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Winter Canola Survival

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CULTIVATING HEALTHY COMMUNITIES

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The UNIVERSITY of VERMONT EXTENSION

2012-2013 WINTER CANOLA SURVIVAL

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Winter canola (*Brassica napus*) is a relatively new crop in Vermont. This crop has the potential to be added into a rotation to both promote soil health and yield a crop for oil production. Generally planted in late August or early September, winter canola should produce ample vegetation and root growth prior to plant dormancy (Figure 1). Growers can often fit a canola crop in after harvesting winter grains or other early crops. Regrowth in the spring depends on the harshness of winter conditions, but generally the plants are "greening up" in April, and will enter the rosette stage and begin to leaf out soon afterwards.

Figure 1. Winter canola dies back under winter conditions and, with the help of some snow cover, generally grows back in spring.

Winter canola survival is a major limitation to the success of the crop in this region. Since our research began in 2009, we have had winter canola survive 3 out of 5 years. Vermont seed yields have been as high as two tons per acre in good years, but have also been poor, due to lack of winter survival. The 2012/2013 winter was extremely difficult for winter canola in Northwestern Vermont, with only about 7% of all plants surviving the cold winter in UVM Extension's research plots at Borderview Research Farm in Alburgh.

Winter temperatures in Alburgh were lower than normal, and there was also less snow cover than in years past (Table 1). November 2012 was 1.5°F colder than the thirty-year average, with 2.4 fewer inches of precipitation. There was less snowfall than average in all months but December 2012. Over the course of the winter canola growing season, there were 5924 GDDs accumulated, which is only 16 more than usual; however, the timing of these growing degree days was a bit unusual, with very few in November compared to the 30-year average, and more in January and February than normal.

In addition to the cold and lack of snow cover in the 2012-2013 winter, freeze-thaw cycles could also have contributed to winterkill. While winter canola does not flower without vernalization, or exposure to cold, the plants fare better when exposed to freezing temperatures for a sustained period of time. Studies have shown that winter canola does better in winter when conditions allow for acclimating to cold weather (Rife and Zeinali, 2002). In winter cereal crops, rapid thawing after a deep freeze has been found to significantly increase the chance of plant death (Gusta and Fowler, 1977). This is likely the case in winter canola as well, and the swings in temperature during the winter of 2012-2013 made overwintering difficult for canola plants (Figure 2). Strong winds, a common occurrence in Alburgh, can also contribute the desiccation and stress on overwintering plants.

Figure 2. Winter canola in late September 2012 (left) and May 2013 (right).

Table 1. Consolidated weather data from Alburgh, VT during the winter canola growing season, 2012-2013.

	2012					2013			
Alburgh, VT	Aug	Sep	Oct	Nov*	Dec	Jan	Feb	Mar	Apr
Average temperature (°F)	71.1	60.8	52.4	36.7	28.7	20.6	21.9	32.1	43.6
Departure from normal	2.3	0.2	4.2	-1.5	2.8	1.8	0.4	1.0	-1.2
Precipitation (inches)	2.9	5.4	4.1	0.7	3.5	0.6	1.1	1.0	2.1
Departure from normal	-1.0	1.7	0.5	-2.4	1.1	-1.5	-0.7	-1.2	-0.7
Growing Degree Days (base 32°F)	1241	896	652	144	535	433	281	623	1119
Departure from normal	102	38	150	-770	1	433	281	-124	-127

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger. Historical averages (normal) are for 30 years of NOAA data (1981-2010) from Burlington, VT.
* November 2012 data are based on National Weather Service data from cooperative observation stations in South Hero, VT.

Varietal Differences

While all winter canola varieties require vernalization, this requirement is not always correlated with winter hardiness or cold tolerance (Rapacz and Markowski, 1999). For the past few years, UVM Extension has been conducting variety trials to evaluate the winter hardiness of selected varieties. Because the crop is underutilized here in the Northeast, much of the data on winter canola survival and yields is not applicable to our location. Evaluating which varieties might successfully produce reliable crops will help growers make varietal selections. The results of UVM Extension's yearly variety trials are available at www.uvm.edu/extension/cropsoil/oilseeds.

