2013

Cover Crop Planting Date x Seeding Rate Trial

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NORTHWEST CROPS & SOILS PROGRAM

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UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2013 COVER CROP PLANTING DATE X SEEDING RATE TRIAL

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When corn silage is harvested in the fall, the entire plant is removed, leaving the soil exposed through the winter. Many farmers have started to plant cover crops following corn harvest because of the multitude of benefits cover cropping brings to soil health and fertility. The cover crop protects the soil from erosion, adds organic matter, and also scavenges excess soil nitrogen (N), releasing it again after cover crops are terminated in the spring. This keeps the nitrogen from potentially being lost through leaching, which, in addition to the soil benefits, provides a financial benefit to farmers – less nitrogen loss means less fertilizer needed in the spring. Farmers have asked about best practices for growing cover crops to maximize benefit to the soil, while protecting corn silage yield and quality. In particular, establishing a "last chance" planting date for cover crops is important in our region where the growing season is short and common adverse fall weather can delay planting. This study was intended to determine what planting dates and which seeding rates give the best cover crop performance.

MATERIALS AND METHODS

This project consisted of a planting date x seeding rate study. The experimental design of the study was a randomized complete block with split plots replicated three times. Treatments were seven planting dates (12-Sep, 20-Sep, 26-Sep, 5-Oct, 11-Oct, 18-Oct, and 25-Oct). The split plots were seeding rates of 50, 75, 100, 125, and 150 lbs ac^{-1}. The trial field was disked to prepare the seedbed for planting. The plots were broadcast seeded; plots were ten feet wide by ten feet long (Table 1). Seed was lightly incorporated using a tineweeder. The seed was winter rye (variety not specified).

Variations in project results can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among treatments 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 (e.g. yield). Least Significant Differences (LSD's) at the 10% level of probability 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 in 9 out of 10 chances that there is a real difference between the two values. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In the example below, treatment A is significantly different from treatment C but not from treatment B. The difference between A and B is equal to 200, which is less than the LSD value of 300. This means that these treatments did not differ in yield. The difference between A and C is equal to 400, which is greater than the LSD value of 300. This means that the yields of these treatments were significantly different from one another.

Treatment	Yield
A	**2100***
B	1900*
C	1700
LSD	300

Table 1. Agronomic and trial information for the cover crop planting date x seeding rate study, 2012-2013.

	Borderview Research Farm, Alburgh, VT.
Soil type	Benson rocky silt loam
Previous crop	Wheat
Tillage operations	Fall plow, disc, and spike tooth harrow
Plot area (ft.)	10 x 10
Seeding rate (lbs. ac^{-1})	50, 75, 100, 125, 150
Replicates	3
Planting date (2012)	12-Sep, 20-Sep, 26-Sep, 5-Oct, 11-Oct, 18-Oct, and 25-Oct
Harvest date (2013)	6-May

Estimations of percent cover were made on 19-Apr 2013. Plots were hand harvested on 6-May.

RESULTS

Using data from a Davis Instruments Vantage Pro2 Weather Station on-site at Borderview Research Farm in Alburgh, VT, weather data were summarized for the 2012-2013 growing season (Table 2). The growing season experienced approximately two inches less precipitation than the 30-year average. The 2012-2013 cover crop growing season experienced 3580 Growing Degree Days (GDD's), which are 895 more than the 30-year average.

Table 2. Summarized weather data for the 2012- 2013 cover crop growing season.

	2012				2013				
Alburgh, VT	September	October	November	December	January	February	March	April	May
Average temperature (°F)	60.8	52.4	36.7	28.7	20.6	21.9	32.1	43.6	59.1
Departure from normal	0.2	4.2	-1.5	2.8	1.8	0.4	1	-1.2	2.7
Precipitation (inches)	5.36	4.13	0.68	3.49	0.6	1.08	1.04	2.12	4.79
Departure from normal	1.72	0.53	-2.44	1.12	-1.45	-0.68	-1.17	-0.7	1.34
Growing Degree Days (base 32°F)	896	652	144	535	47	21	89	348	848
Departure from normal	38	150	-40	535	47	21	89	-36	91

Based on weather data from Davis Instruments Vantage pro2 with Weatherlink data logger in Alburgh, VT.
Historical averages for 30 years of NOAA data (1981-2010).

