2017 GLBRC Standard Sampling Report

Biofuel Cropping System Experiment (BCSE)

Soil

Soil was sampled twice in the BCSE plots in 2017. Samples were taken on April 25 and November 15 in all replicates (R) 1-5 of all treatments (G) 1-10. Soil was sampled using ¾" diameter push corers. Three cores (0-25cm) were taken from each of the three sampling stations and all 9 cores composited for each plot. Also on November 15, soil was sampled from the microplots in all plots, G1-10 R1-5. Nine cores (0-25cm) were composited from each microplot. 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.

All soil sampled on November 15 (both main and microplot samples) was air-dried and archived. Also, a subsample from each was sent to the MSU Soil and Plant Nutrient Lab for standard analysis which includes pH, lime requirement, P, K, Ca, and Mg.

Deep soil cores (1-1.2m depth, 7.6cm diameter) were sampled from all BCSE plots between November 16 and December 7. One core was taken ~4m south and 1m west of each station, so three cores per main plot (150 cores total). In addition, each stover non-removal microplot was sampled in G1-4. Three cores were sampled from each of those microplots (60 cores total). The cores are stored in a walk-in refrigerator until they can be cut open and the soil sectioned into 0-10, 10-25, 25-50 and 50-100cm depths. Bulk density of each section will be calculated. Subsamples will be taken for moisture determination, carbon and nitrogen analysis, standard agronomic analysis, archive and to supply individual researcher requests.

Gas

Gas was sampled five times on the BCSE using static chambers (round) between April 14 and June 2, 2017 to finish out the 2016 crop year. Main site plots that were sampled include G1-5, and 10 in R1-4, as well as the microplots in G2, 3, and 4 in R1-4 - where the cover crop was removed. Sampling frequency was approximately twice each month. Samples were taken between 8am and 12noon. 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. Air temperature was logged both inside and outside, while light was measured outside, of some chambers using HOBO dataloggers.

The automated gas sampling and analysis system in block 1 was stopped on July 9, 2017.

Water

Soil water samplers installed in the plots were used to collect water from the soil in G1-10 R1-4. Samplers were evacuated and leachate collected about twice each month prior to June

1. Four collections were made between March 20 and May 11. The leachate collected was delivered to David Weed in the Hamilton Lab for analysis.

Plants

Above-ground biomass: Plant biomass samples were taken from the BCSE plots at their peak and/or just prior to harvest. Species separations were completed on the majority of samples taken. The plant sampling season began with cover crop samples taken from G2, 3, and 4 on May 24, 25 and 30. Green leaf samples were taken from the G8 main and microplot trees on June 26 and 27. In the main part of G8, understory samples were taken July 27 and 28. Leaves were collected in ground traps as they fell from the trees in G8 between July 27 and November 22. Traps were typically checked bi-weekly and leaf litter collected. At peak biomass, mid-August through mid-September, plant samples were taken from G5, 7, 9 and 10. Soybeans were sampled near their peak in G3 on September 21. Peak corn samples were taken from G1, 2 and 4 on September 22 and 25. On September 28, miscanthus ANPP was sampled from G6. On November 28, the residue remaining following machine corn stover collection was sampled from the ground in G1, 2, and 4 to evaluate collection efficiency. Harvest efficiency samples were not taken in 2017. Poplar tree diameters from both the main and microplot portions of G8 were measured November 27. One tree from each of the five replicates of G8 will be harvested in early January 2018. Height, diameter and weight measurements will be recorded for each tree. All plant material from all samplings was dried at 60ºC for at least 48 hours. The dried biomass will be weighed, ground and archived. Combustion analysis for carbon and nitrogen determination is not planned for 2017.

Switchgrass stand frequency was determined in May with stand counts done in all replicates of G5 and G7, main and microplot portions.

Below-ground biomass: Roots were sampled in two ways during the fall of 2017. Deep soil cores (1m depth, 7.6cm diameter) were sampled from all treatments (G1-G10) post-harvest. The cores were cut open and soil sectioned into 0-10, 10-25, 25-50 and 50-100cm depths with roots removed from each section. Excavations were done in R2-4 of the perennial treatments (G5-7, 9, 10). A backhoe with 9" bucket was used by Kevin Kahmark to excavate ~1m^3 pits, one near the southern border of each plot. The excavated soil will be sieved and coarse roots collected. All roots are rinsed with water and dried at 60ºC for at least 48 hours. The dried roots will be weighed, ground and analyzed for carbon and nitrogen content through combustion analysis by Stacey VanderWulp.