In the 2012-2013 trial, there was a significant varietal difference in the successful establishment of fall stands (Table 2). The varieties 'Claremore,' 'Chrome,' and 'Wichita' had the highest populations (299, 226, and 209 plants per square meter) when assessed on 24-Sep 2012. 'Rumba' had only 93 plants per square meter at that time. The average plant height on 25-Sep 2012 was 27.8 cm (10.9 in), and there was no significant difference in height by variety. Spring population varied significantly, but was, on average, only 1.6 plants per square meter. The average survival rate was 1.39%, and though 'Riley' and 'Hornet' overwintered best, they did not perform statistically better than other varieties (Figure 3).

Table 2. Fall stand establishment and winter survival of fifteen winter canola varieties, 2012-2013.

Variety	Fall population plants m^{-2}	Fall plant height cm	Spring population plants m^{-2}	Winter survival %
Baldur	133	30.8	0.75	0.57
Chrome	**226***	27.3	0.36	0.17
Claremore	**299***	**34.1**	0.39	0.16
Dimension	120	25.9	1.36	1.35
Dynastie	159	17.6	**4.66***	3.13
Edimax	140	27.1	0.18	0.15
Flash	206	32.9	0.43	0.17
Hornet	96	24.9	3.09	**4.36**
Riley	179	25.0	**7.75***	**7.19**
Rumba	93	29.8	0.25	0.36
Safran	166	25.3	1.72	1.38
Sitro	103	29.1	0.25	0.34
Virginia	203	28.6	0.11	0.06
Visby	149	26.3	0.68	0.58
Wichita	**209***	31.9	2.08	0.82
LSD (0.10)	78	NS	3.31	NS
Trial mean	165	27.8	1.60	1.39

Treatments indicated in **bold** had the top observed performance.
* Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.
LSD (Least Significant Difference) was used to separate means of a particular treatment when the F-test in a mixed model analysis was significant ($p<0.10$).
NS – No significant difference was determined between treatments.

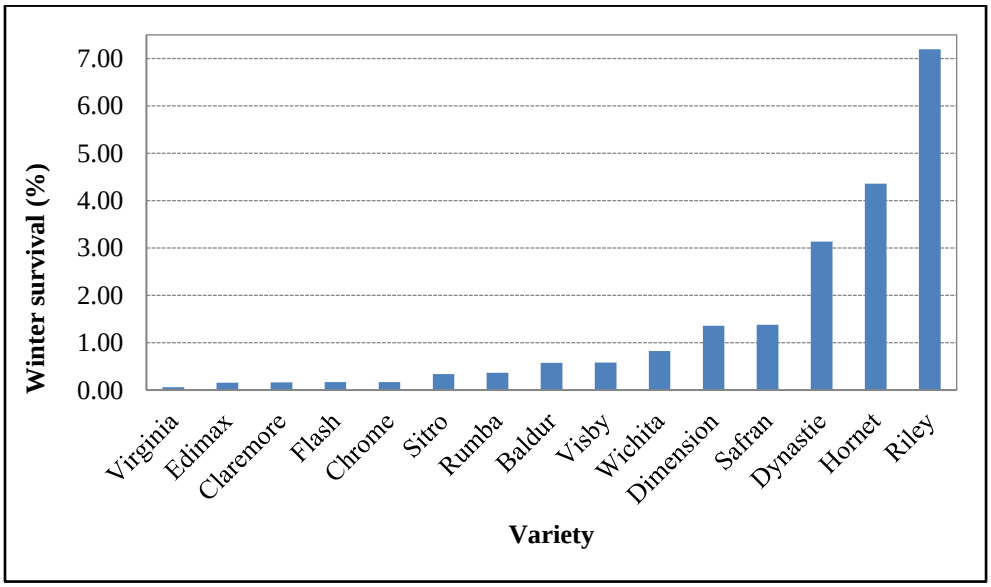

Figure 3. Winter canola overwintering success by variety. There was no significant difference in the winter survival of the fifteen trialed varieties (p=0.10).

PLANTING DATE

In addition to variety evaluations, planting date trials have been conducted in an effort to maximize winter survival rates and yields. A general rule of thumb suggests planting winter canola six weeks before the first killing frost (typically mid-October in Alburgh, VT), in order to establish strong growth before winter. In 2011-2012 planting date studies, winter canola that had been planted before 1-Sep 2011 was harvestable; all other plots in the planting date trial did not overwinter well enough to yield a seed crop. However, in 2012-2013, despite four planting dates ranging from August 15 to September 6, the winter canola planted at Borderview was declared a crop failure, and consequently plowed under in late May.

