NORTHWEST CROPS & SOILS PROGRAM

2021 Winter Canola Variety Trial

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THE UNIVERSITY OF VERMONT EXTENSION

2021 WINTER CANOLA VARIETY TRIAL

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Most 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 2020-2021, which was part of the National Winter Canola Variety Trial (http://www.agronomy.k-state.edu/services/crop-performance-tests/canola-and-cotton.html).

MATERIALS AND METHODS

A variety trial was conducted during 2020-2021 at Borderview Research Farm in Alburgh, VT. The experimental design was a randomized block with four replicates and fourteen varieties as treatments (Table 1).

Table 1. Winter canola variety information, 2020-2021.

Variety	Source	Type*
CP1022WC	CROPLAN by Winfield	OP
CP1055WC	CROPLAN by Winfield	H
CP1077WC	CROPLAN by Winfield	H
KS4662	Kansas State University	OP
KS4677	Kansas State University	OP
KS4719	Kansas State University	OP
KSUR1212	Kansas State University	OP
KWS Farry CL	KWS-MOMONT	H
MH 17HID007	KWS-MOMONT	H
Plurax CL	Rubisco Seeds	H
Riley	Kansas State University	OP
Surefire	Kansas State University	OP
Torrington	Ohlde Seed Farms	OP
Wichita	Kansas State University	OP

*H = hybrid; OP = open pollinated.

Plots were 5’ x 20’ and were seeded on 20-Aug 2020 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 (Table 2). Row spacing was 6 inches. The soil type was Benson rocky silt loam, over shaly limestone with 8-15% slopes and the previous crop was spring grains. Plots were assessed for fall stand and vigor on 29-Oct 2020. Fall stand was ranked using a visual scale of 1-10, where 1 was poor emergence and 10 indicated excellent

emergence. Vigor was ranked using a visual scale of 1-5, where 1 indicated low vigor and 5 indicated very vigorous plants. In the spring, 300 lbs. ac^{-1} of 19-19-19 was applied to all plots. Winter survival was visually assessed as a percentage on 29-Apr 2021. Bloom dates were recorded when at least 50% of the plot had bloomed and were reported as days after 1-Jan 2021. The trial was covered with bird netting in late-Jun and removed just before harvest.

Table 2. Trial information and agronomic information 2020-2021.

Location	**Borderview Research Farm - Alburgh, VT**
Soil type	Benson rocky silt loam, over shaly limestone, 8-15% slopes
Previous crop	Spring grains
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
Tillage operations	Fall chisel plow, disk and spring-toothed harrow
Planting date	20-Aug 2020
Fertilizer application	300 lbs. ac^{-1} 19-19-19 6-Apr 2021
Harvest date	19-Jul 2021
Pressing date	2-Feb 2022

On 19-Jul 2021, just prior to harvest, average plant height was determined by taking three measurements of plants in centimeters in each plot. There was minimal lodging this year, and percent lodging was not recorded. Canola seed was harvested using an Almaco SPC50 plot combine on 19-Jul 2021. At harvest, yields were recorded, and 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 2-Feb 2022, and the amount of oil captured was measured to determine oil content and oil yield.

Data were analyzed using a general linear model procedure of SAS (SAS Institute, 1999). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$. Variations in genetics, soil, weather, and other growing conditions can result in variations in yield and quality. Statistical analysis makes it possible to determine whether a difference between treatments is significant or whether it is due to natural variations in the plant or field. At the bottom of each table, a LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. This means that when the difference between two varieties within a column is equal to or greater to the LSD value for the column, there is a real difference between the varieties 90% of the time. Varieties that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk.

In the example to the right, variety C was significantly different from variety A, but not from variety B. The difference between C and B is 1.5, which is less than the LSD value of 2.0 and so these varieties were not significantly different in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that variety B was not significantly lower than the top yielding variety, indicated in bold.

