FIELD EMERGENCE AND YIELD OF CERTIFIED SEED LOTS OF CVS. WESTAR AND TOBIN CANOLA ON THE CANADIAN PRAIRIE

S. J. Barber(1), G. Rakow(2), R. K. Downey(2).

(1) Plant Products Division, K. W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario, CANADA K1A 0C6.
(2) Agriculture Canada, Research Station, 107 Science Crescent, Saskatoon, Saskatchewan, CANADA S7N 0X2.

INTRODUCTION

There have been reports from farmers and agricultural research and extension personnel (R. K. Downey, P. Thomas, personal communication) that different Certified No. 1 seed lots of the same canola variety appear to perform dissimilarly, some lots producing plants showing greater vigor than others lots.

This study investigated the performance of different seed lots of Canada Certified No. 1 Brassica napus var. Westar, and B. campestris var. Tobin, across western Canada. It was conducted over the three years 1988, 1989 and 1990. Results indicate that different seed lots of the same variety give different stand establishment and different seed yields.

MATERIALS AND METHODS

The Seed Lots:

Canola seed lots of the varieties Westar (B. napus), and Tobin (B. campestris), were obtained from seed growers in Alberta and Saskatchewan. Seed lots were pedigree seed of Certified No. 1 status, guaranteeing varietal purity and a germination level of 90% or greater when first tested.

The 1988 trials were of seed lots produced in 1987 except for Westar 4 and Tobin 5 which were both produced in 1986. Tobin 6 had been previously treated with a fungicide. Percent germination and 1000 seed weights are shown in Table 1.

The 1989 trials were of seed lots produced in 1988 apart from the best performing Westar 9 and Tobin 1 seed lots from the 1988 tests which were produced in 1987, and the 1988 test's Tobin 5 which was produced in 1986. Westar seed lot 5 was previously treated with a fungicide. Percent germination and 1000 seed weights are shown in Table 2.

The 1990 trials were of seed lots from the previous year's trial as well as Westar 12 and Tobin 12 which were produced in 1989, Westar 11 produced in 1988, Tobin 11 produced in 1986, and a series of "swathed" Westar and Tobin seed lots which were produced in Saskatoon in 1989.

This "swathed" series, Westar seed lots 1-6 and Tobin seed lots 1-6, were grown from one certified No. 1 seed lot of Westar and another of Tobin under identical conditions. They were swathed for harvesting at different stages of maturity. Although not produced under pedigree seed isolation conditions, they were cleaned and sized prior to field testing . Germinations of all seed lots in the series apart from the earliest swathed Westar lot (#1) achieved levels above 90%. To reduce the effect of trial plot variation, seed lots were produced in a randomized complete block design with swath dates as the treatment in the

four replicate blocks. Once swathed, the plants remained in the swath until harvested. The final harvested treatment was direct combined. After combining seed from the treatments were allowed to air dry in the laboratory and were then cleaned and bulked.

Percent germination and 1000 seed weights are shown in Table 3. The moisture contents of the "swathed" series at time of swathing are as follows: Westar 1, 2, 3, 4 and 5 were 72.9, 54.3, 44.1, 37.1 and 15.6 percent respectively; Tobin 1,2,3,4, and 5 were 48.5, 41.1, 32.4, 21.5 and 11.7 percent respectively.

Germination:

Germination values of seed lots were determined by placing 100 seeds onto Whatman #1 filter paper moistened with 5 ml of distilled deionozed water. The filter papers were in lidded petri dishes in a growth room at 18 °C. Four replicates of each seed lot were tested. Seeds were considered germinated if the radicle emerged through the testa. Germination counts were taken until no further seeds were observed to germinate.

The Trial Locations:

The 1988 trials were conducted at Melfort, Saskatoon and Scott, Saskatchewan, and Beaverlodge, Lethbridge, Lloydminster and Olds, Alberta.

The 1989 trials were conducted at Melfort, Saskatoon and Scott, Saskatchewan, and Beaverlodge, Ellerslie and Lethbridge, Alberta. Progeny from the 1988 Scott trials were grown in Saskatoon.

The 1990 trials were conducted at Lashburn, Melfort, Saskatoon and Scott, Saskatchewan, and Beaverlodge, Ellerslie and Lethbridge, Alberta.