Figure 4. Winter canola in late September 2012. Planted on four different dates (from left to right: 15-Aug, 23-Aug, 29-Aug, 6-Sep).

Though earlier-planted winter canola was more well-established going into the winter, with greater density and plant height (Figure 4), its success in overwintering was not as great as canola planted in late August (Figure 5). Across planting date trials (with varying seeding rate and variety treatments), data indicate a statistically significant difference in the winter survival of canola according to planting date.

Data were combined to show the effects of altering planting dates on the winter survival of winter canola. The greatest rate of survival (15.7%) was in canola planted on 29-Aug 2012. Strong fall establishment, including increased plant height and overall vigor, is not necessarily correlated with successful overwintering. In other winter crops such as cereal grains, too much growth prior to fall dormancy can be of detriment to the overwintering crop. Often too much top growth can cause smothering of the crown and also result in growth of disease such as snow mold.

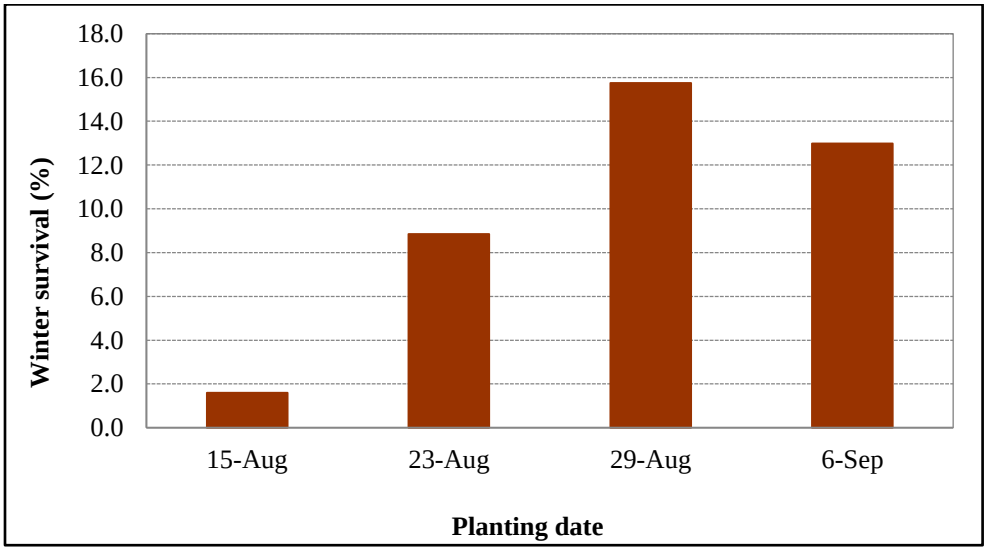

Figure 5. Effects of planting date on winter survival of 2012-2013 winter canola, across seeding rate and varietal treatments. These data combine results from two separate trials, but in each, there were statistically significant differences in winter survival by planting date (p=0.10).

SEEDING RATE

Winter canola was sown at three different rates in a 2012 trial, across varying planting dates. Varying planting dates had no impact on the trends observed between seeding rates. Not surprisingly, the greatest fall populations (188 plants per square meter) were seeded at the highest rate (12 lbs viable seed per acre). This was significantly higher than other seeding rate treatments. There was no significant difference in plant height on 25-Sept 2012, nor was there a significant difference in spring population, though the average population was only 8.24 plants per square meter on 7-May 2013.

Though there was no statistically significant difference between treatments, there was a trend towards stronger winter survival in canola planted at lower seeding rates (Table 3, Figure 6). The greatest winter survival rate (17.8%) was in winter canola planted at 4 lbs of viable seed per acre. The lowest survival rate (7.1%) was in winter canola planted at 12 lbs of viable seed per acre. More research will be done to evaluate the impacts of seeding rate on winter canola stand establishment, survival, and seed and oil yield.

Table 3. Fall stand establishment and winter survival of fifteen winter canola varieties, 2012-2013.

Seeding rate	Fall population	Fall plant height	Spring population	Winter survival
lbs ac^{-1}	plants m^{-2}	cm	plants m^{-2}	%
4	62	21.9	7.99	**17.8**
8	89	21.3	**9.16**	15.3
12	**188***	**23.6**	7.57	7.1
LSD (0.10)	49	NS	NS	NS
Trial mean	113	22.3	8.24	13.4

Treatments indicated in **bold** had the top observed performance.
* Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.
LSD (Least Significant Difference) was used to separate means of a particular treatment when the F-test in a mixed model analysis was significant ($p<0.10$).
NS – No significant difference was determined between treatments.

