NW CROPS & SOILS PROGRAM

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CULTIVATING HEALTHY COMMUNITIES

2012
Cover Crop Planting Date x Seeding Rate Trial

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2012 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 and a planting date x seeding rate study. The experimental design of the planting date study was a randomized complete block with three replicates. Treatments were six planting dates (19-Sep, 26-Sep, 7-Oct, 12-Oct, 20-Oct, and 3-Nov) seeded at 100 lbs ac^{-1}. The experimental design of the seeding rate x planting date study was a randomized complete block with split plots. The main plots were planting dates of 19-Sep, 26-Sep, 7-Oct, and 12-Oct. The subplots were seeding rates of 50, 75, 100, 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). 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, 2011- 2012.

	Borderview Research Farm, Alburgh, VT.
Soil type	Benson rocky silt loam
Previous crop	Wheat
Tillage operations	Fall plow, disc, and spike-toothed harrow
Plot area (ft.)	10 x 10
Seeding rate (lbs. ac^{-1})	50, 75, 100, 150
Replicates	3
Planting date (2011)	19-Sep, 26-Sep, 7-Oct, 12-Oct, 20-Oct, 3-Nov
Harvest date (2012)	10-May

Estimations of percent cover were made on 19-Apr 2012. Plots were hand harvested on 10-May. A subsample of the harvested material was collected, dried, ground, and then sent to Cumberland Valley Analytical Services in Hagerstown, MD for nitrogen analysis. This measurement was taken to provide an estimate of the amount of nitrogen scavenged by the cover crop.

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 2011-2012 growing season (Table 2).With the exception of September 2011 (Tropical Storm Irene), precipitation was less than the 30-year average for all other months. Temperature was higher than the 30-year average for all months encompassing this study from planting to harvest.

Table 2. Summarized weather data for the 2011- 2012 cover crop growing season.

	2011				2012				
Alburgh, VT	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Average temperature (°F)	62.8	50.1	43.4	29.5	22.2	26.0	39.7	44.9	60.5
Departure from normal	2.20	1.90	5.20	3.60	3.40	4.50	8.60	0.10	4.10
Precipitation* (inches)	5.6	3.5	1.4	2.2	1.5	0.7	1.5	2.6	3.9
Departure from normal	1.9	-0.1	-1.7	-0.1	-0.6	-1.1	-0.8	-0.2	0.5
Growing Degree Days (base 32°F)	964	566	368	126	72	91	411	435	917
Departure from normal	106	64	166	107	72	91	285	51	161

Based on weather data from Davis Instruments Vantage pro2 with Weatherlink data logger.
Historical averages for 30 years of NOAA data (1981-2010).
* Precipitation data from June-September 2012 is based on Northeast Regional Climate Center data from an observation station in Burlington, VT.

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 2011 was above average in temperature, mostly likely leading to similar emergence times among cover crop planting dates. The rye planted on 26-Sep yielded the most biomass (2588 lbs ac^{-1}), although not statistically different from planting dates 19-Sep and 12-Oct (Table 4; Figure 1). The earlier planting dates were the tallest in height and also provided the most percentage of ground cover. As planting dates were delayed into late October, cover crop biomass, heights and ground cover were 50% less than earlier planting dates. Planting dates with the highest plant biomass also scavenged the most nitrogen per acre (Table 4).

Table 3. Impact of cover crop planting date on seed emergence, 2011.

Planting date	Emergence date	Days till emergence
19-Sep	23-Sep	4
26-Sep	7-Oct	11
7-Oct	12-Oct	5
12-Oct	21-Oct	11
20-Oct	3-Nov	14
27-Oct	8-Nov	11
3-Nov	18-Nov	21

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

Planting date 2011	Biomass lbs ac^{-1}	Average height cm	Plant cover %	Nitrogen lbs ac^{-1}	Nitrogen %
19-Sep	2044*	**64.0***	58.1*	32.8	1.6
26-Sep	**2588***	61.9*	**63.9***	44.6*	1.8
7-Oct	1508	55.7*	57.1*	28.0	1.9
12-Oct	2356*	59.3*	63.5*	**47.3***	2.0
20-Oct	1041	38.1	43.6	21.3	2.1
3-Nov	410	25.1	8.2	12.8	**3.2***
LSD (0.10)	820	13.8	16.6	12.8	0.3
Trial mean	1658	50.7	49.1	31.1	2.1

