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2013

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2013 SUNFLOWER INTERSEEDING TRIAL

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Sunflower, a relatively new crop for Vermont, has the potential to add value to a farm operation in the form of fuel, feed, food, and fertilizer. However, pest pressures, including weed competition, have limited the yield potential of Vermont sunflower in the past. The practice of interseeding, or planting cover crops between rows, could limit the early-season weed pressures and allow for a competitive advantage for sunflower, increasing yields and quality. Crops like clover, tillage radish, and annual ryegrass may also benefit long-term soil health and decrease expensive inputs by adding organic matter and nutrients into the soil.

MATERIALS AND METHODS

In 2013, a trial was initiated at Borderview Research Farm in Alburgh, VT to determine the impact of interseeded crops on sunflower yield and quality (Table 1). The experimental design was a randomized complete block with interseeded cover crops (ryegrass, radish, red clover, and control) as the treatments (Table 2). There were three replications, and each plot was 10’ by 90,’ with four rows of sunflower. The soil at the research site is a Benson rocky silt loam with a 3-8% slope, and winter canola was previously grown in the trial location.

Table 1. Agronomic information for sunflower interseeding trial, Alburgh, VT, 2013.

Location	Borderview Research Farm – Alburgh, VT
Soil type	Benson rocky silt loam, 3-8% slope
Previous crop	Winter canola
Interseeding treatments	Annual ryegrass, red clover, tillage radish, control (no intercrop)
Replications	3
Plot size (ft)	10' x 90'
Sunflower variety	Cobalt II
Sunflower planting rate (seeds ac^{-1})	34,000
Row width (in.)	30
Planting equipment	John Deere 1750 MaxEmerge planter
Sunflower planting date	31-May
Interseeding equipment	Penn State Cover Crop Interseeder and Applicator
Interseeding date	13-Jul
Sunflower harvest date	21-Oct

Table 2. Intercrop planting specifics for sunflower interseeding trial, Alburgh, VT, 2013.

Crop	Variety	Seeding rate (lbs ac^{-1})
Annual ryegrass	Greenspirit	25
Radish	Tillage Radish®	18
Red clover	Freedom	10

Figure 1. Penn State Cover Crop Interseeder and Applicator.

Sunflowers were planted in 30” rows on 31-May with a John Deere 1750 MaxEmerge corn planter fitted with shorter sunflower fingers. The variety Cobalt II (Seeds 2000) was planted at 34,000 viable seeds per acre. To establish the interseeded crops, an implement was borrowed from Pennsylvania State University, which has the capability to both seed cover crops and apply nutrients simultaneously (Figure 1). Crops were interseeded on 13-Jul, later than ideal, but as early as soil conditions would allow. Normally interseeded crops would be planted closer to the main crop’s planting date, to become established before the main crop and successfully compete with early-season weeds.

Plots were harvested on 21-Oct with an Almaco SPC50 plot combine with a 5’ head and specialized sunflower harvest pans. At harvest, test weight and seed moisture were determined for each plot, with a Berckes Test Weight Scale and a Dickey-john M20P moisture meter. Oil from a known volume of each seed sample was extruded on 20-Nov with a Kern Kraft Oil Press KK40, and the oil quantity was measured to calculate oil content. Oil yield (in lbs per acre and gallons per acre) was adjusted to 10% pressing moisture and reported.

Data were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and soil amendment treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p<0.10$).

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, except where analyzed by pairwise comparison (t-test). Where the difference between two treatments 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 treatments. Treatments that were not significantly lower in performance than the top-performing treatment in a particular column are indicated with an asterisk. In the example at right, hybrid C is significantly different from hybrid A but not from hybrid B. The difference 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.

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

The asterisk indicates that hybrid B was not significantly lower than the top yielding hybrid C, indicated in bold.

RESULTS

Weather data was collected with an onsite Davis Instruments Vantage Pro2 weather station equipped with a WeatherLink data logger. Temperature, precipitation, and accumulation of Growing Degree Days (GDDs) are consolidated for the 2013 growing season (Table 3). Historical weather data are from 1981-2010 at cooperative observation stations in Burlington, VT, approximately 45 miles from Alburgh, VT.

For the most part, it was colder and wetter than average in the spring of 2013. In June 2013, there were 5.54 more inches of precipitation than normal. After June, however, the summer of 2013 was drier than normal, with an average of 5.20 inches fewer than average in July, August, and September. GDDs are calculated at a base temperature of 44°F for sunflowers. Between the months of planting and harvesting, there were an accumulated 2950 GDDs for sunflowers, 74 more than the 30-year average.

