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Cover Crop Planting Date x Seeding Rate Trial Report

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UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

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INTRODUCTION

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 being 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 into the spring.

CULTURAL PRACTICES

The trial field was disked to prepare the seedbed for planting. The experimental design was a randomized complete block in a split plots design. Main plots were planting dates beginning on September 5, 2009, and occurred roughly weekly for eight weeks to establish eight different planting date treatments (table 1). Seeding rates of 75, 100, 125, and 150 lbs per acre were subplots. The plots were planted with a Kincaid cone seeder (image 1) set to six-inch rows; plots were three feet wide by twenty feet long. The variety of winter rye planted was Aroostook rye, an especially winter hardy variety developed for planting as a cover crop after late-harvested crops in the Northeast.

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

Borderview Farm, Alburgh, VT	
Soil Type	Silt loam
Previous Crop	Fallow
Tillage Methods	Plow and disk
Fertilizer	None applied
Row Width	6 inches
Replicates	3
Planting Date Treatments (8)	9/5; 9/12; 9/19; 9/26; 10/3; 10/13; 10/18; 11/1
Seeding Rate Treatments (4)	75, 100, 125, 150 lbs ac^{-1}
Termination Date	5/26/2010

WEATHER DATA

The end of the 2009-growing season was wetter and cooler than average, while the winter and spring of 2010 was warmer than the 30-year average. Accumulated growing degree days (GDDs) from emergence of the cover crop at the end of March through termination in May were close to 1500 (table 2), which is almost 275 GDDs higher than normal. These data were recorded at weather stations in close proximity to the research site.

Table 2. Summarized weather data for the 2009 - 2010 cover crop growing season.

South Hero (Alburgh)	September	October	February	March	April	May
Average Temperature	57.7	44.1	26.2	37.8	49.3	59.6
Departure from Normal	-2.7	-4.7	5.9	7.0	5.8	3.0
Precipitation	4.01	5.18	1.85	2.79	2.76	0.92
Departure from Normal	+0.55	+0.79	0.44	0.73	0.25	-2.01
GDDs (base 32˚)	771	396	3.1	229	521	854
Departure from Normal	-81.0	-125	3.1	113	176	91.5

Based on National Weather Service (NWS) data from South Hero, VT. Historical averages are for 30 years of data (1971-2000).
* Data not available from NWS

ANALYSIS

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 400, which is less than the LSD value of 2.0. This means that these treatments did not differ in yield. The difference between A and C 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.

Treatment	Yield
A	**2100***
B	1900*
C	1700
LSD	300.0

RESULTS

Both planting date and seeding rate have important implications for spring cover crop performance, especially in terms of the amount of soil covered by plant biomass. As expected, results from this trial indicated that September planting of the cover crop gives better yield and more soil coverage in the spring (table 3). The September 6th planting date produced nearly 5500 lbs. of dry matter (DM) per acre, which was significantly more than the all of the later planting dates (table 3). The next three planting dates (September 12th, 19th, and 26th) were all statistically similar, producing between 2600 and 2900 lbs. DM per acre (figure 1). The October planting dates were all statistically similar to each other as well, and produced significantly lower yields than the late September dates. The October planting dates produced relatively low yields of approximately 1425 to nearly 1800 lbs DM per acre and covered less than 20% of the soil surface.

Table 3. Effect of planting date on yield, height, cover, and growth stage characteristics

Planting Date	DM yield (lbs. ac^{-1})	4/1 Height (cm)	Cover %	4/22 Height (cm)	Flowering (5/11) %	Flowering (5/26) %
6 - Sep.	**5478***	**12.7***	**48.2***	**54.3***	**97.5***	**100***
12 - Sep.	2672	10.7	29.6	36.9	60.4	93.3*
19 – Sep.	2949	10.8	40.7*	38.1	55.8	86.7*
26 – Sep.	2673	10.8	38.0*	33.2	42.1	65.0
3 – Oct.	1798	9.00	18.5	25.4	14.0	41.7
13 – Oct.	1426	8.00	16.7	23.9	0.90	28.3
18 – Oct.	1430	7.40	13.0	20.4	0.50	21.7
1 – Nov.	1455	7.90	21.3	21.9	2.00	10.7
LSD	566	1.0	13.2	3.8	11.6	20.1
Trial Mean	2485	9.70	19.8	31.8	34.2	55.9

*Results that are not significantly different than the top performer in a particular column are indicated with an asterisk.