Phenology: Weekly checks for emergence began in late February 2017. Following emergence, phenology data was collected twice each month from April 27 – October 27 in all plots of block 1. Average plant height measurements were taken three times, including once at peak. Phenology data was collected by Matt Arndt and Allyson Schnell.

Leaf Area Index (LAI): Measurements of light above and below the canopy for LAI calculation were taken twice each month between May 26 and October 27 in all plots of block 1. Sampling was done beginning just after sunrise and typically took 60-75 minutes. Readings were taken by Allyson Schnell and Stacey VanderWulp using an AccuPAR LP-80 Ceptometer.

Scale-up Fields

Soil

Soil was sampled on December 5 in all the GLBRC scale-up fields at Lux Arbor and Marshall Farms. Soil was sampled using ¾" diameter push corers. Ten cores were taken to a depth of 25 cm at each of the 10 stations in 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.

These soil samples will be air-dried and archived. Also, a subsample from each will be sent to the MSU Soil and Plant Nutrient Lab for standard analysis which includes pH, lime requirement, P, K, Ca, and Mg.

Gas

Gas was sampled five times using static chambers (round) between April 14 and June 2, 2017 to finish out the 2016 crop year. All seven plots were sampled, L1-3 and M1-4, with four chambers in each plot. Samples were taken between 12:45pm and 4:30pm, on the same day as the BCSE. 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. Air temperature was logged both inside and outside, while light was measured outside, of some chambers using HOBO dataloggers.

Plants

Plant biomass samples were not taken from any scale-up plots for ANPP in 2017. Corn residue samples were collected from the ground near each station following machine corn harvest and stover collection in L1 and M1 on November 29-30 and December 4. These samples were weighed wet (in order to calculate percent moisture once weighed dry) and then dried at 60^{o}C for at least 48 hours. Combustion analysis for carbon and nitrogen determination is not planned for 2017.

Marginal Land Experiment (MLE)

Soil

Soils from each site were characterized to provide a formal taxonomic description for each. A small soil pit (~1 x 0.5 x 1m deep) was dug in the alleyway of each site after using auger samples to find a spot that was most representative of the site. Soils were characterized and sampled by horizon. This work was done by Chase Kasmerchak, in addition to soil bulk density calculations. Soil samples were air-dried and a subsample sent to the MSU Soil and Plant Nutrient Lab for analysis. Analyses performed by the lab were regular field soil tests (pH, lime requirement, P, K, Ca, Mg) as well as texture, Na, and CEC by ammonium saturation. Additional subsamples of each will be analyzed for carbon and nitrogen at KBS and stored in the soil archive at the LTER field lab.

Plants

Species composition was evaluated in G5-7 and 9-11 in August and September in all Michigan and Wisconsin MLE sites using a line-point intercept protocol. Species were identified along two transects in both the fertilized and unfertilized portions of each plot. Michigan sites were completed by a four-person crew from the Robertson lab and Wisconsin sites were completed by a crew led by Jessica Mayry (UW).

In May/June, stand counts were done in all replicates of G5 and G7, fertilized and unfertilized portions. Yield data was collected from all of the mechanically harvested plots (G5-7, 9, 10) separately in the fertilized and unfertilized split plots. G11 was not harvested, so hand samples were taken there to look at production. Ten randomly chosen poplar trees were measured (diameter) in each G8 plot in the fall. This work was done by personnel from Kurt Thelen's lab.

Switchgrass Nitrogen/Harvest Experiment

Soil

Soil samples were taken on October 19. Four cores (0-25cm) were composited from each plot. H1 and H2 were each sampled and kept separate. The field-moist soil was analyzed for pH by Cathy McMinn.

Water

Soil water samplers were used to collect water from the soil in blocks 2-4. Samplers were evacuated and leachate collected about twice each month. Twelve collections were made between March 20 and November 16. The leachate collected was delivered to David Weed in the Hamilton Lab for analysis.

Plant

A sub-sample from the machine harvest of these plots was saved. This biomass is dried and will be ground, archived, and analyzed for carbon and nitrogen.

Written by Stacey VanderWulp