

CO1995 A46: F₁ HYBRID TECHNOLOGY

HETEROISIS IN SINGLE CROSS HYBRIDS OF SUMMER TURNIP RAPE IN SASKATCHEWAN, CANADA: A YIELD COMPONENT STUDY.

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ABSTRACT

The performance of *Brassica rapa* L. single cross hybrids was evaluated under western Canadian field conditions. Six of 12 hybrids exhibited mid-parent heterosis. Strong positive correlations were observed between pods/m² and yield and between pods/m² and pods/plant. The single largest factor determining high seed yield was the ability of the turnip rape plant to produce more pods.

INTRODUCTION

Summer turnip rape, *Brassica rapa* L. is adapted to the short season growing areas of Alberta and Saskatchewan, Canada. All presently grown cultivars in western Canada are either open-pollinated populations or population synthetics. Although hybrid vigour or heterosis has been investigated in turnip rape (Hutcheson et al., 1981, Schuler et al., 1992 and Falk et al., 1994), little is known about the factors responsible for heterosis in this species. Seed yield components such as the number of seeds in each pod (seeds/pod), harvestable plants per plot (plants/plot), pods per unit area (pods/m²), pods per plant (pods/plant) and thousand kernel weight (Kwt) may all be considered important to seed yield. The purpose of this study was to determine which of these factors were the major contributors to the high seed yield observed in hybrids of summer turnip rape.

EXPERIMENTAL

Three Canadian cultivars Echo, Torch and Tobin as well as the Swedish strain Sv8236580, were reciprocally hand-crossed by bud-pollination in a complete diallel. Yield tests were conducted at the Agriculture and Agri-Food Canada Research Farm in Saskatoon, Saskatchewan. Plots, 3.6 m² in size, were arranged in a randomized complete block design with five replicates in 1985 and four replicates in 1986. Kwt was estimated by counting and weighing 1000 seeds. The number of seeds/pod was estimated by randomly harvesting five pods from the base of the main raceme of 10

plants in each plot and counting the number of seeds in each intact pod. The average number of plants/m² of row was determined after harvest by counting the stubble. The number of pods/m² was calculated from the seed yield, Kwt and seeds/pod while the number of pods/plant was calculated from the seed yield, Kwt, seeds/pod and plants/plot.

The level of heterosis for seed yield varied greatly among the hybrids (TABLE 1). Six of 12 hybrids exhibited mid-parent heterosis. The most heterotic hybrids were produced from crosses between genetically diverse cultivars, an observation which is consistent with classical theories on heterosis. For example, Tobin x Torch and Torch x Tobin exhibited 35 and 14 % mid-parent heterosis, respectively. The reciprocal hybrids involving Sv8236580 with either Torch or Echo also exhibited mid-parent heterosis. In contrast, crosses between the most closely related parents, Echo and Torch, were not heterotic.

Hybrids did not differ from parents in Kwt, number of seeds/pod, pods/m² or pods/plant (TABLE 1). Hybrids produced 12 % more plants/plot and 9 % more pods/m² than parents. Strong positive correlations were observed between pods/m² and yield ($r=0.81$) and between pods/m² and pods/plant ($r=0.68$). The number of pods/plant were positively correlated with seed yield ($r=0.48$) and negatively correlated with the number of plants/plot ($r=-0.82$). The latter observation was not unexpected since high plant densities corresponded to less branching and therefore fewer pods per plant. Pods/m² and pods/plant were negatively correlated with Kwt and with seeds/pod. The strong positive correlation observed between the number of pods/m² and seed yield and the positive correlation between the number of pods/plant and seed yield indicate that the number of pods produced by either hybrids or parents was an important factor in determining seed yield. This conclusion is supported indirectly by the fact that the number of seeds/pod did not differ among hybrids and parents. In summary, the single largest factor determining high seed yield was the ability of the turnip rape plant to produce more pods.

TABLE 1. Means for seed yield (g/plot), thousand kernel weight (g), seeds/pod, plants/plot, pods/m² and pods/plant of single cross hybrids and parents of *B. rapa* in Saskatchewan, Canada (1985-86).

Treatment	Yield	Kwt	Seeds /Pod	Plants /Plot	Pods/ m ²	Pods/ Plant
<i>Hybrids</i>						
Tobin x Echo †	624	2.66	19.0	211	3447	65
Echo x Tobin	739	2.62	19.8	238	4123	94
Tobin x Torch	734	2.68	19.8	214	3906	85
Torch x Tobin	622	2.74	18.2	226	3479	71
Tobin x Sv8236580	687	2.68	18.0	233	4048	106
Sv8236580 x Tobin †	627	2.53	18.6	227	3872	65
Echo x Torch	675	2.53	19.7	207	3936	115
Torch x Echo	679	2.45	17.6	228	4553	105
Echo x Sv8236580 †	788	2.56	20.9	220	3949	73
Sv8236580 x Echo	763	2.56	20.8	213	4063	87
Torch x Sv8236580	734	2.61	19.3	227	4160	89
Sv8236580 x Torch	675	2.52	17.8	233	4254	97
<i>Parents</i>						
Tobin †	583	2.76	18.7	216	3182	78
Echo	765	2.53	19.3	206	4412	93
Torch †	507	2.52	18.6	177	3065	86
Sv8236580 †	598	2.67	18.2	196	3785	93
<i>Varietal type means</i>						
Hybrids	694	2.59	19.1	223	3990	89
Parents	624	2.62	18.7	200	3660	88
SEM ‡	35	0.05	0.8	13	289	13

† Standard error is underestimated but not for seed yield of Tobin x Echo

‡ Standard error of a mean for *Hybrids* and *Parents* but not *Varietal type*

REFERENCES

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- Hutcheson, D.S., Downey, R.K. and Campbell, S.J. (1981). Performance of a naturally occurring subspecies hybrid in *B. campestris* L. var. *oleifera* Metzg. *Canadian Journal of Plant Science*, 61,895-900.
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TECHNICAL SESSION B

ANIMAL NUTRITION