Early fall planting of winter rye allows for significant vegetative growth that provides a greater mass of overwintering roots that can 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 per acre in the spring. The winter rye biomass samples from this trial averaged 2.41% N, which translates to 132 lbs. of potential N per acre for the earliest planting date. As planting date was delayed the amount of biomass declined and reduced the quantity of potential N to a low of 34 lbs per acre.

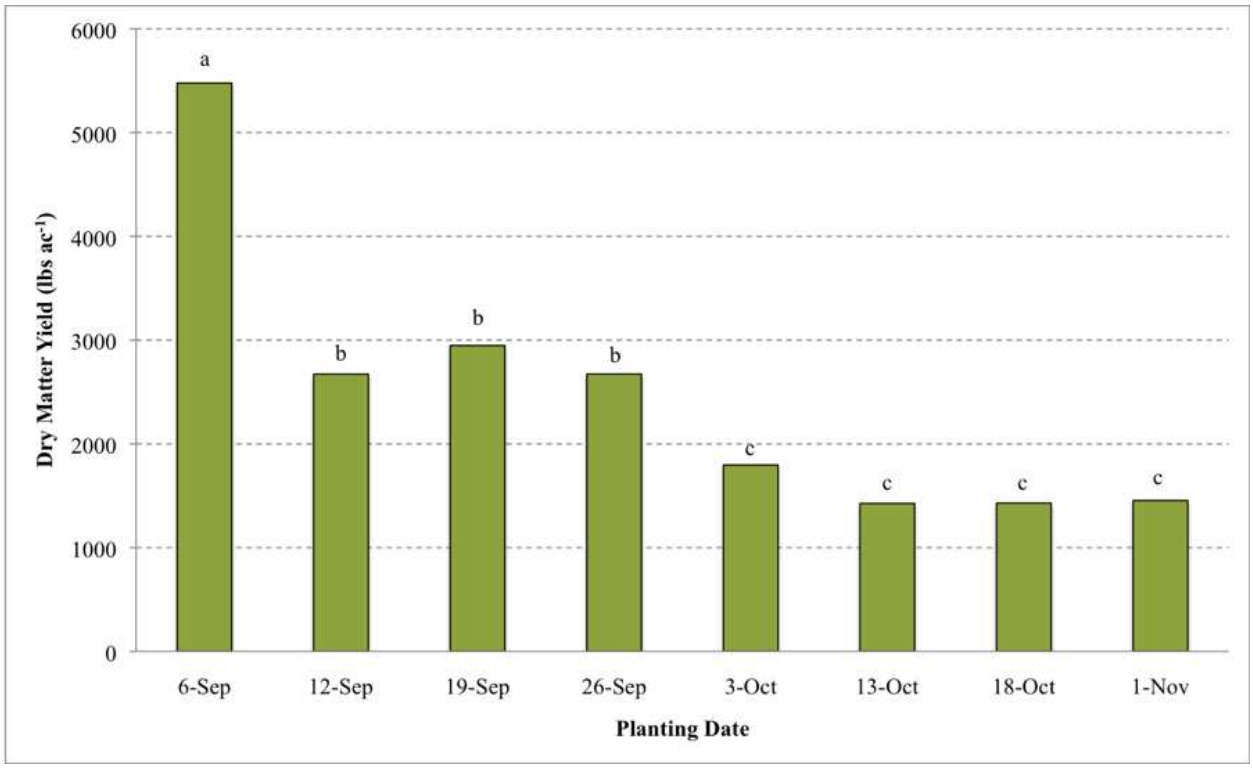

Figure 1. Effect of planting date on winter rye dry matter yield per acre. Values with the same letter did not perform significantly differently (P < 0.10).

