

HYBRID CANOLA SEED PRODUCTION IN WESTERN CANADA
USING THE *POL* CMS SYSTEM

P.B.E. MCVETTY, R. SCARTH, S.R. RIMMER

Dept. of Plant Science, University of Manitoba, Winnipeg, MB, Canada R3T 2N2

R. PINNISCH

Dept. of Agronomy and Plant Genetics, University of Minnesota, St. Paul, MN,
U.S.A. 55108

ABSTRACT

Hybrid canola seed is being successfully produced in western Canada using the *pol* CMS system with 3A:3R row ratios, 50,000 leaf cutter bees ha⁻¹, 2 m R-line borders on four sides of the field and an isolation distance of 800 m.

INTRODUCTION

Hybrid summer rape (*Brassica napus* L.) canola cultivars display significant levels of high parent heterosis for seed yield (Brandle and McVetty 1990). To exploit this heterosis, hybrid canola seed production methods which maximize hybrid seed yield and hybridity of seed lots derived from commercial scale seed production are required. Successful commercial production of *pol* CMS system-based hybrid canola seed using a method developed by the University of Manitoba is now routinely occurring throughout western Canada.

MATERIALS AND METHODS

Hybrid summer rape canola seed production trials, using *pol* CMS A-lines and R-lines (Fang and McVetty 1989), have been established by University of Manitoba staff at several locations in Manitoba every year since 1986.

Row ratios from 1A:1R through 30A:3R, leaf cutter bee (*Megachile rotundata* F.) populations of 20,000 to 75,000 ha⁻¹, and A-lines with MSI ratings (Burns et al. 1991) of > 5.0 down to < 0.9 have been used in the hybrid seed production trials. A 2 m R-line border surrounding the hybrid seed production blocks has been used in recent years. Leaf cutter bees were placed in all trials when both the A-line and R-line parents were in flower and removed when the R-line parent had completed flowering. The R-line parent was destroyed with a rotary mower after flowering. An isolation distance of at least 800 m has been used. A minimum of 3000 seeds per trial were grown out in the greenhouse and scored at flowering for male fertility/sterility to determine hybridity.

RESULTS AND DISCUSSION

Yields of hybrid seed varied from a low of 275 kg ha⁻¹ to a high of 1293 kg ha⁻¹ (Table 1). The highest hybrid seed yields were obtained from the 1A:1R row ratios, an impractical row ratio for mechanized hybrid seed production. Hybrid seed yields on the commercially useable 3A:3R row ratios averaged 635 kg/ha, about half of the seed yield expected for open pollinated summer rape seed production in Manitoba. As MSI ratings have declined, yields of hybrid seed have declined (Table 1). Pinnisch and McVetty (1992) reported a 352 kg/ha hybrid seed yield decline per unit decrease in MSI.

Mean hybridity of the hybrid canola seed lots produced in Manitoba varied from a low of 14% to a high of 95% (Table 1). Hybridities of 90% or more have been obtained in recent years using A-lines with MSI ratings of 1.4 or less (Table 1). Hybridities have climbed steadily as MSI ratings have declined (Table 1). Pinnisch and McVetty (1992) reported that hybridity increased by 5 to 6% per unit decrease in MSI. Hybridities for hybrid canola seed lots produced in Manitoba since 1988 have consistently exceeded the minimum standard of 75% as stipulated by the Canadian Seed Growers Association (CSGA). Hybridities for western Canada produced hybrid canola should steadily increase towards the 100% target with the steady decreases in MSI ratings now being seen in *pol* CMS A-lines because the reduction in hybridity is primarily due to A-line contamination caused by selfing and sibling of the A-lines in the hybrid seed production fields (Pinnisch and McVetty 1992). To further improve hybrid canola seed production in western Canada, it will be necessary to develop *pol* CMS A-lines that have very low MSI ratings and that are resistant to reversion to male fertility that occurs at high temperatures (Fan and Stefansson 1986). An MSI rating of zero will be required to completely prevent A-line contamination from occurring in the hybrid seed production fields (Pinnisch and McVetty 1992).

Table 1. Mean MSI ratings, mean hybrid seed yield and mean hybridity for *pol* CMS hybrid canola seed production trials grown in Manitoba, 1986 to 1994.

Year/No. of trials	Mean size of trials (ha)	Mean leaf cutter bee population size ha ⁻¹	A:R row ratios	Mean MSI ratings (0 - 6)	Mean hybrid seed yield (kg ha ⁻¹)	Mean hybridity (%)
1986 / 2	0.25	20,000	30:3	> 5.0	431	24
1987 / 2	0.25	20,000	30:3	> 5.0	275	14
1988 / 6	0.025	40,000	1:1	3.5	1293	76
1989 / 8	0.025	75,000	2:2	2.8	1061	85
1990 / 7	0.025	50,000	3:3	2.4	836	83
1991 / 2	1.0	50,000	3:3	1.8	525	81
1992 / 3	1.0	50,000	3:3	1.4	731	95
1993 / 2	1.0	50,000	3:3	0.8	450	90
1994 / 10	5.0	50,000	3:3	?	?	?

? = Data for 1994 not available at time of paper preparation.

CONCLUSIONS

Hybrid canola seed is being successfully produced in western Canada using the *pol* CMS system with 3A:3R row ratios, 50,000 leaf cutter bees ha⁻¹, a 2 m R-line border surrounding the field and an isolation distance of 800 m. This method requires the use of stable *pol* CMS A-lines with MSI ratings of 1.5 or less. Using this method, mean hybrid seed yields of 592 kg ha⁻¹ at a mean hybridity of 90% have been obtained in the 1990's. The use of the above method permits the successful production of hybrid canola seed in western Canada with a high degree of reliability. Occasionally, hybrid seed lots with hybridities of less than 90% will be produced. There are, however, few if any, negative agronomic consequences for hybridities as low as 75% (Pinnisch and McVetty 1994) so that low hybridity seed lots can be used in commercial fields in any case. As MSI ratings decrease, it should be possible to increase the number of A-line rows in the A-line block to 6 or more while holding the number of R-lines constant at 3. This should increase the amount of hybrid seed produced ha⁻¹ while having minimal effects on hybridity.

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