NORTHWEST CROPS & SOILS PROGRAM

2018 Winter Canola Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

2018 WINTER CANOLA VARIETY TRIAL

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Winter canola is a relatively new crop to the Northeast. The majority of the canola grown in North America is grown in the Midwestern U.S. and Canada for both culinary oil as well as biodiesel production. Winter canola is planted in the late summer where it grows through the fall before entering a period of dormancy for the winter. The following spring, the plants resume growth and seed is harvested during the summer months. Winter canola could potentially be a useful crop to growers in the Northeast for diversifying rotations, farm products and markets, and producing fuel on farm. However, for winter canola to be a viable crop in our region, we must identify the varieties that can survive the winter months. To do this, the Northwest Crops and Soils Program conducted a variety trial in 2017-2018. This trial was initiated as part of the National Winter Canola Variety Trial.

MATERIALS AND METHODS

A trial was conducted during the 2017-2018 season at Borderview Research Farm in Alburgh, VT. The experimental design was a randomized block with four replicates and fifteen varieties as treatments (Table 1).

Table 1. Winter canola variety information, 2017-2018.

Variety	Source	Type*	Trait
Atora	DL Seeds	H	
DK Imiron CL	Monsanto/DEKALB	H	Semi-dwarf, Clearfield®
DK Imistar CL	Monsanto/DEKALB	H	Semi-dwarf, Clearfield®
DK Sensei	Monsanto/DEKALB	H	Semi-dwarf
Edimax CL	Rubisco Seeds	H	Clearfield®
Harmour	KWS-MOMONT	H	
Hidylle	KWS-MOMONT	H	
Inspiration	Rubisco Seeds	H	
KSUR1211	Kansas State University	OP	SU
Mercedes	Rubisco Seeds	H	
Phoenix CL	DL Seeds	H	Clearfield®
Plurax CL	DL Seeds	H	Clearfield®
Popular	Rubisco Seeds	H	
Quartz	KWS-MOMONT/Photosyntech	OP	
Riley	Kansas State University	OP	

*H = hybrid; OP = open pollinated.
Clearfield® = tolerant of Beyond® ammonium salt of imazamox herbicide.
SU = sulfonylurea herbicide carryover tolerant.

Plots were 5’ x 20’ and were seeded with a Great Plains grain drill (5’ wide) at a rate of 500,000 and 300,000 live seeds ac^{-1} for open pollinated and hybrid varieties, respectively on 24-Aug 2017 (Table 2). The soil was a Benson rocky silt loam and the previous crop was spring barley. Plots were assessed visually for emergence and vigor. Emergence was ranked on a scale 1-10 where 1 was poor emergence and 10 indicated all plants emerged. Vigor was ranked on a scale 1-5 where 1 indicated low vigor and 5 indicated very vigorous plants. Plots were fertilized with 60 lbs ac^{-1} N supplied through urea (46-0-0) on 14-May 2018.

Plots were covered with bird netting on 20-Jun 2018. Canola seed was harvested using an Almaco SPC50 plot combine on 16-Jul 2018. At harvest, moisture and test weight were determined using a DICKEY-john Mini-GAC plus moisture and test weight meter. Oil was extruded from the seeds with an AgOil M70 oil press on 29-Jan 2019, and the amount of oil captured was measured to determine oil content.

Table 2. Trial information and agronomic information 2017-2018.

Location	Borderview Research Farm - Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Spring barley
Plot size (ft.)	5 x 20
Seeding rate (live seeds ac^{-1})	500,000 for open pollinated varieties 300,000 for hybrid varieties
Replicates	4
Planting date	24-Aug 2017
Fertilizer application	60 lbs ac^{-1} N via urea (46-0-0) 14-May 2018
Harvest date	16-Jul 2018
Pressing date	29-Jan 2019
Tillage operations	Fall chisel plow, disk and spring-toothed harrow

All data was analyzed using a mixed model analysis where replicates were considered random effects and varieties were considered fixed effects. The LSD procedure was used to separate cultivar 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 were analyzed using a mixed model analysis where replicates were considered random effects. At the bottom of each table a LSD value is presented for each variable (e.g. yield). Least Significant Differences (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. Treatments listed in bold had the top performance in a particular column; treatments that did not perform significantly lower than the top-performer in a particular column are indicated with an asterisk. In the example above, 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 500. This means that these treatments did not differ significantly in yield. The difference between A and C is equal to 650, which is greater than the LSD value of 500 indicating that the yields of these treatments were significantly different.