Impact of Planting Date on Winter Rye Production

In general, the earlier in the fall that winter rye is planted, the faster the seed will germinate (Table 3). At this time, the soil temperature is warmer and allows for a more rapid germination. This will ultimately allow the cover crop to become better established prior to fall dormancy. The fall of 2012 was above average in temperature, mostly likely leading to similar emergence times among cover crop planting dates. The rye planted on 12-Sep yielded the most biomass (1681 lbs ac^{-1}), and was statistically different from all other planting dates. (Table 4; Figure 1). The earlier planting dates provided the most percentage of ground cover, with the planting date on 12-Sep having the highest percentage (73.1%). As planting dates were delayed into October, cover crop biomass, and ground cover were drastically reduced (Table 4).

Table 3. Impact of cover crop planting date on seed emergence, 2012.

Planting date	Emergence date	Days till emergence
12-Sep	20-Sep	8
20-Sep	26-Sep	6
26-Sep	11-Oct	16
5-Oct	25-Oct	20
11-Oct	25-Oct	14
18-Oct	1-Nov	14
25-Oct	9-Nov	15

Table 4. Impact of planting date on cover crop yield and quality, Alburgh, VT.

Planting date	Plant cover	Biomass
2012	%	lbs ac^{-1}
12-Sep	**73.1**	**1681**
20-Sep	39.6	895
26-Sep	62.5	1243
5-Oct	42.2	923
11-Oct	32.3	813
18-Oct	18.8	695
25-Oct	9.10	453
LSD (0.10)	7.53	115
Trial mean	39.7	957

*Varieties that did not perform significantly lower than the top performing treatment (in **bold**) in a particular column are indicated with an asterisk.

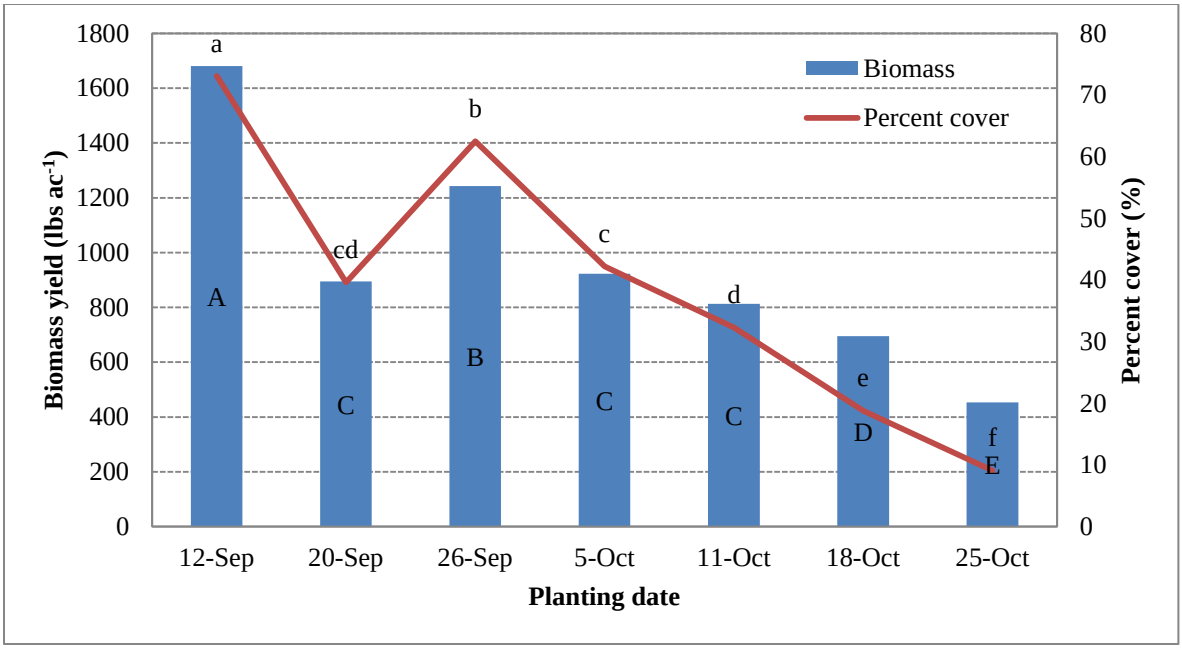

Figure 1. Impact of planting date on cover crop biomass and percentage of ground cover in Alburgh, VT. Treatments that share a letter were not significantly different from one another (p=0.10, compare capital letters for biomass and lower-case letters for percent cover).

