2014 Tillage Radish Seeding Rate Trial

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Tillage radishes are being utilized by farmers as a new cover crop for their unique characteristics. Tillage radishes are quick at scavenging nitrogen, provide good ground cover, and break down very quickly in the spring to make way for spring planting and provide available nitrogen to the next crop. The plants winter kill, but the dead frozen plant material can still supress the earliest spring weeds from establishing. The holes left by decomposed roots allow more water to infiltrate the soil. Growing tillage radish as a cover crop in the northeast is new and best practices for success have yet to be established. Proper seeding rates must be determined to enable the crop to proivde quick ground cover and substantial root growth while minimizing planting costs.

MATERIALS AND METHODS

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

Table 1. Agronomic information for the 2014 tillage radish seeding rate trial at Borderview Research Farm.

Location	Borderview Research Farm – Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Spring wheat/oats
Tillage operations	Fall chisel plow, disk, spike tooth harrow
Plot size (ft.)	5 x 20
Replicates	3
Seeding rates	3, 6, 8 and 12 lbs/ac^{-1}
Planting date	27-Aug
Harvest date	29-Oct

The radishes were planted on 27-Aug. The four seeding rates were 3, 6, 8 and 12 lbs per acre.
Tillage radish biomass was measured 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/). Weights for the harvested material (root and vegetation) were recorded. Five plants were selected at random from each plot sample to record root diameter and length. Subsamples of vegetation and roots were weighed before and after drying to determine dry matter for each plot. Dried vegetation was 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.

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

Hybrid	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 month the crop was planted (August) through the month it was harvested (October). 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.

Although differences were not significant, the 6 lbs per acre seeding rate had the highest total yield as well as nitrogen scavenged per acre (Table 3). On average tillage radishes produced 1573 lbs of dry matter per acre and were able to scavenge 40.4 lbs of nitrogen per acre from the soil. Increased biomass may be achieved from earlier planting dates.

Table 3: Dry matter yield and harvest dry matter percent by seeding rate, Alburgh, VT 2014.

Seeding rate	Nitrogen yield	Dry matter yield	Harvest dry matter
lbs/ac^{-1}	lbs ac^{-1}	lbs ac^{-1}	%
3	36.3	1288	6.2
6	**49.1**	**1860**	**9.0**
8	36.7	1628	7.5
12	38.8	1535	7.7
LSD (0.10)	NS	NS	NS
Trial mean	40.4	1573	7.6

Treatments indicated in **bold** had the top observed performance.
LSD – Least significant difference.
NS = No significant difference.

Seeding rate did not significantly impact root length or diameter (Table 4). On average tillage radishes produced roots that were 19.0 inches long and 1.8 inches wide. The 6 lbs per acre seeding rate also had the longest average root length, although it was not significantly different from the other treatments (Table 4). As expected, the 3 lbs per acre seeding rate had the widest root diameter, although not significantly wider than the other treatments (Table 4).

Table 4: Root length and root diameter by seeding Rate, Alburgh, VT, 2014.

Seeding rate	Root length	Root diameter
lbs/ac^{-1}	in	in
3	19.9	**2.4**
6	**20.9**	1.7
8	18.4	1.7
12	16.6	1.6
LSD (0.10)	NS	NS
Trial mean	19.0	1.8

Treatments indicated in **bold** had the top observed performance.
LSD – Least significant difference.
NS = Not significant difference.

Similarly, there was no significant difference among seeding rates for percent soil cover. All seeding rates provided excellent soil cover indicating that this cover crop can protect the soil from potential erosive forces such as wind and rain.

Table 5. Percent soil cover by seeding rate, Alburgh, VT, 2014.

Seeding rate	Percent soil cover
lbs ac^{-1}	%
3	98.3
6	**99.1**
8	98.9
12	98.4
LSD (0.10)	NS
Trial mean	98.7

Treatments indicated in **bold** had the top observed performance.
LSD – Least significant difference.
NS = Not significant difference.

DISCUSSION

In this study, seeding rate did not significantly impact tillage radish yield, root size, and percent of soil cover. The current recommended seeding rate provided by most seed companies is 6 to 8 lbs of tillage radish seed per acre. Based on this data, the lower seeding rate is adequate to accomplish the goals of this cover crop. However, this is only one year's worth of data from one location. Multiple years of data would be necessary to confirm this recommendation.

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