Eastern Soybean Board Project Progress Report
UVM Extension, August 2021

Due to continued economic and climatic pressures, farmers in the Northeast are looking for ways to increase on-farm feed production and diversity their operations to increase resilience and profitability. Soybeans could be grown for human consumption, animal feed, and biodiesel in Vermont. However, farmers face challenges due to the relatively short growing season and limited research-based information available in our area. The purpose of our trials is to evaluate soybean yield and quality to determine cover cropping management practices that enhance soil health while supporting high soybean yields. Understanding how soybeans perform under various cropping systems can help producers make important management decisions that lead to better crop success. With a growing concern of agriculturally related water quality implications in Vermont waterways, farmers are now required in some instances to cover crop their annually cropped fields. However, with this increase in cover cropping there is a need to investigate potential impacts on following cash crops and best practices for establishing cover crops into and following soybeans. Similarly, with the concerted effort to reduce nutrient loading in waterways due to soil erosion, farmers are becoming more interested in adoption reduced and no-till practices. Understanding how to best combine these two practices into soybean cropping systems specifically for the Northeast is critical to the success of soybean crops in Vermont.

This year we initiated several soybean trials at Borderview Research Farm in Alburgh, VT. These trials include a variety evaluation trial, a cover crop trial in which soybeans follow fall planted cover crops under varying tillage regimes, and a soybean interseeding trial. This report will summarize our research and outreach activities around these trials thus far this season.

Variety Evaluation Trial

The conventional variety trial includes 29 varieties from four different seed companies spanning maturity groups 0.70 to 2.4. The trial was planted on 25-May 2021 into a Benson rocky silt loam at a rate of 185,000 seeds ac^{-1} treated with soybean inoculant and with 5 gal ac^{-1} 9-18-9 liquid starter fertilizer. Throughout the season the trials were inspected for insect and disease issues however due to extremely hot and dry conditions very little disease and insect pressure has been seen thus far. With recent rainfall, we have been observing instances of downy mildew (Figure 1). We will continue to monitor the trials and will conduct additional assessments to capture differences between varieties if warranted. The trials will also be evaluated for populations, yield, and quality upon harvest.

Figure 1. Soybean leaf infected with downy mildew

Cover Crop Trials

In the fall of 2020, four cover crop seeding rate treatments, summarized in table 1 below, were planted at Borderview Research Farm in Alburgh, VT on 6-Oct. Rates ranging from 50 to 150 lbs ac^{-1} of winter rye and a no cover crop control were used to produce varying levels of cover crop biomass leading to varying levels of residue that precedes soybean planting the following spring. These four treatments were replicated four times each within three termination systems: conventional tillage, pre-plant herbicide application with no tillage, and post-plant herbicide application with no tillage.

Table 1. Winter rye seeding rate treatments, 2020.

Treatment	Seeding rate (lbs ac^{-1})
No residue (control)	0
Low residue	50
Moderate residue	100
High residue	150

Establishment of the cover crop was later than normal due to overly dry conditions extending field preparation and delaying planting. Due to this later planting, no biomass was collected in the fall of 2020.

In the spring of 2021, soil health samples were taken from four replication from each of the seeding rate treatments including the control. Samples were collected according to the Cornell Soil Health Laboratory protocol and were submitted to that laboratory for analysis. At this time, biomass was collected in each plot within a $0.25m^2$ quadrat on 12-May in the plow and pre-plant herbicide blocks, and on 21-May in the post-plant herbicide block. Ground cover was also captured at this time using the Canopeo smartphone application. Soil moisture and temperature were measured in each plot at approximately 6" prior to planting and every other week following planting. Table 2 summarizes the ground cover, biomass, and soil conditions at termination prior to establishing soybeans.

Table 2. Biomass, ground cover, and soil conditions in four cover crop treatments prior to termination.

Cover Crop Treatment	Dry matter yield tons ac^{-1}	Ground cover %	Soil moisture %	Soil Temperature ◦F
No cover/residue (control)	0	0.523	18.5	52.2
50 lbs ac^{-1}	1.53	67.8	16.5	52.1
100 lbs ac^{-1}	1.82	85.9	15.7	52.6
150 lbs ac^{-1}	2.05	88.3	16.1	51.8
Trial Mean	1.79	60.9	16.7	52.1

At this time these data have not been statistically analyzed nor have any quality analyses (nutrient content) performed.