Variety	Yield
A	**1600***
B	1200*
C	950
LSD (0.10)	500

RESULTS

Weather data was collected with an onsite Davis Instruments Vantage Pro2 weather station equipped with a WeatherLink data logger. Temperature, precipitation, and accumulation of Growing Degree Days (GDDs) are consolidated for the 2017-2018 growing season (Table 3). Historical weather data are from 1981-2010 at cooperative observation stations in Burlington, VT, approximately 45 miles from Alburgh, VT. In the

fall of 2017, conditions were warmer and drier than normal. Temperatures in late fall and early winter dropped below normal with periods of temperatures remaining below 0° F. Conditions fluctuated through the spring with some months being cooler and wetter and others being warmer and drier than normal. Warm, dry conditions persisted through much of the summer months. Overall, precipitation across the entire canola growing season was 8.67" below normal. Warm conditions provided a total of 5650 growing degree days across the whole season, which is 752 more than normal.

Table 3. Weather data and GDDs for winter canola in Alburgh, VT, 2017-2018.

	2017				2018						
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Average temperature (°F)	64.4	57.4	35.2	18.5	17.1	27.3	30.4	39.2	59.5	64.4	74.1
Departure from normal	3.76	9.16	-2.96	-7.41	-1.73	5.79	-0.66	-5.58	3.10	-1.38	3.51
Precipitation (inches)	1.84	3.29	2.28	0.78	0.79	1.16	1.51	4.43	1.94	3.74	2.43
Departure from normal	-1.80	-0.31	-0.84	-1.59	-1.26	-0.60	-0.70	1.61	-1.51	0.05	-1.72
Growing Degree Days (base 32°F)	971	786	202	56	53	93	90	272	853	973	1301
Departure from normal	113	284	17	56	53	93	90	-112	97	-42	103

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.

The favorable conditions in the fall allowed the canola to emerge and establish very well (Table 4). All varieties ranked high for emergence (1-10 scale) as the plots had formed adequate stands when assessed. Vigor (1-5 scale) was assessed visually at this time as well. The most vigorous variety was Mercedes which was statistically similar to six other varieties. The following spring, plots were assessed for winter survival which was determined through a visual assessment. The variety Quartz had the highest winter survival of 81.7%. This was statistically similar to three other varieties. The trial average for winter survival, despite good fall establishment, was 51.3%. Interestingly, the two varieties with the highest fall vigor, Mercedes and Phoenix CL, had the lowest winter survival of less than 30.0%. Conversely, Quartz, the variety with the highest winter survival, had the lowest fall vigor ranking. This inverse relationship suggests that winter canola that grows too vigorously in the fall may be more susceptible to winter damage resulting in low survival (Figure 1).

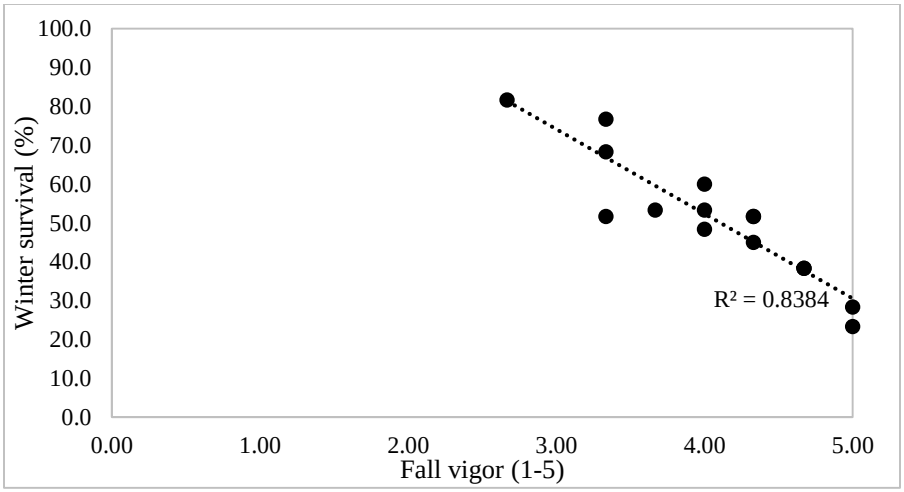

Figure 1. Fall vigor vs winter survival for 15 winter canola varieties, 2017-2018.

Table 4. Pre-harvest characteristics for 15 winter canola varieties.

