2014

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2014 WINTER CANOLA PLANTING DATE x SEEDING RATE TRIAL

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Because winter canola is a relatively new crop for the Northeastern United States, optimal planting dates for winter canola have not yet been established for this region. In addition, the impact of seeding rate on winter survival remains unclear for our region. Therefore, the goal of this project was to determine the impact of planting date and seeding rate on winter canola survival, plant characteristics, and seed and oil yields. Winter canola is planted in late summer and harvested the following summer. Getting canola planted as early as possible is often recommended for Midwest producers, but growers in the Northeast struggle with timing canola seeding after harvesting another crop, as well as wet fall conditions for planting. In addition, seeding at a higher or lower rate may impact the survival of the crop, its growth the following spring, and ultimately seed and oil yields. While the data presented are only representative of one year, this information can be combined with other research to aid in making planting decisions for canola in the Northeast.

MATERIALS AND METHODS

To evaluate the impact of seeding rate and planting date on winter canola survival, yield, and quality, a research trial was conducted at Borderview Research Farm in Alburgh, VT. Agronomic information for trial can be found in Table 1. The soil was a Benson rocky silt loam and plots were prepared with fall chisel plow and disk, and finished with a spike tooth harrow. The experimental design was a randomized complete block with split plots replicated four times. The plot size was 5'x20', and plots were seeded with a Great Plains cone seeder. The main plots were four planting dates (16-Aug, 23-Aug, 30-Aug, and 6-Sep 2013). The subplots were three seeding rates: 4, 8, and 12 lbs of viable seed per acre.

Table 1. Agronomic practices for the 2014 winter canola planting date trial, Alburgh VT.

Location	Borderview Research Farm – Alburgh, VT
Soil type	Benson rocky silt loam 3-8% slope
Previous crop	Spring wheat
Tillage operations	Fall chisel plow, disk and spike tooth harrow
Seeding rate (lbs ac^{-1})	4, 8, 12
Planting equipment	Great Plains cone seeder
Row width (in.)	6
Plot size (ft)	5 x 20
Planting dates	16-Aug, 23-Aug, 30-Aug, 6-Sep 2013
Variety	Riley
Starter fertilizer	70 lbs ac^{-1} 21-0-0 Ammonium sulfate
Additional fertilizer	120 lbs ac^{-1} 27-0-0 Chilean nitrate
Weed control	12 oz. ac^{-1} Clethodim
Harvest dates	30-Aug 2014

On 4-Oct 2013, plots were assessed for fall vigor (on a scale of 0 to 10, where 0 is equal to no stand and 10 represents an extremely vigorous stand) and plant population. At this time, plots were fertilized with

Ammonium sulfate (21-0-0) at a rate of 70 lbs N per acre, and sprayed with the herbicide clethodim at a rate of 12 oz. per acre. In the spring of 2014, the stands were evaluated for winter survival, equal to the difference in estimated vigor since late fall. Plots were fertilized on 29-Apr 2014 with Chilean nitrate (27-0-0) at a rate of 120 lbs per acre.

Plots were harvested on 30-Aug 2014 according to physiological maturity, with an Almaco SPC50 plot combine. Following harvest, test weight was measured with a Berckes Test Weight Scale and a Dickey-John M20P moisture meter was used to measure harvest moisture levels. Yields were calculated at harvest moisture due to moisture reading errors. Harvested seeds were then cleaned with a Clipper fanning mill. Prior to oil extraction, seed samples were dried and moisture levels quantified. Oil was extruded from a subsample of each harvested plot using a Kern Kraft Oil Press KK40. After pressing, oil content and yields were determined.

All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate means when the F-test was 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 treatments is real or whether it might have occurred due to other variations in the field. All data was analyzed using a mixed model analysis where replicates were considered random effects. At the bottom of each table a Least Significant Difference (LSD) value is presented for each variable (e.g. yield). LSDs at the 10% level (0.10) 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. In the example at right, 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 two treatments were significantly different from one another. The treatment in bold had the top observed performance, while treatments with an asterisk did not differ significantly from the top performer.

Planting date	Yield
A	**2100***
B	1900*
C	1700
LSD (0.10)	300

RESULTS

Using data from an on-site Davis Instruments Vantage Pro2 Weather Station at Borderview Research Farm in Alburgh, VT, weather data are summarized for the 2013-2014 winter canola growing season (Table 2). In general, the 2013-2014 seasons were drier and cooler than normal. We saw particularly low temperatures in December and January with some extended periods with temperatures well below zero. There was also below average precipitation during the fall and winter of 2013 followed by a slightly above average precipitation in the spring and summer of 2014. Overall, there were 6,130 GDDs for winter canola, 95 more than the 30-year average.