Table 3. Consolidated weather data and GDDs for sunflower, Alburgh, VT, 2013.

Alburgh, VT	June	July	August	September	October
Average temperature (°F)	64.0	71.7	67.7	59.3	51.1
Departure from normal	-1.8	1.1	-1.1	-1.3	2.9
Precipitation (inches)	9.23 *	1.89	2.41	2.20	2.39 ◊
Departure from normal	5.54	-2.26	-1.50	-1.44	-1.21
Growing Degree Days (base 44°F)	607	863	740	465	275
Departure from normal	-47	37	-27	-33	144

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.

* June 2013 precipitation data based on National Weather Service data from cooperative stations in South Hero, VT.

◊ October 2013 precipitation data based on National Weather Service data from cooperative stations in Burlington, VT.

Sunflowers were harvested on 21-Oct at an average moisture level of 7.55%. There were no significant differences in the harvest moisture by interseeding treatments. There was also no statistically significant difference in test weight, an indicator of seed plumpness and overall quality. The trial average for test weight was 29.6 lbs per bushel, which is between the general target of 28 to 32 lbs per bushel.

Seed yields ranged from 2438 lbs per acre to 3375 lbs per acre. Though there was no significant impact of interseeding treatment, the greatest seed yield was in sunflowers interseeded with annual ryegrass. Pressing moisture did not vary significantly by treatment, averaging 6.86%, which was lower than optimal pressing conditions. The oil content was only slightly lower than average, however, at 37.2%. Though there was no significant difference in oil content, interestingly, the control treatment had lower oil content than all interseeded crops (Figure 2).

Table 4. Yield and quality data for interseeded sunflowers, Alburgh, VT, 2013.

Interseeding treatment	Harvest moisture	Test weight	Seed yield at 13% moisture	Pressing moisture	Oil content	Oil yield at 10% moisture	
	%	lbs bu^{-1}	lbs ac^{-1}	%	%	lbs ac^{-1}	gal ac^{-1}
Annual ryegrass	**8.03**	**31.0**	**3375**	6.80	37.3	**1284**	**168**
Radish	7.03	30.2	3096	6.57	**37.9**	1219	160
Red clover	7.63	28.7	2438	**7.53**	37.7	956	125
Control	7.50	28.7	2701	6.53	35.9	1011	132
LSD (0.10)	NS	NS	NS	NS	NS	NS	NS
Trial mean	7.55	29.6	2903	6.86	37.2	1117	146

NS – Treatments were not significantly different from one another (p=0.10).
Treatments shown in **bold** are top-performing in a particular column.

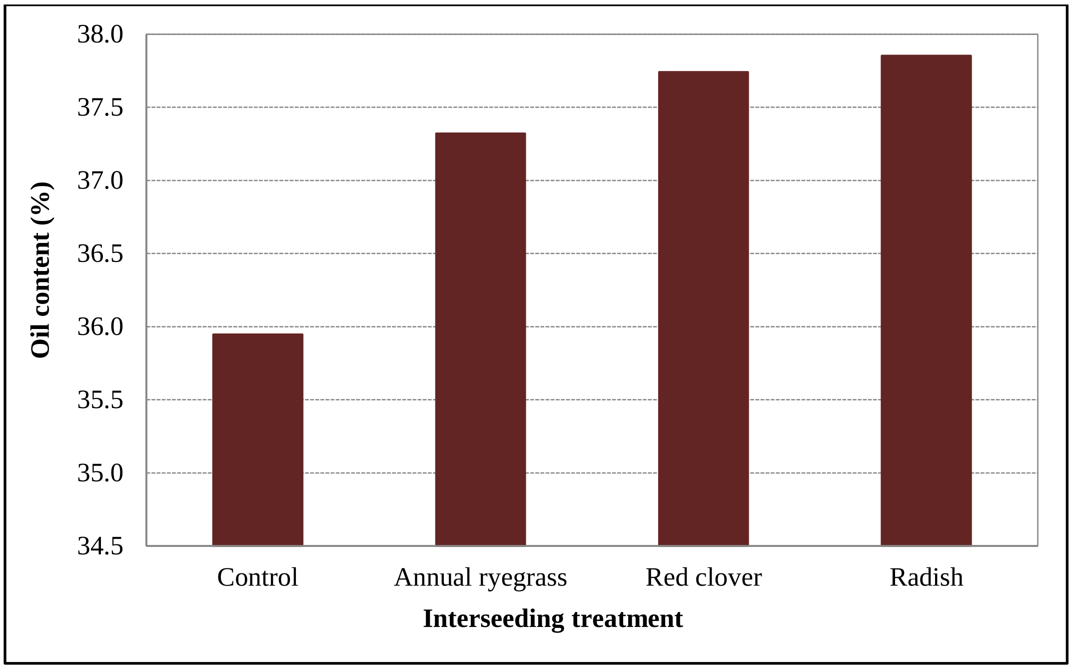

Figure 2. Impact of interseeding treatment on oil content. Treatments did not differ significantly in oil content (p=0.10).