Winter rye height and flowering date were significantly impacted by the date of planting. Winter rye had an average height of 3 feet when seeded in mid to end of September, which was a foot taller than rye planted in October. Though the effect was not as pronounced early in the season, the difference between the early and late planting dates became more and more clear as the spring progressed (Figure 2).

Winter rye planted in September reached the flowering stage one to two weeks earlier than later planted rye. Flowering time of rye is important if implementing rolling and crimpling termination strategies. The earlier flowering dates can allow for timely planting of corn or soybeans into the killed mulch.

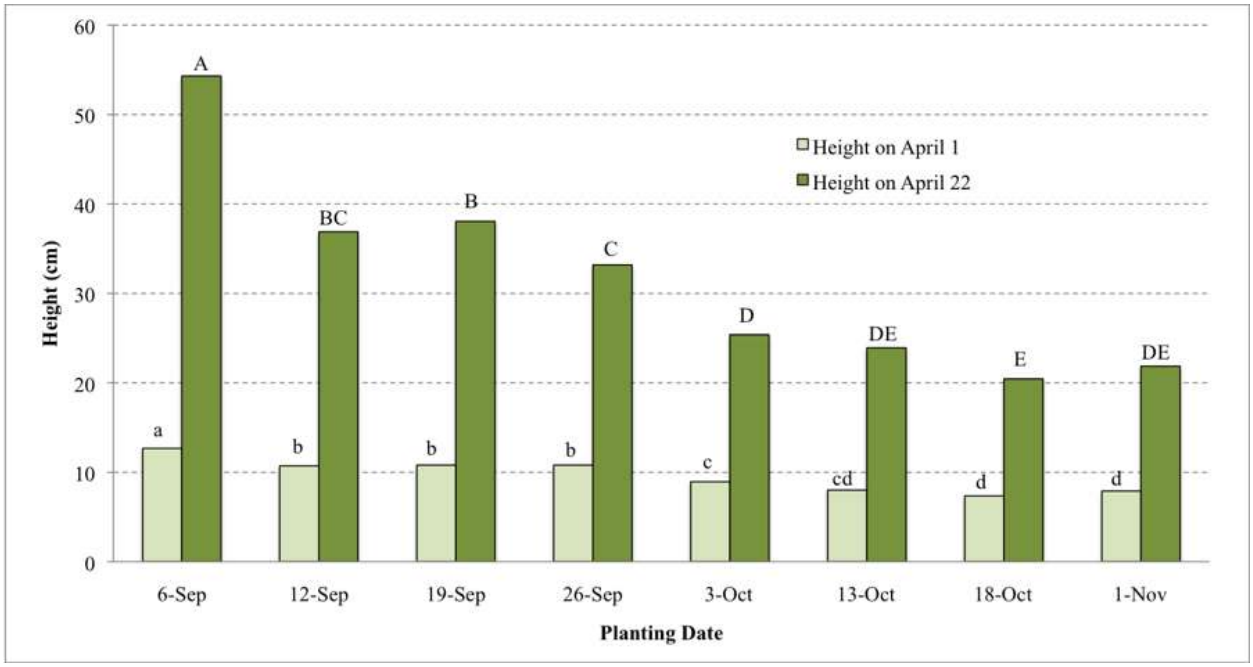

Figure 2. Effect of planting date on winter rye height on two dates, April 1 and April 22. Lower case letters correspond to April 1 heights and capital letters correspond to April 22 heights. Values with the same letter did not perform significantly differently (P < 0.10).

Differences were relatively small (but statistically significant) in winter rye yield between the seeding rates of 75, 100, and 125 lbs seed per acre (table 4; figure 3). This indicates that if seeding with a grain drill adequate yields could be obtained by only seeding 75 lbs per acre. The seeding rate of 150 lb per acre yielded the most biomass but this amount of seed may be cost prohibitive for most farmers (Table 4). Seeding rates did not significantly impact the height or flowering dates of the winter rye.