Seeding:

Trial sites were cultivated immediately prior to seeding. Trials were conducted as Randomized Complete Block designs with 6 replicates (Lethbridge 1990 had 5 replicates and Lashburn 1990 had 4 replicates). Plots were 1m by 6m in depth. Four rows of 200 seeds were planted per plot in those tests seeded with a single row seeder, 800 seeds per plot were sown in those tests where a four row splitter seeder was used.

Observations:

Stand establishment was determined in most trial. The centre two rows of each plot were counted approximately 14 to 21 days following seeding. Data was subjected to analyses of variance. Emergence rates were determined by counting selected trials daily.

Plants were either swathed or direct combined at maturity. After combining, seed was dried cleaned and weighed. Yield data were subjected to analyses of variance.

RESULTS

1988 Trials:

Stand Establishment: Tests were severely affected by drought across all locations. This is shown by the low percentage stand establishment over 5 locations (see Table 1). However, there were significant differences among both Westar and Tobin seed lots stand establishment.

Tobin seed lots 1, 10 and 11 gave above average stand establishment across locations, while seed lots 4, 7 and 9 were below average performers.

Westar seed lots 9, 11 and 5 were above average in stand establishment across locations and in rate of emergence at the Scott site. Westar 4 was consistently poor, and seed lots 8 and 12 were consistently below average in stand establishment.

Seed Yield: At four locations the Westar seed lots showed significantly different seed yields. Westar 4 gave the lowest yield, and 6 and 1 were below average across the four locations. Westar 9 gave the highest yield. Westar 9 yielded 8.8% above the mean (Westar 4, an obviously abnormal seed lot was excluded from calculation of the mean), and 14.1% more than Westar 6.

There were no significant differences in yield of Tobin seed lots at any location.

Comparing Westar stand establishment with seed yield indicates that a seed lot's final plant stand may not correlate with its seed yield potential (see Table 4).

Westar 4 gave the poorest stand establishment and seed yield. Westar 9 stand establishment was 110.7% of the mean, and seed yield was 108.8% of the mean. However, Westar 6 showed stand establishment at 105.5% of the mean but yield at 95.3% of the mean, and Westar 1, 105.3% and 95.6%, Westar 8, 84.3% and 98.8%, and Westar 12, 79.4% and 98.5% of the mean plant stand establishment and mean seed yield respectively.

1989 Trials:

Stand establishment and yield results are shown in Table 2. Analyses of variance of stand establishment and seed yield over locations for both Westar and Tobin showed significant differences at the 0.05 level. There was no significant location effect apart from Tobin seed yield in which the Ellerslie data was significantly different, this data is omitted from the yield means in Table 2. Rates of emergence of both Tobin and Westar determined in Saskatoon showed that earlier emergers resulted in higher stand establishment.

There were no significant differences in yield or in stand establishment of the progeny of Westar and Tobin from the 1988 Scott trials.

Westar: Westar 2 showed the poorest stand establishment and seed yield. This seed with a low germination level (66%) was below standard.

Comparing the performance between stand establishment and seed yield of the other seed lots shows a poor correlation between these performance parameters (see Tables 2 and 4). Westar 1 which gave a stand establishment of 96.1% of the mean (Westar 2 was omitted from the calculation of the mean stand establishment and mean yield) gave a yield of 104.5% of the mean. Westar 10 gave and stand establishment of 99.2% of the mean but a yield of 95.4% of the mean. The highest yield was from Westar 4 which gave a yield of 105.7% of the mean, and 110.8% of Westar 10, the lowest yielding seed lot (Westar 2 excluded). Of interest is Westar 9 from the 1988 trials which gave a stand establishment of 97.1% of the mean and the second highest seed yield at 104.5% of the mean.

Tobin: Tobin 10 with a germination level of 100%, but the lowest 1000 seed weight (see Table 2), gave the lowest stand establishment and yield; 79.2% and 88.5% of the means respectively.

The highest yielding Tobin, seed lot 3, gave a stand establishment of 94.0% of the mean but a seed yield of 107.9% of the mean. Tobin 3 (germination level 96%) gave a yield of 122% of that of Tobin 10 (germination level 100%). This indicates that yield can not be predicted by stand establishment.

1990 Trials:

Stand establishment and yield results are shown in Table 3.Analyses of variance of stand establishment and seed yield over locations for both Westar and Tobin showed significant differences at the 0.05 level. There was a significant difference in the ranking of yield of Westar seed lots across locations.

