

2008 LTER 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 twelve times between April 15 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 will be completed by Cathy McMinn, with training by Stacey VanderWulp, during winter 2008-2009. Additionally, soil was taken to a depth of 5 cm from T1-7, all replicates, in order to evaluate the soil seed bank. Seed bank sample elutriation was completed by the Kay Gross lab and seed counting is planned.

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 this year), DF, and SF (added in 2007), were 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 twelve times between April 8 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 twelve times between March 19 and November 20. The volume of leachate collected was recorded and the leachate filtered and frozen. Inorganic nitrogen analysis for these samples will be completed by Cathy McMinn during winter 2008-2009.

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 during the first week of January. In January and February, all T5 plots were clear cut, the trees chipped and the chips weighed. A sample of these chips was collected from each replicate. The cover crop (red clover) was sampled in May from T3 and T4, including the weed control microplots in those plots, prior to tillage. Wheat samples were taken from T6 in July prior to harvest. At peak biomass in August, plant samples were taken from T7, T8, and SF. Corn was sampled from T1-4 in October prior to entire plot combine harvest. In November, a post-frost biomass sample was taken from T7. Species separations were not made on post-frost biomass. Leaves were collected in traps on the ground as they fell from the trees in CF, DF, and SF (new this year), starting September 15 and continuing into 2009. All plant material was dried at 60°C for at least 48 hours. All dried biomass will be weighed, ground, and sub sampled for CN analysis by Stacey VanderWulp.

All replicates (1-6) of T7 were burned on April 3.

Scale-up Fields

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

Biodiversity Study

In November, soil was sampled to 25 cm in all plots. Inorganic nitrogen extractions and soil moisture determinations were completed on sub samples. An air-dried soil sample was archived. Also, soil was collected to 10cm from B3, B9, and B18-21 in blocks 2 and 3 and sent to Tom Schmidt.

In May and June, cover crop biomass was sampled from those corn and soybean treatments utilizing a cover crop (B4, B5, B7, B8, B15, and B16). Weeds were separated from the cover crop and all of the biomass dried and weighed. In October, weed biomass was sampled from all of the plots. This biomass was also dried and weighed.

Nitrogen Fertility Gradient

All parameters were sampled in F1-8 of block 2 (rain fed), unless otherwise stated.

Soil cores, to a depth of 25 cm, were taken seventeen times between April and November. Inorganic nitrogen extractions were done on sub samples from each sampling. Ion exchange strips were also used to measure soil nitrogen. Strips were deployed then collected four times between July and September. An additional ion exchange strip experiment was conducted in F1, F5 and F8 of block 5 (irrigated). All resin strips for this experiment were deployed at the same time and individuals collected five times between August and November. All soil and strip nitrogen extracts will be analyzed for nitrate and ammonium by Cathy McMinn. Continuous soil moisture (at depths of 5 and 30 cm) and soil temperature (at 5 cm) measurements were taken using a CR10 data logger, along with standard meteorological data, in F1, F5 and F8 in block 2.

Semi-continuous gas samples were taken using an automated chamber system with on-site GC analysis for nitrous oxide, carbon dioxide and methane. This semi-continuous collection consisted of six incubations per day with four gas samples taken during each of the six incubations. Static chambers were manually sampled fourteen times between May and October. Those samples were also analyzed for nitrous oxide, carbon dioxide and methane using the automated GC system in Academic 330.

Plant litter was sampled early in the season and corn samples taken near harvest. These samples were oven-dried and will be ground for CN analysis. Also, corn stalk samples were taken in November for stem nitrate analysis. Corn plant root structure and distribution was examined on several plants in F2 of block 2.

European Corn Borer Study

This study was not sampled.

Gene Transfer Study

This study was not sampled.

Nitrogen Deposition Study

Urea fertilizer solutions were applied to the 1F and 3F plots in this study on November 12 and 13. All of the fertilizer was added in one application. Typically the total fertilizer applied each year is split between three applications (spring, summer, and autumn). However, spring and summer applications were postponed due to ongoing investigations into erroneous rates applied in previous years. Fertilization rates were 100 and 300 kg N ha⁻¹, ten times the originally intended application rates. This error was discovered this year and will require discussion in 2009 as to how to continue this study.

Living Field Laboratory

In the spring, just prior to planting, soil was sampled to 25 cm in all 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. Jennifer Herbert is in charge of analysis of these inorganic nitrogen extracts for nitrate and ammonium.

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 by Jennifer Herbert for nitrate, nitrite, and ammonium.

Cover crop aboveground biomass was sampled just prior to tillage in the continuous corn and the rotation system 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, 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 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. In order to determine crop N uptake and allocation, the biomass samples were 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 was established this year with 4 replicates of 12 treatments. Yield data was collected from all of the annual treatments when harvested mechanically. The 9 perennial treatments of switch grass, grass/legume mix, and native prairie grass were mowed twice. The cut biomass was collected from six 0.5 by 0.5 m areas in a diagonal transect across each plot. This material was dried at 60°C for at least 48 hours. All dried biomass will be weighed, ground, and sub sampled for CN analysis by Stacey VanderWulp.