Variety	Yield
A	6.0
B	7.5*
C	**9.0**
LSD	2.0

RESULTS

Weather data were 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 2020-2021 growing season (Table 3). Historical weather data are from 1991-2020 at cooperative observation stations in Burlington, VT, approximately 45 miles from Alburgh, VT. In 2020, temperatures were cooler than normal in August-October but above average in November and December. In August of 2020, precipitation was 3.23 inches above the 30-yr normal. The remainder of 2020 and much of the 2021 growing season experienced less precipitation than normal. In the weeks leading up to canola harvest, counties in northern Vermont were in moderate drought (D1) according to the U.S Drought Monitor. In 2021, it was more than 3 degrees colder than average in February, but temperatures increased in the spring months with above average temperatures in March, April, and June. It was 2.52 and 2.81 degrees above the 30-yr average in April and June respectively. July was unseasonably cool, with temperature 4.31 degrees below average. Overall, there was a total of 6791 Growing Degree Days (GDDs) from August 2020 to July 2021, 121 GDDs above the 30-yr average.

Table 3. Weather data and GDDs for winter canola in Alburgh, VT, 2020-2021.

	2020					2021						
Alburgh, VT	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Average temperature (°F)	68.8	59.2	48.3	42.0	29.4	21.5	19.8	33.2	48.1	58.4	70.3	68.1
Departure from normal	-1.89	-3.53	-2.01	2.69	1.20	0.64	-3.07	0.93	2.52	-0.03	2.81	-4.31
Precipitation (inches)	6.77	2.75	3.56	1.41	1.40	0.39	0.47	0.97	3.52	0.66	3.06	2.92
Departure from normal	3.23	-0.92	-0.27	-1.29	-1.10	-1.74	-1.30	-1.27	0.45	-3.10	-1.20	-1.14
Growing Degree Days (base 32°F)	1141	816	521	352	100	8	32	241	497	818	1146	1119
Departure from normal	-58	-107	-48	117	52	8	21	103	85	-1	83	-134

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.
Historical averages are for 30 years of NOAA data (1991-2020) from Burlington, VT.

All varieties were able to establish moderately well in the fall and had relatively high stand and vigor ratings (Table 4). In the fall, the variety KS4662 had the highest stand rating, 9.67, but was not statistically different from nine other varieties. The variety MH 17HID007 had the highest fall vigor rating, 4.67, but was statistically similar to all the other varieties except Surefire. Winter survival differed significantly by variety. The variety KSUR1212 had the highest winter survival, 90.0%, and was statistically similar to six other varieties. The trial average was only 58.5%, and the variety CP1077WC had only 3.33% winter

survival. The average bloom date was 15-May (135 days after 1-Jan 2021). The variety MH 17HID007 was the last to bloom on 19-May but was not significantly different from six other varieties.

Table 4. Pre-harvest characteristics for 14 winter canola varieties, Alburgh, VT, 2020-2021.

Variety	Fall stand	Fall vigor	Winter survival	Bloom date
	1-10 rating§	1-5 rating¥	%	Days after 1-Jan, 2021
CP1022WC	7.00	3.67*†	56.7	137*
CP1055WC	7.67	4.00*	33.7	137*
CP1077WC	9.00*	4.67*	3.33	137*
KS4662	**9.67**	4.67*	75.0*	132
KS4677	8.00*	4.33*	81.7*	134
KS4719	6.33	3.67*	88.3*	136*
KSUR1212	8.33*	3.67*	**90.0**	132
KWS Farry CL	7.00	3.67*	71.7*	135
MH 17HID007	8.67*	**4.67**	16.0	**139**
Plurax CL	8.67*	4.33*	51.7	137*
Riley	8.00*	3.67*	60.0*	132
Surefire	9.00*	3.33	58.3	132
Torrington	9.00*	4.33*	49.7	136*
Wichita	8.33*	4.33*	83.7*	132
LSD (p= 0.10)‡	1.70	1.23	30.9	3.97
Trial mean	8.19	4.07	58.5	135

†Values followed by an asterisk (*) performed statistically similarly to the top performer in **bold.**
‡LSD- Least significant difference (p=0.10)
§Stand emergence rating- 1 indicates low emergence and 10 indicates high emergence.
¥Vigor rating- 1 indicates low vigor and 5 indicates very high vigor.

