# CHARACTERISTICS OF CMS *POL* AS A SYSTEM CONTROLLING HYBRID SEED PRODUCTION IN WINTER OILSEED RAPE

# I.BARTKOWIAK-BRODA, W.POPŁAWSKA, A.LIERSCH, B.GAZECKA

Instytut Hodowli i Aklimatyzacji Roślin, Plant Breeding and Acclimatization Institute Oil Crop Department, ul. Strzeszyńska 36, 60-479 Poznań, Poland

## ABSTRACT

In Oil Crop Department in Poland two maintaining double low winter lines of rapeseed have been selected — PN 410/88 and PN 4315/89 assuring in CMS pol lines over 90 per cent of plants with stable expression of male sterility. To obtain the maintaining lines with a set of analogous recessive genes determining male sterility in homozygous stage doubled haploids have been obtained by androgenesis from line PN 410/88. The genotypes of obtained dihaploid lines were investigated in test crosses with CMSpol lines in F<sub>1</sub>, BC<sub>1</sub>, BC<sub>2</sub> progeny. From the investigated 33 dihaploid lines four determined the occurrence only of male sterile plants during the whole flowering period in F<sub>1</sub> as well as in BC<sub>1</sub> and BC<sub>2</sub> progeny.

Also heterosis effect was studied in hybrids with lines possesing in genotype restorer gene originating from variety Italy and restorer gene originating from partially male fertile plants (pMF).

#### INTRODUCTION

In the yield of oilseed rape high heterosis effect occurs in the range 20 to 40 per cent (Bartkowiak-Broda, 1977; Lefort-Buson, 1982; Lefort-Buson, Dattee, 1982; 1983; Grant, Beversdorf, 1985). This level of heterosis and the discovery of pollen control systems stimulate interest in the development of hybrid oilseed rape cultivars.

Gene-cytoplasmic male sterility CMSpol found in oilseed rape spring variety Polima in China (Fu, 1981) is one of the most promissing CMS forms which can be used for creation of hybrid varieties. First hybrid varieties of summer oilseed rape have been already created by the use of CMSpol system. However, instability of male sterility expression as well as low frequency of maintaining and restoring genotypes in *B. napus* species limit the possibility of utilization of CMSpol for hybrid seed production. In addition some results suggest that the biological cost associated with polima cytoplasm relative to another sterile cytoplasm as napus and to normal cytoplasm is high and because of that hybrids are less performant (McVetty et al., 1990, Chamberlain et al., 1991).

## **EXPERIMENTAL**

In Oil Crop Department in Poland CMSpol system is developed in winter rapeseed form and there have been selected:

- male sterile plants with Polima cytoplasm in genotype of double low oilseed rape,
- two maintaining double low winter lines of oilseed rape PN 410/88 and PN 4315/89 assuring in CMSpol over 90 per cent of stable male sterile plants,
- · two sources of restorer genes:
  - double low winter rapeseed line PN 5297/86,
  - forms selected from partially male fertile plants (pMF).

Also genotype of traditional spring variety Italy possessing dominant restorer gene of male fertility for CMSpol was introduced into genotype of double low winter oilseed rape.

30

To obtain the maintaining lines with a set of analogous recessive genes determining male sterility in homozygous stage 33 doubled haploids (DH) have been obtained by androgenesis in vitro from line number PN 410/88. The genotypes of these dihaploid lines were investigated for ability to maintain stable male sterile forms in test crosses with CMSpol lines in F<sub>1</sub>, BC<sub>1</sub> and BC<sub>2</sub> progeny. Observations were made in greenhouse conditions for all generations on ten plants from each combination as well as in field conditions for F<sub>1</sub> and BC<sub>1</sub> progeny on 20–30 plants for each combination. In greenhouse before and during the flowering period the day length was 16h and day/nigth temperature from 20°C/10°C to 25°C/15°C. Pollen production was observed during the whole flowering period and seed set on bagging branches.

Out of investigated dihaploid lines in hybrids with CMSpol in F<sub>1</sub>, BC<sub>1</sub> and BC<sub>2</sub> generations four have been selected as complete maintainers (Table 1). It seems that it is possible to improve the stability of male sterility expression by the use of fully homozygous maintaining lines. But these results need to be confirmed in different climatic conditions.

Heterosis effect was also studied in field trials in hybrids with lines possesing in genotype restorer gene originating from variety Italy and lines with restorer gene originating from partially male fertile plants (pMF).

It was stated that with the use of CMSpol the selection of hybrids with high heterosis effect is possible (Figure 1). It was the confirmation of earlier studies on CMSpol hybrids with another genetical background (Bartkowiak-Broda et al. 1994). Generally hybrids with restoring lines possesing restorer gene from Italy variety gave higher heterosis effect.

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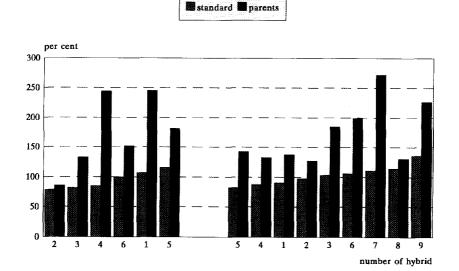
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TABLE 1. Ability to maintaining	CMSpol by some doubled	haploids originating from line
	DN 410/99	

	111 410/88			
Number of line	Type of plants obtained in progeny with CMSpol lines			
	$F_1$	BC <sub>1</sub>	BC <sub>2</sub>	
PN 5756/5	MS	MS,pMF	MS	
PN 5793/1	MS	MS	MS	
PN 5793/2	MS	MS,pMS	MS	
PN 5793/6	MS	MS, pMS	MS	
PN 5793/7	MS, pMS	MS, pMS	MS, pMS	
PN 5793/10	MS	MS, pMS	MS, pMS	
PN 5794/3	MS	MS	MS	
PN 5794/6	MS,pMS	MS, pMS	MS, pMS	
PN 5794/8	MS	MS, pMS	MS, pMS	
PN 5794/13	MS	MS, pMF	MS, pMS	
PN 5795/1	MS, pMF	MS, pMF	MS, pMS, pMF	
PN 5796/I	MS, pMS	MS	MS, pMS	
PN 5796/3	MS	MS	MS, pins	
PN 5796/4	MS,pMS, pMF	MS	MS, pMF	
PN 5796/6	MS	MS	MS, pill	
PN 5796/7	MS	MS, pMF	MS, pMS	

MS — male sterile plants; pMS — partially male sterile plants; pMF — partially male fertile plants

Figure 1. Heterosis effect in yield of F1 hybrid progeny



restored by gene "Italy"

restored by gene "pMF"