Table 4. Seeding rate effect on DM yield, spring heights, and growth stage.

Seeding Rate lb ac^{-1}	DM yield lb ac^{-1}	4/1 Height cm	4/22 Height cm	Flowering (5/11) %
75	2313	9.6	30.6	33.0
100	2352	**9.8**	31.8	29.8
125	2507*	9.5	31.8	**37.3**
150	**2770***	9.8	**32.8**	36.5
LSD	400	NS	NS	NS
Trial Mean	2485	9.7	31.8	34.2

*Results that are not significantly different than the top performer in a particular column are indicated with an asterisk.

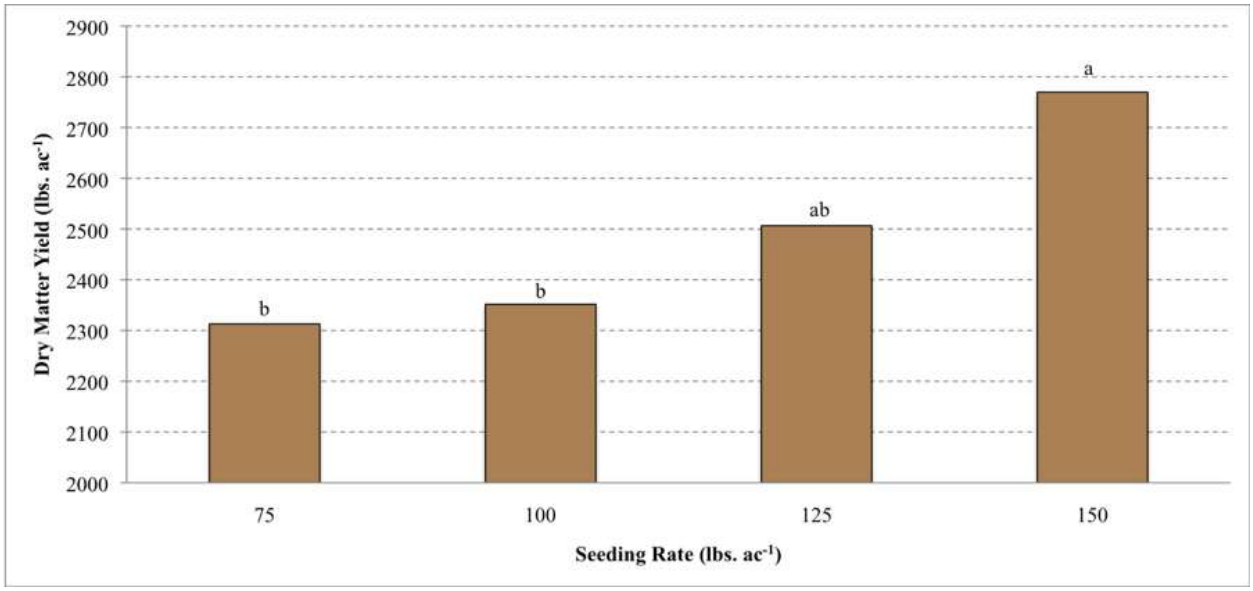

Figure 3. Effect of seeding rate on winter rye dry matter yield per acre. Values with the same letter did not perform significantly differently (P < 0.10).

CONCLUSION

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 the cover crop. If combined with planting shorter season corn, data from this trial suggests that planting cover crops in Sep. can provide significant cover to the soil surface as well as scavenge very high amounts of nitrogen. If planting with a grain drill the seeding rates can be reduced to as low as 75 lbs per acre. Although not evaluated in this project higher seeding rates may be required if broadcast seeding winter rye. Higher seeding rates would also be warranted as the planting date moves into the mid to late Oct. and winter rye has less time to produce biomass and additional plant tillers to provide cover of the soil surface.

ACKNOWLEDGEMENTS

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