CMS POLIMA IN WINTER OILSEED RAPE /B.NAPUS L./

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Introduction

Numerous investigations showed that the application of heterosis in winter oilseed can cause a significant increase in seed yield ranging between 20-40 per cent /Schuster 1969; Chelkoudenko 1972; Schuster and Michael 1976; Shiga 1976; Lefort-Buson and Dattée 1982a, 1985a/. The sources of male sterility worked out so far did not allow to obtain a complete system for hybrid production. Depending on the source of male sterility there are difficulties in obtaining hybrids due to the lack of restorers or maintainers or due to the MS character, e.g. instability in the Bronowski CMS system /Thompson 1972; I.Bartkowiak Broda et al. 1979/.
Other defects can also occurr such as chlorophyll deficiency connected with the Ogura cytoplasmic male sterility /Rousselle 1982/.

Male sterile forms found in the population of spring variety Polima and transferred to winter oilseed rape seem to give a new opportunity to obtain a reliable system for hybrid seed production.

Materials and methods

The source of cytoplasmic male sterility of Polima type originates from China. It was a population of spring oilseed rape segregating into male-sterile and male-fertile plants. These plants were characterised by very weak vigour and by anomalies in development, viz. two siliques on one petiole. The seeds had low fat content and high content of erucic acid and glucosinolates, including synigrine. The latter does not normally occur in oilseed rape. Table 1 presents the characteristics of these traits in Polima

seeds in BC_2 generation obtained from the crosses of Polima with double low winter oilseed rape lines.

The purposes of the study were as follows:

1/ selection of lines maintaining complete male sterility under field- and greenhouse conditions;
2/ introduction of the CMS system into double low winter oilseed rape;
3/ increasing the vigour of MS plants;
4/ search for maintainers and restorers in the double low winter oilseed rape lines by the use of test crosses.

Results

Male sterile, double low winter lines, also without synigrine, were obtained by multiple back-crossings to double low winter rapeseed lines /Table 2/.
Genetic analysis showed that the occurrence of synigrine in seeds of MS plants was determined by one pair of recessive genes. Crosses between MS plants containing synigrine and double low lines produced segregants without synigrine or with synigrine content at the same level as in maternal plants. The average content of synigrine in seeds from MS plants with synigrine was 3.6 μM/gffdm. Twenty two lines stable with respect to male sterility were obtained as a result of selection performed under field- and greenhouse conditions. These plants failed to produce pollen and did not develop seeds under bagging over the whole flowering period.

Test crossings with 111 double low lines of winter oilseed rape were performed to find out maintainers and restorers. All but one were maintainers or partial maintainers. Only one combination of MS line pollinated with double low line No. 5293 gave restoration of pollen fertility. However, it was only a single observation conducted under greenhouse conditions in 1986/87. The pollinator line will be tested also with other MS lines both under field- and greenhouse conditions.

About 80 per cent of plants in the BC_3 had biennial character and satisfactory winterhardiness.

The average percentage of overwintering in the field was 84.5 for two years of testing. Also, other agronomic traits of MS plants were found to be improved after backcrossing to double low lines of winter oilseed rape. MS plants became vigorous and the average height reached 148 cm. Seed setting under open pollination was similar to that in male fertile plants. The weight of 1000 seeds was fairly high and approximated 6.42g.

Conclusions

It was found that most of the tested double low lines of winter oilseed rape were maintainers or partial maintainers for the Polima CMS type. Only one line gave restoration of pollen fertility. This observation and the findings of McVetty on restorers in spring rape variety Italy (personal communication) allow to expect that it will be possible to derive a complete system of hybrid seed production using this source of male sterility.

References

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Table 1. Content of fat, erucic acid and glucosinolates in seeds from male sterile plants of Polima type after backcrossing with double low winter oilseed rape /BC_2 and BC_3/.

	fat	erucic acid	synigrine	gluconapin	glucobrassicanapin	progoitrin	total of glucosinolates
	%	%			µM/g ffdm		
max	52.8	19.8	4.53	15.81	25.54	63 78	95.97
min	34.3	10.9	1.81	6.18	2.98	32.28	20.59
mean	40.1	14.2	3.53	9.53	9.12	48,61	66.10

Table 2. Percentage of desired segregants in BC_4 and BC_5 generations.

trait	percentage of MS plants
Erucic acid content < 0.1%	14.8
Glucosinolate content < 15 µM/g ffdm	27.9
Without synigrine	80.3