Table 2. Summarized weather data for 2013–2014, Alburgh, VT.

	2013					2014						
Alburgh, VT	August	September	October	November	December	January	February	March	April	May	June	July
Average temperature (°F)	67.7	59.3	51.1	35.1	20.0	16.8	19.0	22.2	43.0	57.4	66.9	69.7
Departure from normal	-1.1	-1.3	2.9	-3.1	-5.9	-2.0	-2.5	-8.9	-1.8	1.0	1.1	-0.9
Precipitation (inches)	2.41	2.2	1.87	3.16	0.23	0.85	0.65	1.70	4.34	4.90	6.09	5.15
Departure from normal	-1.5	-1.44	-1.73	0.04	-2.14	-1.20	-1.11	-0.51	1.52	1.45	2.4	1
Growing Degree Days (base 32°F)	1112	825	600	176	16	31	14	25	330	789	1041	1171
Departure from normal	102	38	150	-40	16	31	14	25	-54	33	27	-27

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).

Planting Date by Seeding Rate Interactions

With the exception of fall height and fall vigor, there were no significant interactions between winter canola planting date and seeding rate. This suggests that the seeding rates performed similarly across planting dates. This would suggest that seeding rate does not need to be modified regardless of planting date. There was an interaction between planting date and seeding rate for fall height (Figure 1). This interaction is to be expected as late planting does not provide adequate time for differences in height to become apparent. Altering seeding rates during suboptimal planting dates will not generate the same trends in plant height compared to optimal planting dates, which provide adequate time for growth. A similar trend was observed for vigor.

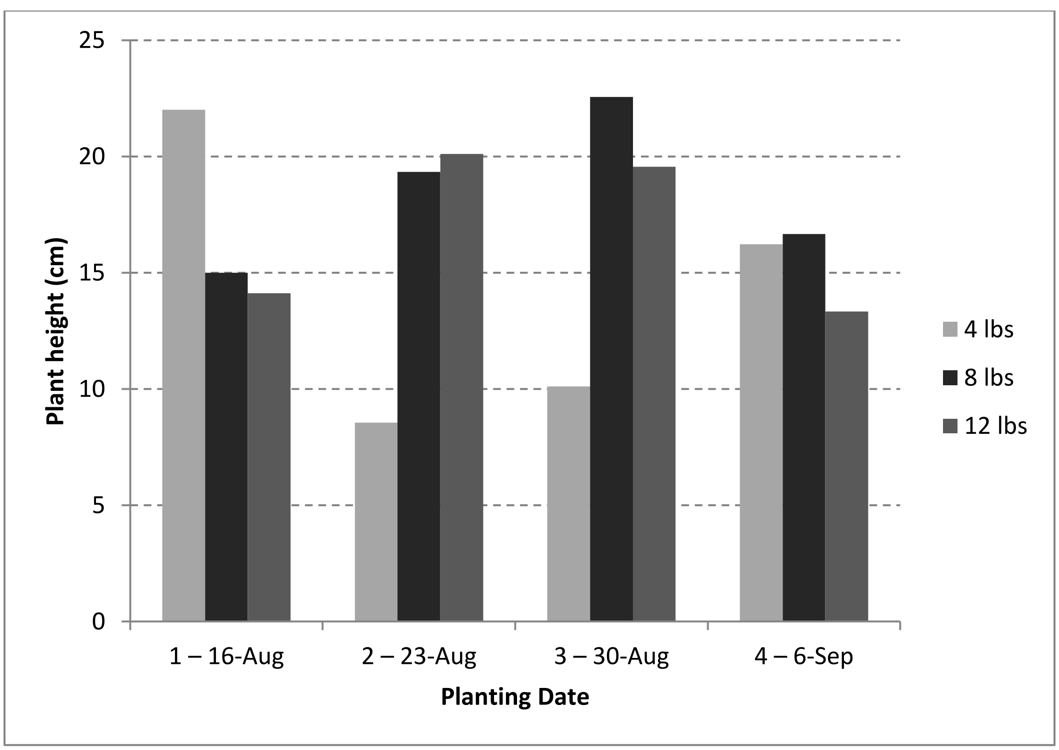

Figure 1. Plant height by planting date for three seeding rates (lbs. ac^{-1})

Impact of Planting Date

There was no statistical difference in fall vigor, height, winter survival, or seed yield across planting dates (Table 3). The tallest plants and highest yields of 17.4 cm and 310 lbs. per acre respectively, were observed in the third planting date, 30-Aug. The greatest winter survival of 24.6% was seen in the first planting date 16-Aug. Yields were incredibly low as the average winter survival for the trial was 22%.

