growth stage. Crop aboveground biomass samples were taken just prior to harvest for wheat, soybean and corn. Yields for wheat and soybean were determined by mechanically harvesting 2 yield rows in each sub-treatment (cover and no cover). In order to determine corn N uptake and allocation, the biomass samples were hand harvested and then divided into three fractions: 1) husk, cob, shank, and tassel 2) leaf and stem, and 3) grain. The leaf and stem fraction was weighed fresh, shredded, and then sub sampled for the remainder of the analyses. Grain was removed from the ears by hand. All plant samples were dried at 60°C, weighed, ground and nitrogen analysis conducted.

Cellulosic Biofuel Experiment

This experiment began in 2008 and includes 4 replicates of 12 treatments. Stand assessments were made for the switchgrass treatments (C4-7) on June 16. In early July, plant biomass samples were taken from C8 and 10 - 12, and species separations completed. In late July, C4-7, 9 and 11, were mowed to control for weeds. Samples of mowed biomass were collected by hand. Plant samples were dried at 60°C for at least 48 hours and then weighed. Yield data was collected from all of the annual treatments when harvested mechanically.