Ground cover and biomass increased with seeding rate as expected, however statistical analysis has not yet been performed to determine if these differences are significant. Soil moisture was approximately 2% higher in the control plots than all the cover cropped plots prior to planting. This suggests that, in years with wet springs cover crops can help absorb and utilize excess soil moisture which may allow for earlier field preparation. However, it is also possible that, in dry years, this could be detrimental to crop establishment. To investigate this, we continued to take soil moisture and temperature reading every other week to track changes across treatments throughout the growing season.. In addition to soil moisture, soil temperature was measured prior to planting. Although little difference was seen between treatments prior to planting,

difference in soil surface residue could influence soil temperature over the season. These data will be analyzed for the final report.

Cover crop residue was incorporated into the soil in the plow block with disc harrows and the soil finished for planting with a spike-tooth harrow on 12-May. In the pre-spray block, cover crops were terminated using an application of Roundup® PowerMax herbicide at a rate of 1 qt. ac^{-1} on 12-May. Finally, cover crops were terminated with a post-planting application of Roundup® PowerMax at a rate of 1 qt. ac^{-1} on 22-May. Soybeans were planted in all plots on 21-May at a rate of 185,000 seeds ac^{-1}, treated with soybean inoculant, and planted with 5 gal ac^{-1} 9-18-9 liquid starter fertilizer. To understand the nutrient release rates of the various levels of cover crop biomass and how this is impacted by termination method, soil nitrate content was assessed in each plot prior to termination and biweekly following termination and planting. At this time these analyses have not all been completed. Soil temperature and moisture were also measured weekly in all plots to understand differences between cover crop and tillage treatments. The soybeans were also scouted for slug damage in early June to investigate differences between residue levels and potential slug harboring habitat between termination methods and cover crop treatments. However, with dry conditions persisting from late spring through early summer no slug damage was observed in any treatment. Soybeans will continue to be monitored for insect and disease pressure and will be evaluated for populations, yield, and quality at the time of harvest.

We also plan to implement a soybean interseeding trial this fall. Specific details surrounding treatments and experimental design have yet to be solidified, however, a topic of interest to farmers in our region is interseed timing. Soybeans typically reach maturity and are harvested beyond the optimal times for establishing cover crops, even the most hardy and vigorous species like winter cereal rye. Therefore, looking towards other establishment strategies that can be utilized pre-harvest, such as interseeding, could provide farmers opportunities to be able to implement cover cropping to aid their conservation and soil health promoting efforts (Figure 2). Compared to post-harvest seeding, interseeding presents additional challenges related to equipment and timing seeding with crop growth stage to avoid damage while getting good establishment. Soybean plants that are too young and bushy may be damaged by equipment pushing them over if interseeding occurs too early. Conversely, if done too late, shattering damage may occur. We plan to investigate the efficacy of interseeding cover crops at various growth stages leading up to harvest in order to identify practices that support both high soybean yields and successful cover crop establishment.

Figure 2. Mature soybeans interseeded with winter rye.

Outreach

Outreach this year has continued to be very difficult. Our main mode of outreach during the summer months typically are workshops and field days attracting hundreds of farmers, technical service providers, and other agricultural professionals. Similar to last year, with most in-person events still unable to occur, we continued to provide farmers with valuable, research-based, and season relevant information through other modes of communication. Reports summarizing our research have been posted to our website (links below) and shared through our blog and social media networks. On August 4, we were able to host an on-farm field day in Franklin, VT. The participation had to be capped at 75 due to COVID-19 restrictions. Farmers were able to learn about previous soybean research and also view variety evaluation plots. A second workshop will be held in October and will focus on cover cropping and other conservation practices across multiple cropping systems including soybeans. At the conclusion of our season, we will still create research reports which will be made available through our website and in-print in our office. In lieu of conferences if we cannot hold them this winter, we will continue to prioritize performing cover cropping, no-till, and soybean production outreach to our farmer and agricultural professional stakeholders to the best of our abilities.

2020 Reports

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Conventional_Soybean_VT_Report_Final.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Conventional_Soybean_VT_Summary.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Organic_Soybean_Variety_Trial_Report.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Organic_Soybean_VT_Summary_Final.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Soybean_PD_x_Var_Report.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Cover_Crop_Termination_Trialdocx.pdf

https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Soybean_Cover_Crop_Report.pdf

Link to blog and social media postings
https://blog.uvm.edu/outcropn/2021/08/26/lets-talk-soybeans/
https://www.facebook.com/uvmcropsoil