Variety	Emergence	Vigor	Winter survival	Bloom date
	1-10	1-5	%	Days after 1-Jan, 2018
Atora	10	4.00	53.3	132*
DK Imiron CL	10	3.33	76.7*	130*
DK Imistar CL	10	3.33	68.3*	130*
DK Sensei	10	3.33	51.7	**130**
Edimax CL	10	4.67*	38.3	134
Harmour	10	3.67	53.3	130*
Hidylle	10	4.67*	38.3	130*
Inspiration	10	4.33*	45.0	131*
KSUR1211	10	4.00	60.0*	130*
Mercedes	10	**5.00**	28.3	135
Phoenix CL	10	5.00*	23.3	133
Plurax CL	10	4.00	48.3	131*
Popular	10	4.33*	51.7	132*
Quartz	10	2.67	**81.7**	130*
Riley	10	4.33*	51.7	130*
LSD (p= 0.10)	NS	0.765	21.8	2.44
Trial mean	10	4.04	51.3	131

*Values followed by an asterisk performed statistically similarly to the top performer in **bold.**
NS- Not significant.
Emergence rating- 1 indicates low emergence and 10 indicates high emergence.
Vigor rating- 1 indicates low vigor and 5 indicates very high vigor.

Canola varieties also differed significantly in harvest characteristics (Table 5). Seed moisture content at harvest varied drastically across varieties ranging from 19.3 to 56.9%. The variety DK Imiron CL had the lowest moisture content of 19.3% which was statistically similar to nine other varieties. The few varieties that had moistures above 35% likely required additional time prior to dry down to adequate moistures.

However, despite these differences, all varieties still required drying prior to storage. Varieties differed significantly in terms of seed yield. Yields ranged from 556 to 1905 lbs ac^{-1}. The top yielding variety was Quartz which performed similarly to four other varieties. In general, canola yields in this region range from 1000-2000 lbs ac^{-1}. The average yield over the trial was approximately 1200 lbs ac^{-1} which is similar to the yields in 2017, however, greater variation among varieties was observed in 2018. Varieties did not differ significantly in oil content which averaged 32.5%. Because the varieties differed in seed yields, oil yields were significantly higher in the same varieties. Varieties also differed in test weight. The variety producing seed with the highest test weight was Hidylle at 48.5 lbs bu^{-1} which was statistically similar to seven other varieties. None of the varieties trialed produced seed at or above the industry standard test weight of 50 lbs bu^{-1}. This was likely due to the dry conditions through the growing season, especially during seed fill.

DISCUSSION

These data indicate that winter canola, when it survives winters in the Northeast, can produce adequate yields but may have a lower potential compared to the common winter canola growing regions of the country. The top yielding variety this year, Quartz, has been one of the top yielding varieties in the Vermont variety trials for the last three years. Testing these varieties across a range of growing conditions will help identify varieties that consistently perform well in the Northeast. By participating in the National Winter Canola Variety Trial, we hope to provide data and encouragement for the development of hardier, high yielding winter canola varieties suitable for this region.

Table 5. Harvest characteristics for 15 winter canola varieties.

Variety	Harvest moisture	Seed yield at 8% moisture	Test weight	Oil content	Oil yield at 7.5% moisture	
	%	lbs ac^{-1}	lbs bu^{-1}	%	lbs ac^{-1}	gal ac^{-1}
Atora	32.3	1033	45.6	34.1	352	46.1
DK Imiron CL	**19.3**	1792*	48.3*	32.0	581*	76.2*
DK Imistar CL	19.7*	1634*	48.2*	31.4	524*	68.7*
DK Sensei	24.2*	929	45.2	31.1	290	38.0
Edimax CL	46.2	778	45.0	31.4	307	40.2
Harmour	22.6*	1140	47.5*	31.6	368	48.2
Hidylle	20.5*	1095	**48.5**	32.6	361	47.2
Inspiration	33.1*	1269	44.5	**35.2**	478*	62.6*
KSUR1211	22.5*	1580*	46.6*	32.6	510*	66.9*
Mercedes	56.9	577	46.5*	33.2	192	25.1
Phoenix CL	38.5	556	43.1	32.2	178	23.3
Plurax CL	29.5*	880	45.1	32.3	296	38.7
Popular	36.6	1111	45.8	32.4	371	48.5
Quartz	22.1*	**1905**	47.2*	33.6	**637**	**83.5**
Riley	23.7*	1581*	46.6*	32.6	524*	68.7*
LSD (p= 0.10)	14.4	548	2.32	NS	211	27.6
Trial mean	29.8	1191	46.2	32.5	398	52.1

*Values followed by an asterisk performed statistically similarly to the top performer in **bold.**
NS- Not significant.

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