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

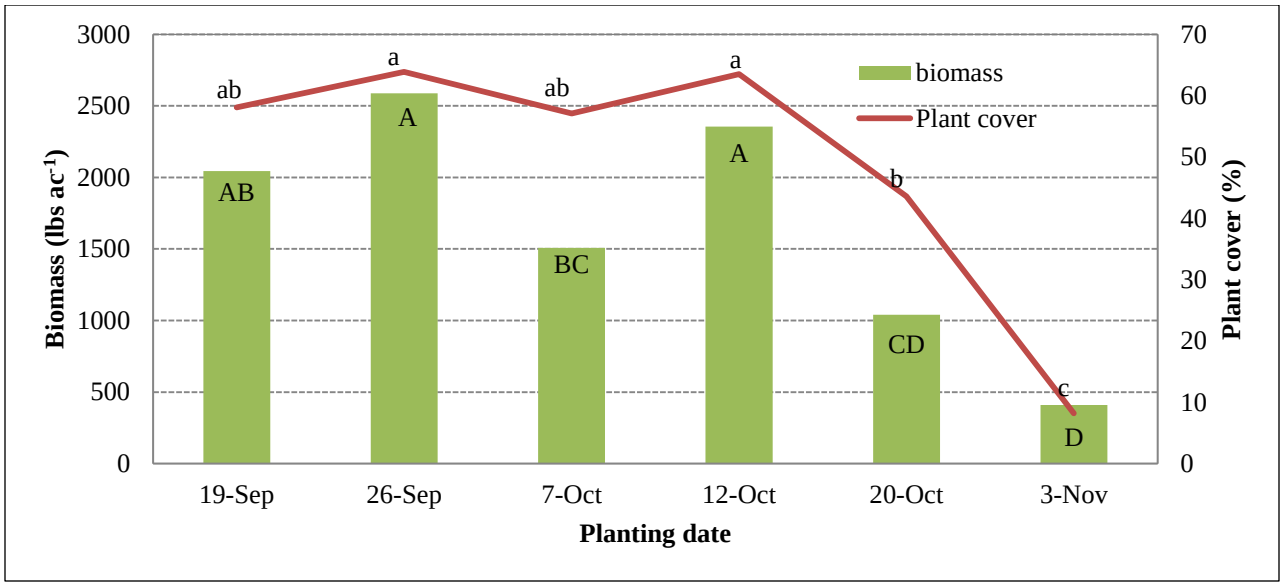

Figure 1. Impact of planting date on cover crop biomass and percentage of ground cover in Alburgh, VT. Treatments that share a letter were not significantly different from one another (p=0.10, compare capital letters for biomass and lower-case letters for percent cover).

Impact of Planting Date and Seeding Rate on Winter Rye Production

Planting Date x Seeding Rate Interaction

Interestingly, there was no significant interaction between cover crop planting date and seeding rate. This indicates that the winter rye performed similarly across seeding rates regardless of the planting date. Hence, we would assume that the same seeding rate can be used regardless of how early or late the cover crop is planted. This may be a result of mild fall weather enabling the winter rye to become well established and set tillers prior to fall dormancy. Therefore, the remainder of the report will focus on the main of effects of planting date and seeding rate.

Impact of Planting Date

With the exception of the 7-Oct planting date, cover crop establishment was similar across planting dates (Table 5 Fig. 2). The trial mean winter rye biomass was 2065 lbs ac^{-1}. Winter rye planting between mid-September and mid-October allowed for adequate ground cover averaging 57.6% for the trial. The cover crops also scavenged nearly 40 lbs of nitrogen per acre. The 7-Oct planting date resulted in lower biomass yields, height, and ground cover than all other planting dates. This may be due to adverse weather at the time of planting.

Table 5. Impact of planting date on cover crop yield and quality, Alburgh, VT.

Planting date 2011	Biomass lbs ac^{-1}	Average height cm	Ground cover %	Nitrogen lbs ac^{-1}	Nitrogen %
19-Sep	2145*	**63.2**	60.5*	36.3	1.7
26-Sep	**2373***	62.5	**64.0***	41.3	1.7
7-Oct	1577	54.9	46.4	32.6	**2.2***
12-Oct	2166*	57.5	59.4*	**42.0**	2.0*
LSD (0.10)	452	NS	9.3	NS	0.3
Trial mean	2065	59.5	57.6	38.1	1.9

NS – No statistical significance was determined between varieties.
*Varieties that did not perform significantly lower than the top performing treatment (in bold) in a particular column are indicated with an asterisk.

