

2016

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2016 SOYBEAN COVER CROPPING TRIAL
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In 2016, the University of Vermont Extension Northwest Crops and Soils Team interseeded cover crops into soybean varieties to evaluate cover crop establishment and effect on soybean yield at Borderview Research Farm in Alburgh, VT. Growing conditions in Alburgh are conducive to grow soybeans from maturity group 1.8 and under. Due to the later harvest date of soybeans in Vermont, little research has been done of cover crop establishment. Cover crops, particularly legumes, have difficulty establishing after the late soybean harvest and are not able to develop enough biomass to protect the otherwise bare soil during the winter. In an effort to support and expand the local soybean market throughout the northeast and increase soil health in fields rotated with soybeans, the University of Vermont Extension Northwest Crop and Soils (NWCS) Program, as part of a grant from the Eastern Soybean Board, established a trial in 2016 to evaluate cover crop seeding methods and establishment in soybeans.

MATERIALS AND METHODS

Two cover crops were evaluated for their ability to establish within a soybean canopy without affecting soybean yield and quality (Table 1).

Table 1. Cover crops and rate, Alburgh, VT, 2016.

NRCS Mix 2	Winter Rye
Ryegrass Crimson clover Arifi radish	Variety not specified (VNS)
100 lbs ac ⁻¹	25 lbs ac ⁻¹

The soil type at the Alburgh location was Benson rocky silt loam (Table 2). The plots were 5' x 20' with row spacing of 30". The cover crop treatments were planted on 6-Sep and 22-Sep. The Penn State interseeder was used to seed plots on the first planting date. Cover crops were seeded by hand broadcast on both planting dates. Soybeans were harvested on 10-Oct.

Table 2. Soybean cover crop trial specifics, Alburgh, VT, 2016.

	Borderview Research Farm Alburgh, VT
Soil type	Benson rocky silt loam, 3% slope
Plot size	5 x 20
Row spacing (inches)	30
Soybean planting date	26-May
Tillage type	Moldboard plowed and disked
Soybean seeding rate	185,000 seeds ac ⁻¹
Cover crop planting dates	6-Sep, 22-Sep
Cover crop planting methods	Interseeding, Hand broadcasting
Soybean harvest date	10-Oct

On 10-Oct, the soybeans were harvested using an Almaco SPC50 small plot combine. Seed was cleaned with a small Clipper M2B cleaner (A.T. Ferrell, Bluffton, IN). They were then weighed for plot yield, tested for harvest moisture using a DICKEY-John M20P moisture meter, and evaluated for test weight using a Berckes Test Weight Scale.

The cover crop plots were evaluated for establishment through percent ground cover on 10-Nov.

Soybean yields are presented at 13% moisture on a per acre basis. Yields were analyzed using the GLM procedure in SAS and brew values were analyzed using the PROC MIXED procedure in SAS with the Tukey-Kramer adjustment, which means that each cultivar was analyzed with a pairwise comparison. Relationships between variables were analyzed using the GLM procedure.

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among hybrids is real or whether it might have occurred due to other variations in the field. At the bottom of each table a LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. Where the difference between two hybrids within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure that for 9 out of 10 times, there is a real difference between the two hybrids. In this example, hybrid C is significantly different from hybrid A but not from hybrid B. The difference

Hybrid	Yield
A	6.0
B	7.5*
C	9.0*
LSD	2.0

between C and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these hybrids did not differ in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these hybrids were significantly different from one another.

RESULTS

Weather data was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT. Missing precipitation data from 17-Aug through 31-Oct was supplemented using data provided by the NOAA from Highgate, VT. May through September was unusually dry, accumulating 7.27 inches less rain than in a usual year (Table 3). Despite the lack of rain, June and July were close to the average temperature. However, late summer and early fall were hotter than the average. Overall, there were an accumulated 2708 Growing Degree Days (GDDs) this season, approximately 302 more than the historical 30-year average.

Table 3. 2016 weather data for Alburgh, VT.

Alburgh, VT	May	June	July	August	September	October
Average temperature (°F)	58.1	65.8	70.7	71.6	63.4	50.0
Departure from normal	1.80	0.00	0.10	2.90	2.90	1.90
Precipitation (inches)	1.5	2.8	1.8	3.0	2.5	5.0
Departure from normal	-1.92	-0.88	-2.37	-0.93	-1.17	1.39
Growing Degree Days (base 50°F)	340	481	640	663	438	146
Departure from normal	74	7	1	82	104	34

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger. Historical averages are for 30 years of NOAA data (1981-2010) from Burlington, VT. Alburgh precipitation data from 8/17/16-10/31/16 was missing and was replaced by data provided by the NOAA for Highgate, VT.

Yields of soybeans were compared between cover crop treatments (Table 4). Soybean varieties with cover crops seeded in their plots yielded significantly higher than soybean varieties without cover crops. The trial average was 64.8 bu ac⁻¹.

Table 4. Yields of soybeans with and without cover crops, Alburgh, VT, 2016.

Cover crop presence	Soybean yield @ 13% moisture bu ac⁻¹
With cover crop	65.1
No cover crop	64.5
Trial mean	64.8
p-value (0.1)	0.0003

The top performing treatment is indicated in **bold**.

Cover crop establishment was compared between the two planting dates (Table 5). The cover crops planted on 6-Sep had an average ground cover percentage of 43.4% and was statistically significant from cover crops planted on 22-Sep. The difference between average ground cover of the treatments was 24.8%.

Table 5. Cover crop establishment by planting date, Alburgh, VT, 2016.

Cover crop planting date	Ground cover %
6-Sep	43.4
22-Sep	18.6
Trial mean	33.5
p-value (0.1)	0.098

The top performing treatment is indicated in **bold**.

Two seeding methods were used to disperse cover crops in soybean plots (Table 6). While the cover crops planted using the interseeder established more successfully, this method would not be feasible for production as the soybeans in some plots were not harvestable after being knocked over by the interseeder.

Table 6. Cover crop establishment by seeding method, Alburgh, VT, 2016.

Seeding method	Ground cover %
Interseeder	72.8
Broadcast seeding	23.2
Trial mean	41.8
p-value (0.1)	0.042

The top performing treatment is indicated in **bold**.

DISCUSSION

It is important to remember that the results only represent one year of data. 2016 was a challenging growing season due to lack of rain. While the soybeans thrived this growing season, the cover crops had difficulty establishing. Populations were low in many plots, likely due to a lack of available water.

It is also interesting to note the difference in seeding methods. While there was a much higher ground cover percentage in plots that were seeded using the Penn State interseeder, some plots were damaged by the equipment and were not harvestable. The presence of cover crops appeared to be correlated to a higher soybean yield. To evaluate this further, another year of study will commence in 2017.

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