Table 3. Effect of planting date on winter canola fall stand, height, winter survival, and seed yield.

Planting date	Fall vigor 0-10 scale	Fall height cm	Winter survival %	Seed yield lbs ac^{-1}
1 – 16-Aug	6	17.0	**24.6**	294
2 – 23-Aug	6	16.0	21.8	255
3 – 30-Aug	**6**	**17.4**	18.9	**310**
4 – 6-Sep	6	15.4	22.5	294
LSD (0.10)	NS	NS	NS	NS
Trial mean	6.1	16.5	22.0	288

Treatments indicated in **bold** had the top observed performance.
NS – No significant difference was determined between treatments.

Due to prolonged periods of subzero temperatures, minimal snow cover, and high winds during the winter, the winter canola showed very low levels of survival leading to poor stands in the spring and at harvest. Winter kill in the plots left barren areas that were quickly populated by weeds. Increased weed pressure led to difficulties with harvest. Plots with less than 0.5 lbs of harvested seed were not kept and therefore, were not pressed. Due to the large number of plots in this situation, oil content and yield were not statistically analyzed. Averages by planting dates are compared to the trial mean below (Table 4).

Table 4. Oil characteristics by planting date.

Planting date	Oil content %	Oil yield gal ac^{-1}
1 – 16-Aug	33.4	20
2 – 23-Aug	35.1	16
3 – 30-Aug	**36.1**	**24**
4 – 6-Sep	33.8	22
Trial Mean	35.0	19.3

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

The trial average for oil content was 35% and the oil yield was 19.3 gallons per acre. The average oil content observed in this trial was similar to that of other winter canola trials during the 2013-2014 season. The third planting date, 30-Aug, produced seed with the highest oil content of 36.1% and an oil yield of 24 gallons per acre.

Impact of Seeding Rate

The effect of seeding rate did not significantly impact fall vigor, winter survival, or seed yield (Table 5). The average winter survival across seeding rates was 22.0%. Overall yields were very low due to low overwintering populations. Fall height was the only parameter that statistically differed across seeding rates. The tallest plants, which were 18.4 cm, were observed in the 8 lbs per acre seeding rate although this did not differ significantly from the 12 lbs per acre seeding rate.

Table 5. Effect of variety on winter canola plant stand characteristics and seed yield.

Seeding rate	Fall vigor	Fall height	Winter survival	Seed yield
lbs ac^{-1}	0-10 scale	cm	%	lbs ac^{-1}
4	6	14.2	17.8	211
8	**6**	**18.4***	**25.3**	288
12	6	16.8*	22.7	**366**
LSD (0.10)	NS	4.13	NS	NS
Trial mean	6.1	16.5	22.0	288

Treatments indicated in **bold** had the top observed performance.
NS – No significant difference was determined between treatments.
* Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.

Due to prolonged periods of subzero temperatures, minimal snow cover, and high winds during the winter, the winter canola showed very low levels of survival leading to low stands in the spring and at harvest. Plots with less than 0.5 lbs. of harvested seed were not kept and therefore were not pressed. Due to the large number of plots in this situation, oil content and yield were not statistically analyzed. Averages by seeding rates are compared to the trial mean below (Table 6).

Table 6. Effect of variety on winter canola seed weight and oil yield.

Seeding rate	Oil content	Oil yield
lbs ac^{-1}	%	gal ac-1
4	33.4	20
8	35.1	16
12	**36.1**	**24**
Trial Mean	35.0	19.3

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

The trial average for oil content was 35% and the oil yield was 19.3 gallons per acre. The average oil content observed in this trial was similar to that of other winter canola trials during the 2013-2014 season. The highest oil content of 36.1% and oil yield of 24 gallons per acre were observed in the 12 lbs per acre seeding rate.

DISCUSSION

Due to prolonged periods of subzero temperatures, minimal snow cover, and high winds during the winter, the winter canola showed very low levels of survival leading to low stands in the spring and at harvest. The field that this trial was planted in has somewhat poorer soils and a low spot in which excess water may have accumulated, resulting in poor stands. The trial average seed yield was only 288 lbs per acre, only about 30% of typical winter canola yields observed in our other trials. The only statistical difference observed was that of taller plants in the two higher seeding rates. This difference did not translate into higher winter survival or yield. Therefore, it seems that little benefit is achieved by planting winter canola at seeding rates higher than 4 lbs. per acre. It also appears that planting date did not significantly affect winter survival or yields. However, it is critical to note the extremely unfavorable winter conditions which lead to an average survival of only 22%. These data only represent one year and should not alone be used to make management decisions.

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