Westar: 1989 Westar 4 the best seed yield performer gave 105.1% of the mean of all seed lots (Westar 1 omitted from the calculations of stand establishment and seed yield). The best stand establishment was shown by Westar 12 at 114% of the mean, however, it was only an average performer in terms of seed yield with 99.4% of the mean. Westar 11 was a poor performer in terms of both stand establishment and seed yield, and yielded only 91.6% of 1989 Westar 4, which gave the highest seed yield.

1988 Westar 9 in its third year of testing performed above the average in terms of both stand establishment and seed yield, with 108.5% and 102.5% of the mean stand establishment and yield respectively.

Results from the swathed series (Westar 1-6) indicate that earlier swathing may result in lower stand establishment and seed yield. The best performer of the swathed series of seed lots was the direct combined Westar 6. Westar 1 was the poorest performer, Westar 2 was better followed by Westar 3 and then Westars 4 and 5 which were similar.

Tobin: Tobin seed lots 2, 4 and 5 were not field tested as there was an indication when laboratory tested that the seed lots carried virulent blackleg (Leptosphaeria maculans). The unswathed Tobin 6 from the swathed series was above average in terms of both stand establishment (106.8% of the mean) and seed yield (106% of the mean) and performed better than the earlier swathed Tobins 1 sand 3.

Tobin 8 was the poorest seed lot in terms of both stand establishment and seed yield with 92% and 93.2% of the respective means.

Tobin 11 was used as the 1990 Cooperative check. It yielded the average of all seed lots, but was 6% lower in yield than the best Tobin seed lot, Tobin 6.

DISCUSSION

Stand Establishment:

In three cases where germination levels were below 90%, Westar 4 in 1988, Westar 2 in 1989 and Westar 1 in 1990, stand establishment was well below the mean of the seed lots tested.

Regression analyses of stand establishment against percent germination shows germination as a reasonable predictor of stand establishment for Westar seed lots, but not for Tobin.

Seed Yield:

Both Westar and Tobin showed different seed yields among seed lots of No.1 Canada Certified seed. These differences were as high as 22% for Tobin (1989) and 14% for Westar (1988).

General Comments:

Financial return: The financial reward to a farmer in western Canada from a canola crop of Westar or Tobin could be significantly influenced by the choice of certified seed lot.

Cooperative testing: The choice of seed lot for use as a check reference in performance trials could have a significant effect on the merit scores of candidate varieties. Differences in seed yield between the best and worst seed lot of both Westar and Tobin used in these tests were greater than differences observed among many candidates in variety tests. Similarly, the quality of seed used of the candidate varieties may mask their true genetic potential.

Age of a seed lot: The 1988 Westar 9 seed lot used in 1988, 89 and 90 was an above average performer in all three years, outyielding younger seed lots in 1989 and 1990. Thus a seed lot may be able to retain its high yield potential over several years. Storage conditions, in particular low seed moisture levels which are easily obtained in Saskatoon, are critical to long term viability and seed vigor of a seed lot.

Seed yield prediction of a seed lot: Although percentage germination of a Westar seed lot gave an indication of the stand establishment potential, germination of a Tobin seed lot did not correlate with its stand establishment.

Neither germination nor stand establishment was a good predictor of seed yield of the Westar or Tobin seed lots tested.

TABLES

Table 1: % Germination, 1000 Seed Weights, Percent Stand Establishment and Seed Yield of Westar and Tobin Seed Lots Used in 1988 Trials.

Seed lot	% germination	1000 seed weight	% stand est.	seed yield (gm)	Seed lot	% germination	1000 seed weight	% stand est.	seed yield (gm)
Westar 9	99	4.30	31.1	2014	Tobin 10	95	2.47	29.4	—
Westar 2	95	4.31	27.9	1958	Tobin 1	99	2.25	26.3	—
Westar 5	98	3.77	30.3	1891	Tobin 11	93	2.33	26.0	—
Westar 10	95	4.14	28.5	1873	Tobin 6*	na	2.32	25.7	—
Westar 11	98	4.21	30.4	1829	Tobin 5	97	2.52	25.1	—
Westar 8	92	3.79	23.7	1829	Tobin 3	98	2.47	24.3	—
Westar 12	93	4.39	22.3	1824	Tobin 8	96	2.76	23.3	—
Westar 7	99	4.03	29.4	1805	Tobin 12	98	2.90	22.3	—
Westar 3	93	3.29	26.4	1804	Tobin 9	96	2.83	22.2	—
Westar 1	98	3.62	29.6	1770	Tobin 2	99	2.63	21.9	—
Westar 6	98	3.38	29.7	1765	Tobin 7	98	2.31	21.9	—
Westar 4	84	3.67	17.8	1579	Tobin 4	98	2.20	20.4	—

* Treated seed, germination not tested.