Impact of Planting Date x Seeding Rate Interaction

Interestingly, there was a significant interaction between cover crop planting date and seeding rate in terms of percent ground cover (p=0.06). This indicates that seeding rates did differ significantly by individual planting dates, with respect to percent cover (Figure 2). Meaning that earlier in the planting season, it doesn't statistically matter as much which seeding rate is used, because there is plenty of time for establishment; although later in the season, seeding rates do matter because germination and survivability of seed decreases. There was no significant interaction between cover crop planting date and seeding rate in terms of biomass yield. This means that as long as cover crops are planted during an ideal time frame (early/mid-September), seeding rate will not have a statistically significant impact on biomass yield. These data show that overall, seeding rates will affect ground cover, which can moderate soil temperature and decrease soil erosion, but they will not significantly affect biomass yields.

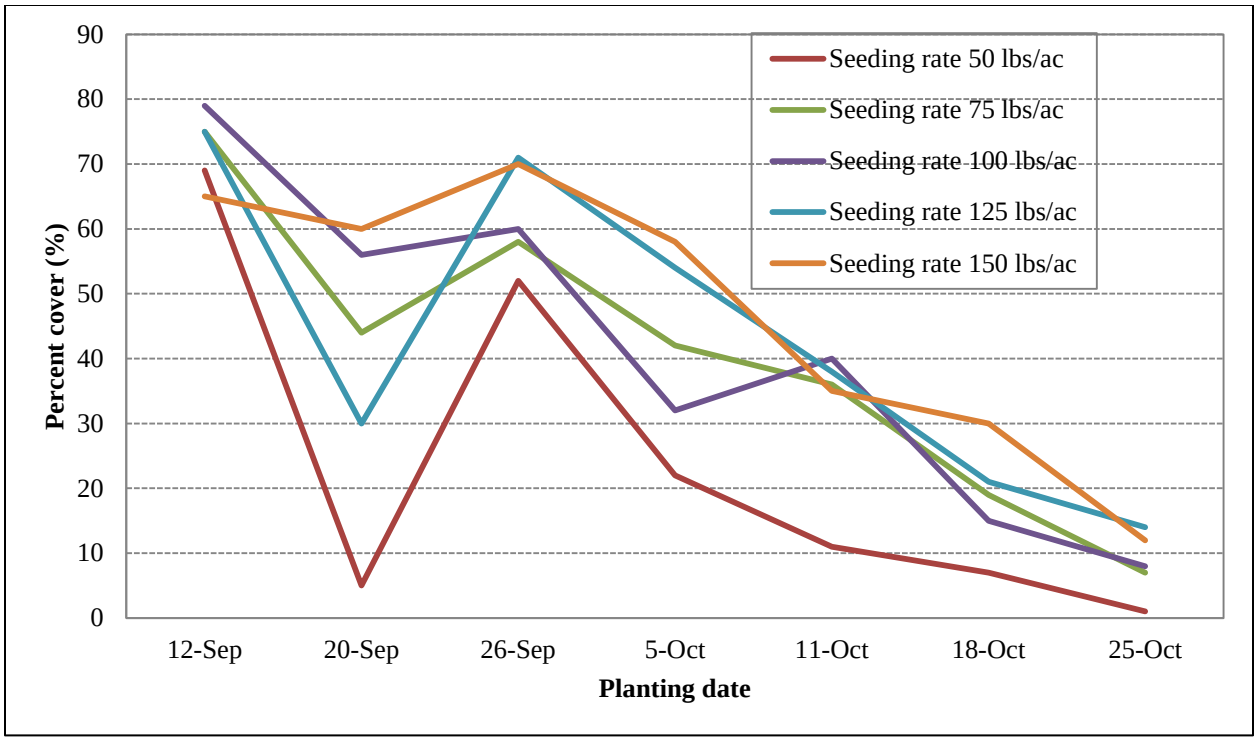

Figure 2. Interaction between planting date and seeding rate, Alburgh, VT, 2013.

Impact of Seeding Rate on Winter Rye Production

Winter rye yields and percent ground cover differed significantly by seeding rate. The seeding rate of 150 lbs/acre performed best for biomass yield (1083 lbs/acre), although not statistically different from seeding rates of 125 or 100 lbs/acre (Table 5; Figure 3). The seeding rate of 150 lbs/acre also performed best for percent cover (47.6%), although not statistically different from seeding rates of 125 or 100 lbs/acre.

Table 5. Impact of seeding rate on cover crop yield and quality, Alburgh, VT.

Seeding rate	Plant cover	Biomass yield
lbs ac^{-1}	%	lbs ac^{-1}
50	24.4	720
75	40.6	937
100	41.8*	998*
125	43.8*	1049*
150	**47.6***	**1083***
LSD (0.10)	6.4	97
Trial mean	39.6	957

*Varieties that did not perform significantly lower than the top performing treatment (in **bold**) in a particular column are indicated with an asterisk.