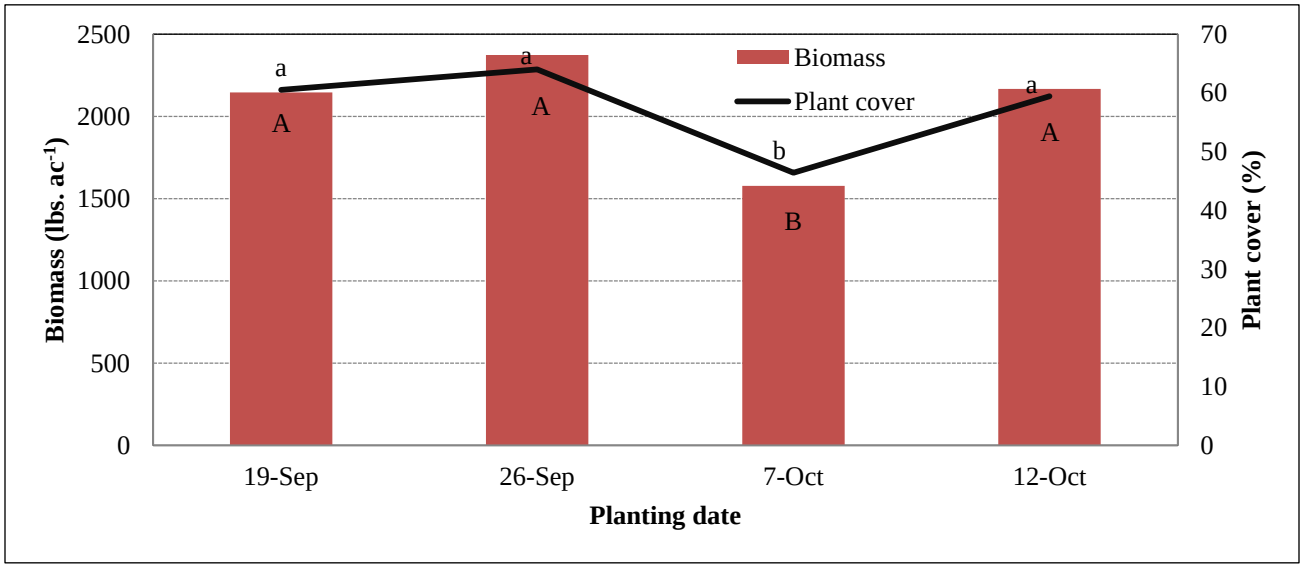

Figure 2. Impact of planting date on biomass and ground cover in Alburgh, VT (averaged across seeding rates). Treatments that share a letter were not significantly different from one another (p=0.10, compare capital letters for biomass and lower-case letters for plant cover).

Impact of Seeding Rate

Winter rye yields, height, and percentage of ground cover were not significantly impacted by seeding rate in this study. Winter rye planted at 150 lbs. ac^{-1} was top performing for biomass (2342 lbs. ac^{-1}), although not statistically significant (Table 6). All seeding rates provided over 50% ground cover and scavenged on average 30 lbs of nitrogen per acre.

Table 6. Impact of seeding rate on cover crop yield and quality, Alburgh, VT.

Seeding rate	Biomass	Average height	Ground cover	Nitrogen	Nitrogen
lbs ac^{-1}	lbs ac^{-1}	cm	%	lbs ac^{-1}	%
50	2045	59.4	53.7	37.6	1.9
75	1750	59.3	55.5	33.3	**2.1**
100	2124	**60.2**	**60.7**	39	1.8
150	**2342**	59.3	60.4	**42.4**	1.8
LSD (0.10)	NS	NS	NS	NS	NS
Trial mean	2065	59.5	57.6	38.1	1.9

NS – No statistical significance was determined between varieties.
*Varieties that did not perform significantly lower than the top performing treatment (in bold) in a particular column are indicated with an asterisk.

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 or early October can provide significant cover to the soil surface as well as scavenge very high amounts of nitrogen.

Overall, winter rye biomass, average height, and percentage of ground cover dropped significantly for cover crops planted after mid-October. Cover crops planted in mid to end of September will allow for better establishment in the fall. In 2011, the fall was mild allowing for adequate cover crop establishment later into October; however, any adverse weather during this time would result in severely reduced establishment. This was observed when cover crops were planted on the 7-Oct. During this period of adverse weather, winter rye yields were reduced by half as compared to the cover crop planted on 19-Sep, 26-Sep, and 12-Oct. Hence, earlier cover crop plantings can help buffer against adverse fall conditions.

Surprisingly in this study, seeding rate did not impact winter rye yield or establishment. In past years, seeding rates ranging from 100 to 150 lbs ac^{-1} resulted in higher yields and percentage of ground cover. Ultimately, this would result in better soil erosion protection. The mild fall may have led to increased tillering of the winter rye cover crop. This would have allowed for better yields and percentage of ground cover when compared to past years. Therefore according to these trial results, it may not be cost effective to incorporate higher seeding rates, as long as your cover crops have adequate time to establish and tiller prior to fall dormancy. The earlier your cover crops are planted and established, the better likelihood you will see the intended results of cover cropping.

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