NORTHWEST CROPS & SOILS PROGRAM

2014 Tillage Radish Planting Date Trial

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

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Farmers are interested in growing tillage radishes as they may potentially offer many environmental and economic benefits. Tillage radishes are quick at scavenging excess nitrogen, provide good ground cover, and break down very quickly in the spring to make way for spring planting. The plants winter kill, but the dead frozen plant material can still supress the earliest spring weeds from establishing. The roots themselves are known to drill through compacted soil layers as they grow and the holes left by decomposed roots the next spring may also allow more water to infiltrate into the soil. Although tillage radish may have many benefits, it must be planted earlier than our other cereal grain cover crops commonly used following corn silage. The goal of this project was to identify optimum planting dates for tillage radish in Vermont.

MATERIALS AND METHODS

A trial was conducted at Borderview Research Farm in Alburgh, Vermont in 2014 to evaluate four tillage radish planting dates. The experimental design was a randomized block of 5'x 20' with four replications (Table 1). The soil was a Benson rocky silt loam, and the area was previously planted with barley and oats. The seedbed was prepared with a fall chisel plow, disk, and spike tooth harrow.

Table 1. Agronomic information for the 2014 tillage radish planting date trial at Borderview Research Farm.

Location	Borderview Research Farm – Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Barley/oats
Tillage operations	Fall chisel plow, disk, spike tooth harrow
Plot size (ft.)	5 x 20
Replicates	4
Seeding rates	6 lbs/ac^{-1}
Planting date	18-Aug, 25-Aug, 2-Sep, 10-Sep
Harvest date	29-Oct

The four planting dates were 18-Aug, 25-Aug, 2-Sep, and 10-Sep. The seeding rate was 6 lbs per acre. Radishes were harvested to determine biomass on 29-Oct. Just before harvest, percent cover was determined by analyzing pictures of a 0.5m² subsample of each plot. Percent cover analysis was performed with the "Imaging Crop Response Analyzer" computer program (http://imaging-crops.dk/). Whole plant biomass (root and vegetation) was harvest and recorded. Five plants were selected at random from each plot sample to record root length. Roots and vegetation were separated and weighed. Subsamples of vegetation and roots were weighed before and after drying to determine dry matter for each plot. Dried samples were ground with a Wiley laboratory mill. The coarsely-ground plot samples were brought to the lab where they were reground using a cyclone sample mill (1mm screen) from the UDY Corporation. A subsample of each was retained for nitrogen analysis. The subsamples were analyzed for nitrogen content at the University of Vermont's Testing Laboratory in Burlington, VT.

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and hybrids were treated as fixed. Hybrid 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. 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. In the example below, treatment C is significantly different from treatment 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 treatments 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 treatments were significantly different from one another. The asterisk indicates that treatment B was not significantly lower than the top yielding treatment C, indicated in bold.

Treatment	Yield
A	6.0
B	7.5*
C	**9.0***
LSD (0.10)	2.0

RESULTS

Using data from a Davis Instruments Vantage Pro2 weather station at Borderview Research Farm in Alburgh, VT, weather data was summarized for fall 2014 (Table 2). The table shows weather information from the August (first planting date of tillage radish) through the October (time of harvest). August was slightly cooler than usual, with average weather in September and warmer than normal in October (based on 1981-2010 data). While August and October had average levels of precipitation, September was dry with 2.31 inches less than the average rainfall. There were an accumulated 1016 Growing Degree Days (GDDs) at a base temperature of 50°F from the beginning of August to the end of October. This was 117 more than the historical 30-year average for August-October.

Table 2. Summarized weather data for fall 2014 – Alburgh, VT.

Alburgh, VT	August	September	October
Average temperature (°F)	67.6	60.6	51.9
Departure from normal	-1.2	0.0	3.7
Precipitation (inches)	3.98	1.33	4.27
Departure from normal	0.07	-2.31	0.67
Growing Degree Days (base 50°F)	550	339	127
Departure from normal	-31	21	127
Growing Degree Days (base 44°F)	736	501	258
Departure from normal	-31	3	128
Growing Degree Days (base 32°F)	1108	860	622
Departure from normal	-31	2	119

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.

The 18-Aug planting date resulted in the highest root dry matter and nitrogen yield per acre (Table 3). Although root biomass differed significantly by planting date, the aboveground vegetative matter remained relatively consistent in dry matter yield. Total nitrogen content of the plant did not differ statistically by planting date. Overall, the vegetative biomass had higher nitrogen concentrations than the root biomass of the tillage radish.

Table 3: Dry matter yields by planting date, Alburgh, VT 2014.

Planting Date	Vegetation nitrogen yield lbs/ac^{-1}	Root nitrogen yield lbs/ac^{-1}	Whole plant nitrogen yield lbs/ac^{-1}	Vegetation dry matter yield lbs/ac^{-1}	Root dry matter yield lbs/ac^{-1}
18-Aug	76.7	**30.3***	107	2682	**1574***
25-Aug	96.2*	21.9*	118	**2822**	999
2-Sep	107*	15.2	122	2690	610
10-Sep	**116***	13.5	**130**	2539	465
LSD (0.10)	32.9	9.4	NS	NS	343
Trial mean	99.1	20.2	119.3	2683	912

Treatments indicated in **bold** had the top observed performance.

* Treatments that did not perform significantly lower than the top performer.

NS = No significant difference.

The earliest planting dates (18-Aug and 25-Aug) had the longest root length and the tallest plants (Table 4). Percent soil cover did not differ by planting date and on average provided 95.4% coverage of the soil.

Table 4: Tillage radish root length, plant height, and soil cover by planting date, Alburgh, VT, 2014.

Planting date	Root length cm	Plant height cm	Soil cover %
18-Aug	**23.9***	26.4*	93.4
25-Aug	20.6*	**31.9***	**98.4**
2-Sep	17.0	24.4	95.2
10-Sep	14.7	15.6	94.4
LSD (0.10)	3.68	7.32	NS
Trial mean	19.0	24.6	95.4

Treatments indicated in **bold** had the top observed performance.

* Treatments that did not perform significantly lower than the top performer.

NS = No significant difference.

DISCUSSION

These results indicate that tillage radishes will establish and produce adequate soil coverage to protect against erosion if planted between mid-August and mid-September. Nitrogen content of the whole plant biomass did not differ by planting date. The primary advantage to early planting (August) is larger roots that penetrate deeper into the ground, which should result in deeper breakup of hard soil. Warm weather conditions in October may have boosted radish growth beyond what might be observed in a more normal year. Hence, additional years of research should be conducted to confirm these results.

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