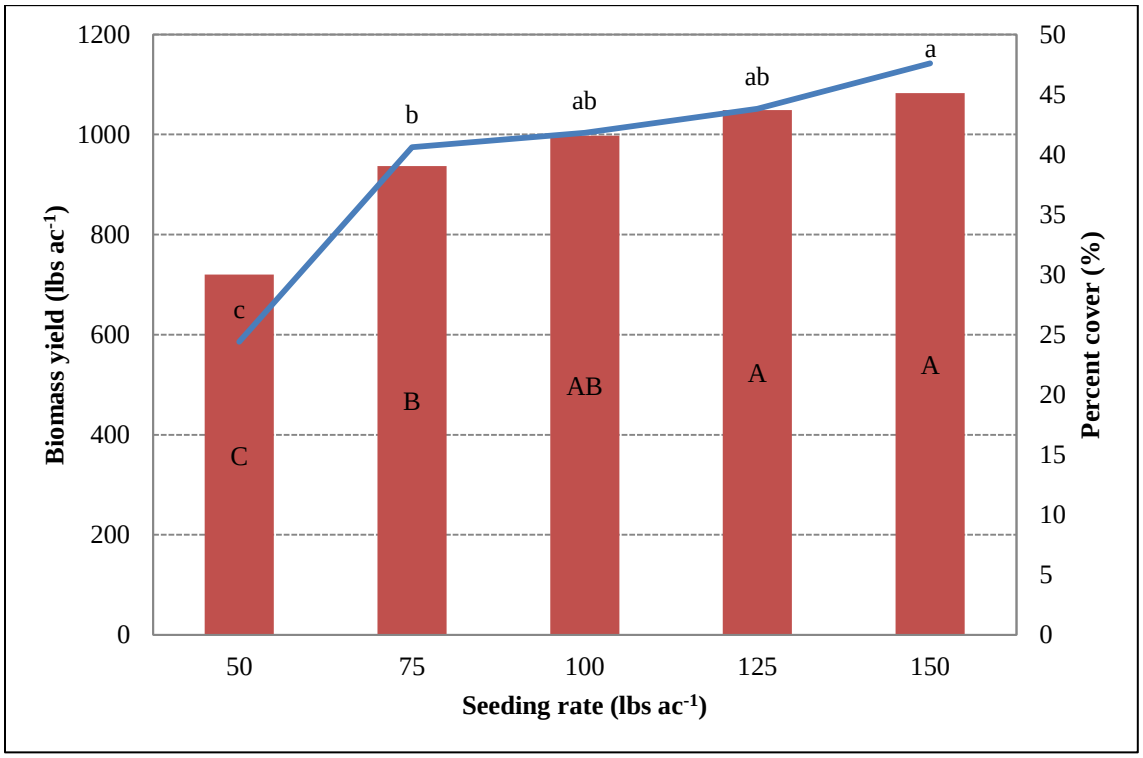

Figure 3. Impact of seeding rate on cover crop biomass and percentage of ground cover in Alburgh, VT. Treatments that share a letter were not significantly different from one another (p=0.10, compare capital letters for biomass and lower-case letters for percent cover).

DISCUSSION

In the Northeast, where the fall tends to be cool and wet, timing corn harvest and cover crop planting is important to maximize corn yield, but also to maximize the soil health and financial benefits of a cover crop. Early fall planting of winter rye allows for significant vegetative growth that provides a greater mass of overwintering roots to hold the soil and reduce risk of erosion. In addition, winter rye has the ability to scavenge N from the soil. The more plant biomass produced, the more N that can be scavenged. Therefore, earlier planting dates that yield more biomass would also provide more N in the spring. If combined with planting shorter season corn, data from this trial suggests that planting cover crops in September can provide significant cover to the soil surface as well as scavenge very high amounts of nitrogen.

Overall, winter rye biomass and percentage of ground cover dropped significantly for cover crops planted after September. Cover crops planted in September will allow for better establishment in the fall. In 2012, the fall was mild allowing for adequate cover crop establishment into October; however, any adverse weather during this time would result in severely reduced establishment. Hence, earlier cover crop plantings can help buffer against adverse fall conditions.

Not surprisingly, seeding rates ranging from 100 to 150 lbs ac^{-1} resulted in higher yields and percentage of ground cover. However, according to these trial results; planting dates have a greater overall impact on yield and percent cover than do seeding rates. Therefore, it may be feasible to use lower seeding rates, as long as cover crop planting occurs during the ideal window of opportunity (typically during the month of September in this region). The earlier your cover crops are planted and established, the better likelihood you will see the intended results of cover cropping.

ACKNOWLEDGEMENTS

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