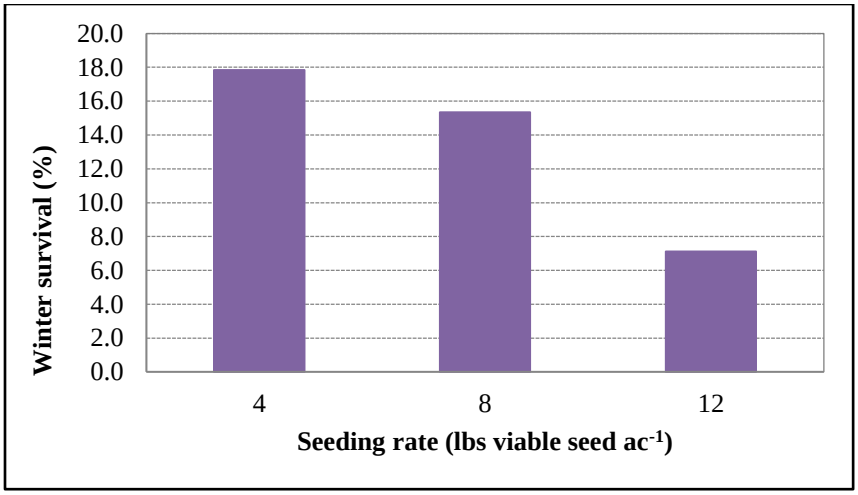

Figure 6. Effects of seeding rate on winter survival of 2012-2013 winter canola, across planting dates. There was no significant difference in winter survival between the three seeding rate treatments (p=0.10).

SOIL PREPARATION

In 2012, UVM Extension initiated a trial to determine what soil preparation practices are most effective for establishing winter canola. The treatments included using a cultipacker (roller) before, and after, planting canola, as opposed to the standard practice of simply drilling canola into the prepared ground. Packing the seedbed adds seed-to-soil contact and theoretically increases germination and survival rates, especially in the production of small-seeded canola, which demands a firm, even seedbed.

Despite recommendations to prepare extremely firm soils, in the 2012-2013 trial, there were no significant differences in the fall population or percentage of plant cover by soil preparation technique (Table 4). Likewise, the spring populations, measured on 7-May 2013, showed no significant difference by preparation treatment. Though there was a slight trend towards higher survival in plots that were planted and then packed with a cultipacker, the difference was not statistically different. The average survival rate in this trial (7.2%) was dismal, and all plots were plowed under in mid-May.

Table 4. Fall stand establishment and winter survival of fifteen winter canola varieties, 2012-2013.

Treatment	Fall population	Fall plant cover	Spring population	Winter survival
	plants m^{-2}	%	plants m^{-2}	%
Drilled	**77.1**	79.9	3.95	5.3
Packed, then planted	65.7	**84.1**	4.43	6.1
Planted, then packed	62.8	64.2	**5.94**	**10.1**
LSD (0.10)	NS	NS	NS	NS
Trial mean	68.6	76.0	4.77	7.2

Treatments indicated in **bold** had the top observed performance.
LSD (Least Significant Difference) was used to separate means of a particular treatment when the F-test in a mixed model analysis was significant ($p<0.10$).
NS – No significant difference was determined between treatments.

DISCUSSION

While the conditions of 2012-2013 in northwestern Vermont were not conducive to the successful overwintering of winter canola, some informative data was still collected in the agronomic trails. There were significant varietal differences in fall and spring populations, though variety did not have an impact on the overall poor winter survival. During this cold winter with minimal snow cover, winter canola planted early did not fare well, though it was taller and more vigorous going into the freezing weather. Seeding rate did not significantly impact the spring population or overall winter survival of winter canola, nor did alterations in seedbed preparation methods.

It is important to note the regional differences in the production of a successful crop. Winter canola did successfully overwinter in the region. A few hours south and a few hours east of the research farm in Alburgh, VT, there were growers with successful stands of winter canola in 2012-2013. Winter canola will continue to be researched in the Northeast, with a focus on strategies to achieve successful overwintering.

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