Table 2. 1000 Seed Weights, % Germination, Percent Stand Establishment and Seed Yield of Westar and Tobin Seed Lots Used in 1989 Trials.

Seed lot	% germination	1000 sd.wt.	% stand est.	seed yield (gm)	Seed lot	% germination	1000 sd.wt.	% stand est.	seed yield (gm)
Westar 4	100	3.98	49.5	1111	Tobin 3	96	2.71	30.0	1044
88/Westar 9	99	4.32	47.0	1099	88/Tobin 5	98	2.52	32.0	1013
Westar 1	92	4.33	46.5	1099	Tobin 8	99	2.81	36.0	1007
Westar 5	na	na	52.0	1071	Tobin 12	99	2.62	33.5	990
Westar 9	98	3.82	50.0	1065	Tobin 11	98	2.61	35.0	974
Westar 11	99	4.01	49.0	1039	Tobin 1	97	2.65	33.0	973
Westar 7	100	4.01	50.0	1035	Tobin 9	97	2.79	34.0	971
Westar 3	99	3.62	47.5	1031	Tobin 7	98	2.39	32.0	963
Westar 8	99	3.71	45.0	1007	Tobin 2	96	2.60	31.0	948
Westar 12	99	4.29	48.0	1004	88/Tobin 1	100	2.28	32.5	946
Westar 10	99	3.97	48.0	1003	Tobin 4	95	2.49	31.0	923
Westar 2	66	4.10	23.0	960	Tobin 10	100	2.05	26.0	856

Table 3. 1000 Seed Weights, % Germination, Percent Stand Establishment and Seed Yield of Westar and Tobin Seed Lots Used in 1990 Trials.

Seed lot	% germination	1000 sd.wt.	% stand est.	seed yield (gm)	Seed lot	% germination	1000 sd.wt	% stand . est.	seed yield (gm)
89/Westar 4	99	3.98	45.0	1223	Tobin 6	100	2.38	39.0	985
Westar 6	99	3.98	46.1	1193	89/Tobin 3	95	2.71	36.8	980
88/Westar 9	98	4.30	45.3	1193	89/Tobin 8	97	2.81	38.6	972
89/Westar 3	99	3.62	44.1	1137	88/Tobin 1	97	2.25	39.3	950
89/Westar 1	92	4.33	38.3	1171	Tobin 1	99	2.16	34.6	935
Westar 4	95	4.01	42.7	1162	Tobin 12	93	2.30	38.5	932
Westar 5	95	4.05	42.3	1160	Tobin 11	94	2.25	35.5	950
Westar 12	98	4.25	47.6	1156	Tobin 3	99	2.39	34.9	911
Westar 3	96	3.95	40.0	1137	89/Tobin 10	98	2.05	33.6	866
Westar 11	92	4.15	31.2	1121					
Westar 2	97	3.45	36.8	1096					
Westar 1	89	2.55	19.7	790					

Table 4. Probability (p) of Significant Correlation, and Correlation Coefficients (r), for Emergence and Seed Yield Correlated with Germination Levels of Westar and Tobin Seed Lots, 1988 - 1990.

	emergence: germination		seed yield: germination			emergence: germination		seed yield: germination	
year	p*	r	p*	r	year	p	r	p	r
Westar*					Tobin				
1988	.0001	0.889	.7379	n.s.	1988	.1369	n.s.	—	—
1989	.0001	0.967	.1660	n.s.	1989	.9463	n.s.	.6903	n.s.
1990	.0051	0.775	.2957	n.s.	1990	.6347	n.s.	.7702	n.s.

*Westar 4 omitted from 1988 data, Westar 2 omitted from 1989 data, Westar 1 omitted from 1990 data.