Oil yield, which is a function of both seed yield and oil content, was greatest in the treatment interseeded with annual ryegrass, though this was not statistically different from other treatments (Figure 3). Plots seeded with annual ryegrass averaged oil yields of 1284 lbs per acre, or 168 gallons per acre. The trial average was 1117 lbs per acre, or 146 gallons per acre.

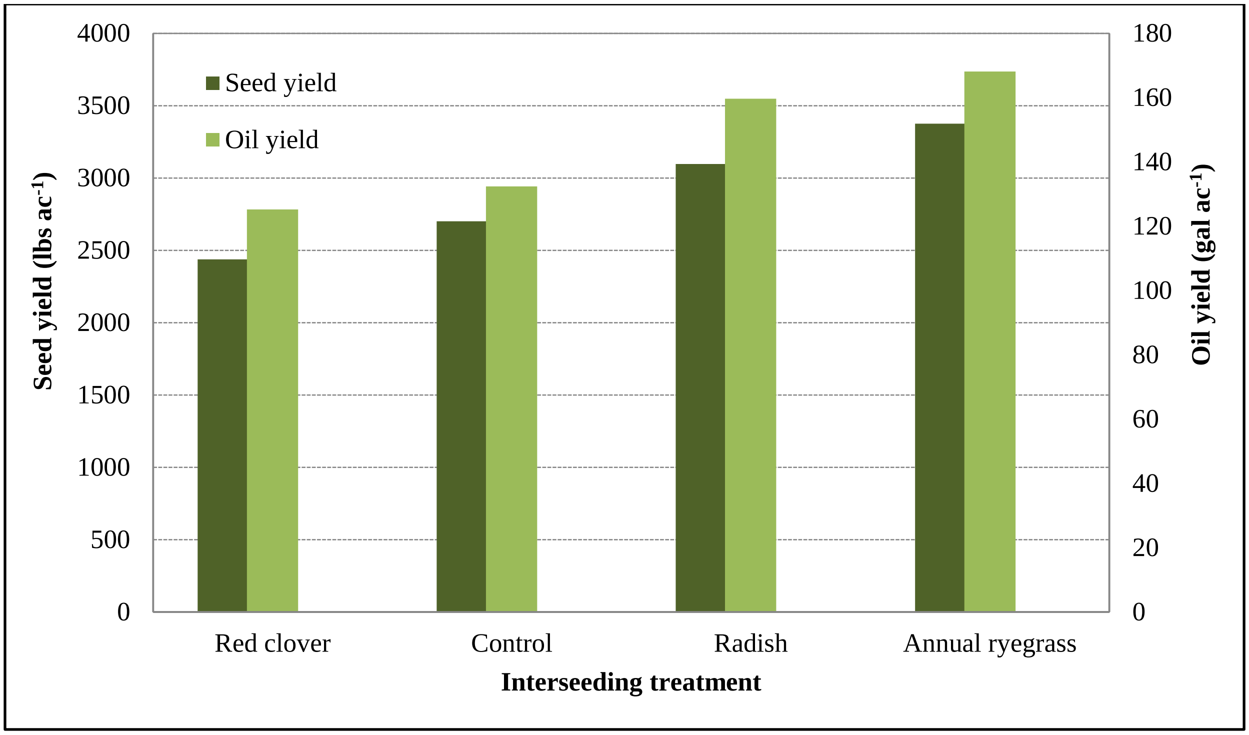

Figure 3. Impact of interseeding treatment on seed and oil yields. There were no significant differences in yields by treatment (p=0.10).

DISCUSSION

Sunflower seed yields in this trial were high overall, averaging 2903 lbs per acre. Test weights were sufficient, compared to industry standards. Oil yields ranged from 125 to 168 gallons per acre. There were no statistically significant impacts of interseeding treatments. It is likely that the interseeded crops were planted too late, due to the wet soil conditions in June and the availability of the borrowed equipment. By the time cover crops were interseeded the sunflower crop had already closed its canopy. A closed canopy would have potentially kept the cover crop seed from establishing due to lack of sunlight reaching the soil surface. In addition, dry soil conditions following seeding may have also led to reduced cover crop germination. It is important to remember that these data represent only one year of research, and in only one location. More data should be generated and considered before making agronomic management decisions.

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