

ACCOMPLISHMENT OF CMS POLIMA SYSTEM IN DOUBLE LOW  
WINTER RAPE (BRASSICA NAPUS L.)

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Considerable heterosis effect has been reported in first generation hybrids of oilseed rape (Lefort-Buson, Dattée 1982; Krzymanski et al. 1979, 1983; Sernyk 1983; Grant, Beversdorf 1985).

Geno-cytoplasmic male sterility (CMS) is an effective mechanism for controlling cross pollination in the production of F<sub>1</sub> hybrid seeds.

Several geno-cytoplasmic male sterile sources are available in the Brassica genus. CMS pol found in the spring rapeseed variety Polima in China (Fu 1981) is one of the CMS forms which can be used for creation of hybrid varieties of oilseed rape.

Genotypes restoring CMS pol occur in low frequency in Brassica napus, but it is more difficult to select maintainer genotypes. Good maintainers should assure thermostability of male sterility independent of varying environmental conditions.

The objective of this study was to identify suitable maintainers and restorer lines to complete the pol CMS- restorer system for commercial hybrid seed production.

MATERIAL AND METHODS

Seeds of male sterile plants selected from the B. napus spring variety Polima were received from China. Populations obtained from these seeds varied in degree of male sterility expressed.

Selected male sterile plants were crossed with double low winter lines of oilseed rape. A search for maintainers and restorers was conducted by means of test hybrids of male sterile lines with different varieties and double low winter lines of oilseed rape.

Selection of maintainers was conducted under field conditions and in a phytotron with day/night temperatures of 15°C/10°C, 20°C/15°C, 25°C/20°C, altered every 7 days throughout the flowering period using a day length of 16 hr. and a light intensity of 20,000 lux.

Plants classified as male sterile were only those plants that failed to produce pollen over the whole flowering period and did not set pods on isolated inflorescences.

RESULTS

To find restorers and maintainers for CMS pol 500 lines and 45 varieties of double low winter oilseed rape were tested. These test hybrids were observed under field conditions. One line, PN-5297/86, contained restorer genes, and 24 lines maintained CMS pol. Hybrids between the male sterile plants and the 24 maintaining lines did not produce pollen over the whole flowering period and did not set pods on isolated branches. The remaining lines produced hybrids that were partial maintainers (46.5%), partial restorers (13.2%) or heterozygous (35.3%).

The investigated varieties were either partial restorers (46.6%) or partial maintainers (53.4%) of CMS pol. The segregation ratio in the F<sub>2</sub> of crosses between male sterile plants and the line PN-5297/86 was about one male sterile plant to 15 fertile plants. It is proposed that restoration by this line is determined by two pairs of duplicative genes.

The genotype of the restoring line has been introduced into 27 different double low lines. The ability of these lines to restore CMS pol was confirmed by test crosses.

Male fertile F<sub>1</sub> progeny, of male sterile plants resulting from crosses with line PN-5297/86 are characterized by normal flower development and good pod set on isolated inflorescences.

Field selected maintainer lines were evaluated under different temperatures in a phytotron. Test hybrids of the BC<sub>1</sub> generation between male sterile plants and 24 maintaining lines were observed under day/night temperatures of 15°C/10°C to 25°C/20°C. Thermostable male sterility of these plants varied from 0 to 62.5% depending on the maintainer used. Only those maintainer lines which resulted in a high frequency (>50%) of thermostable male sterile plants in F<sub>1</sub> hybrids were retained for further investigation. These lines were selfed to obtain genotypes with homozygous alleles determining thermostable male sterility.

The best selected maintainer is line PH-410/1/88. The S<sub>2</sub> progeny of this line gave 62.5 per cent of thermostable male sterile plants in BC<sub>1</sub> and the best S<sub>3</sub> sublines of PN-410/1/88 produced over 90 per cent thermostable male sterile plants in BC<sub>2</sub>.

The selected restorer and maintainer lines are all double low winter forms of rapeseed. Also, all CMS pol lines have been converted into double low winter oilseed rape after seven backcrosses to lines of this kind. The male sterile lines, maintainers and restorers have the potential to create a three-line system of hybrid seed production in double low winter oilseed rape.

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