The canola varieties had significant differences in harvest characteristics (Table 5). The variety KS4719 had the greatest height, 165 cm, and was statistically similar to six other varieties. The trial average was 147 cm. Average moisture at harvest was 16.1% and all varieties had to be dried down prior to storage. CP1077WC had the greatest harvest moisture, 20.6%, which was similar to only two varieties. Canola yields this season were quite high, and the trial average was 2763 lbs. ac^{-1} at 8% seed moisture. KWS Farry CL was the highest yielding variety but was not statistically different from nine other varieties. Only one variety, CP1022WC, had a test weight that met the industry standard of 50lbs. bu^{-1}, and that was not statistically different from four other varieties. Overall test weights were low, and the average, 47.2 lbs. bu^{-1}, was below the industry standard. There was little difference in oil content between varieties, and the top performer, CP1022WC, had 31.3% oil. The variety with the lowest oil content, CP1055WC, had statistically lower percent oil. 18.9%, compared to all other varieties. Average oil yield at 7.5% seed moisture was 770 lbs. ac^{-1} or 101 gal ac^{-1}. KWS Farry CL had the highest oil yield, 1079 lbs. or 141 gal ac^{-1} at 7.5% seed moisture, and was statistically similar to seven other varieties.

Table 5. Harvest characteristics for 14 winter canola varieties, Alburgh, VT, 2021.

Variety	Plant height	Harvest moisture	Seed yield at 8% moisture	Test weight	Oil content	Oil yield at 7.5% moisture	
	cm	%	lbs ac^{-1}	lbs bu^{-1}	%	lbs ac^{-1}	gal ac^{-1}
CP1022WC	151*†	14.5	2673	**50.0**	**31.3**	838*	110*
CP1055WC	142	20.2*	1621	46.0	18.9	336	44
CP1077WC	130	**20.6**	1373	45.6	24.3*	350	46
KS4662	151*	14.2	3230*	45.8	27.3*	873*	114*
KS4677	159*	14.3	3092*	48.6*	29.2*	893*	117*
KS4719	**165**	15.8	3265*	44.8	22.4	726	95
KSUR1212	156*	14.3	2989*	48.0*	30.8*	917*	120*
KWS Farry CL	135	16.3	**3526**	48.0*	30.8*	**1079**	**141**
MH 17HID007	125	16.8	1452	46.7	27.2*	407	53
Plurax CL	143	18.0*	3158*	48.9*	26.9*	851	111
Riley	150*	15.1	3407*	46.7	29.6*	1005*	132*
Surefire	153*	14.6	3018*	47.2	29.5*	888*	116*
Torrington	132	16.1	2750*	46.6	29.4*	800	105
Wichita	162*	14.5	3125*	47.8	26.6*	823*	108*
LSD (p= 0.10)‡	17.3	2.69	788	2.06	26.6	823	108
Trial mean	147	16.1	2763	47.2	27.4	770	101

†Values followed by an asterisk (*) performed statistically similarly to the top performer in **bold.**
‡LSD-Least Significant Difference (p=0.10).

DISCUSSION

The winter of 2020-2021 was relatively warm and dry, and the lack of precipitation carried through the 2021 growing season. Overall, temperatures this season were warmer than last year, especially in April through June. There was a total of 6791 accumulated GDDs from planting to harvest, which is slightly above normal. The mild winter and warm growing season led to increased winter survival and an earlier bloom date compared to the 2020 variety trial. Winter survival was 12% higher and the average bloom date was 10 days earlier in 2021. The average seed yield in 2021 was over 2X greater than in 2020. Oil content was comparable but because of the increased seed yields, oil yields were also much higher in 2021. 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. Further research is needed, as this only represents one year of data at one location. The performance of winter canola will be interesting to monitor in future years if we continue to observe deviations in weather patterns and GDDs as the regional climate fluctuates.

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