Investigation on the Possibility of Cultivation of Winter Oilseed Rape Composite-Hybrid Varieties in Poland

Iwona BARTKOWIAK-BRODA, Jan KRZYMANSKI, A. LIERSCH, M. OGRODOWCZYK
Plant Breeding Acclimatization Institute, Oil Crop Department, Poznan, Poland

Interest in the development of winter oilseed hybrid varieties in Poland is stimulated by the economical importance of this plant. Winter oilseed rape is the main oil crop in Poland with average area of cultivation about 500 000 ha per year.

For many years in Oil Crop Department of Plant Breeding and Acclimatization Institute the investigations are conducted on different systems controlling cross pollination in oilseed rape which can be used for hybrid seed production (Bartkowiak-Broda 1991; Bartkowiak-Broda et al. 1996). The most important research and breeding programs on hybrid varieties development concern the utilization of gene-cytoplasmic male sterility CMS *polima* and CMS *ogura* . However, the instability of male sterility expression in CMS *polima* and the lack of double low restorer forms for CMS *ogura* limit the possibility of utilization of the both systems. Therefore the introduction of composite hybrid varieties which were created on the basis of CMS *ogura*, into the production in 1994 in France (Pinochet 1995) aroused an interest in this kind of varieties in Poland. In connection with this investigations which aim to study the cultivation possibility of this type of varieties in Polish climatic condition are conducted.
These investigations include:
- yielding of non restored hybrids pollinated by foreign pollen,
- competition between hybrid plants and plants of pollinators.

Yielding of non restored hybrids

In 1994/95 season, which was fovourable for good pollination, in nine localities the trials were carried out with non restored F1 hybrid FP 01. Mean yield in these trials was 123,7 per cent of standard variety Bor (Table 1). Hybrid plants were significantly higher. Other negative traits were also observed such as significantly lower overwintering and sensibility to the lodging.

Table 1. Evaluation of non restored FP 01 hybrid in comparison with standard variety Bor in trials conducted in 9 localities

Traits	Bor	FP 01	Per cent of standard	F estimated	NIR 0.05
Yield (q/ha)	42.00	51.96	123.7	7.92**	1.53
Overwintering (%)	91.65	90.83	99.1	1.66*	2.62
Plant hight (cm)	147.91	151.19	102.2	11.82**	2.36
Lodging (score 1-9)	5.04	6.26	124.3	5.01**	0.28

Other hybrids were evaluated in trials conducted in two localities and some of them yielded also on the level significantly better than standard double low variety Bor (Table 2).

Table 2. Evaluation of non restored hybrid yielding level in trials in 1994/95

Hybrid	Borowo		Oleśnica	Mała	Mean yield	
	q/ha	% of standard	q/ha	% of standard	q/ha	% of standard
Bor	54.66	100.00	44.84	100.00	49.75	100.00
DHR 32/1	67.66	123.78	54.92	120.20	61.29	123.20
DHR 32/6	80.02	146.40	47.55	106.04	63.79	128.22
DHC 597/93	80.08	146.50	54.92	122.48	67.50	135.68
DH M II 86	67.15	122.85	51.30	114.41	59.22	119.04
M II 73	65.49	119.81	57.96	129.26	61.72	124.07
NIR (0.05)	9.90		7.72			
NIR (0.01)	13.30		10.28			

Moreover in multilocal trials were investigated the interaction effects of genotypes on the environment for hybrid FP 01 and 18 strains originating from pedigree selection. The results proved that yield increase of hybrid was lower in worse environmental conditions and it grows remarkably with the improvment of environmental conditions. This important increase of the yield was not observed in the case of strains (Fig.1).

Obtained results showed high yielding capacity of non restored hybrids in favourable conditions for allopollination as it was in the case of 1994/95 season. The analysis of interaction effects of genotypes on the environment indicated that economically the most profitable is to cultivate the hybrid varieties in very good environmental conditions.

Competition between hybrid and pollinator plants

In order to examine the competition phenomenon between hybrid and pollinator plants 10 composite hybrids were examined on isolated plots, each 100 m^2, in four localities: Borowo, Łagiewniki, Oleśnica Mała and Radzików. Composite hybrids consisted of non restored FP 01 hybrid and 10 different varieties or strains used as pollinators. Seed proportion was 80:20 per cents respectively. During the flowering period the number of pollinator plants was estimated on three microplots with 60 plants for each combination and in each locality. Two weeks before the harvest 10 plants were taken from microplots and yield components were examined separatly for male sterile hybrid plants and for pollinator plants.

The number of pollinator plants on isolated plots was sufficient for good pollination of male sterile hybrid plants (Table 3). This number of pollinator plants was independent of locality and the genotype of investigated pollinator (Table 4).

It was stated that the contribution of pollinator to total yield was not important because the mean yield of pollinator plants was by a half lower then yield of hybrid plants (Tables 5, 6). This yield increase of hybrid plants was determined by the number of seted pods while the differences in 1000 seed weight were not significant.The presented results were obtained from one year trials and need to be confirmed in next years. However on the basis of the obtained data it is possible to state that the contribution of pollinator plants in total yield is not very important. In reference to these results it is possible to suggest the increase of the number of pollinator plants in composite hybrids with the aim to assure enough pollen for full pollination

of male sterile F_1 hybrid plants. Similar observation was made by Rahman and Poulsen (1995) and it seems that to assure necessary quantity of pollen it will be more safely to mix hybrid with 30 per cent of pollinator seeds. It is very important especially when the weather is wet and cold during the flowering period unsufficient polination can occur in such conditions, as it was observed in Poland in 1995/96 season.

Table 3. Per cent of pollinator plants in the beginning of flowering stage on isolated plots (100 m^2) in assotiations of FP 01 with different pollinators

Pollinator	Borowo	Łagiewniki	Oleśnica Mała	Radzików	Mean
Bor	19.4	16.6	16.6	10.0	15.6
Bolko	16.6	19.4	20.0	16.6	18.2
Polo	15.0	16.1	21.6	20.8	18.6
Marita	13.8	15.0	22.5	21.6	18.2
LAH 390	12.2	19.4	15.8	10.0	14.4
BK 5918	11.6	25.0	12.5	14.2	15.8
BKP 2587	8.9	22.7	13.3	13.3	14.4
MAH 15	22.2	17.7	20.0	23.3	22.4
PB 3450/92	9.4	10.0	18.3	13.3	15.8
PB 2040/92	22.2	15.0	17.5	17.5	19.2
MEAN	15.1	17.7	17.8	16.1	17.3

Table 4. Per cent of pollinator plants on isolated plots with mixture of FP 01 and different pollinators — analysis of variance

Source of variability	No of degrees of freedom	Sum of squares	Mean squares	F		
				estimated	0.05	0.01
Localities	3	95.31	31.77	1.73	2.69	3.97
Pollinators	9	227.67	25.30	1.38	1.97	2.59
Interaction pollinator x locality	27	524.17	19.41	1.06	1.59	1.92
Regression in relation to locality	9	188.24	20.92			
Deviation from regression	18	335.93	18.66	1.02	1.70	1.70
Error of trial	108		18.37			

Fig. 1. Regression of genotypes
Regression lines of interaction effects of genotypes on the environment

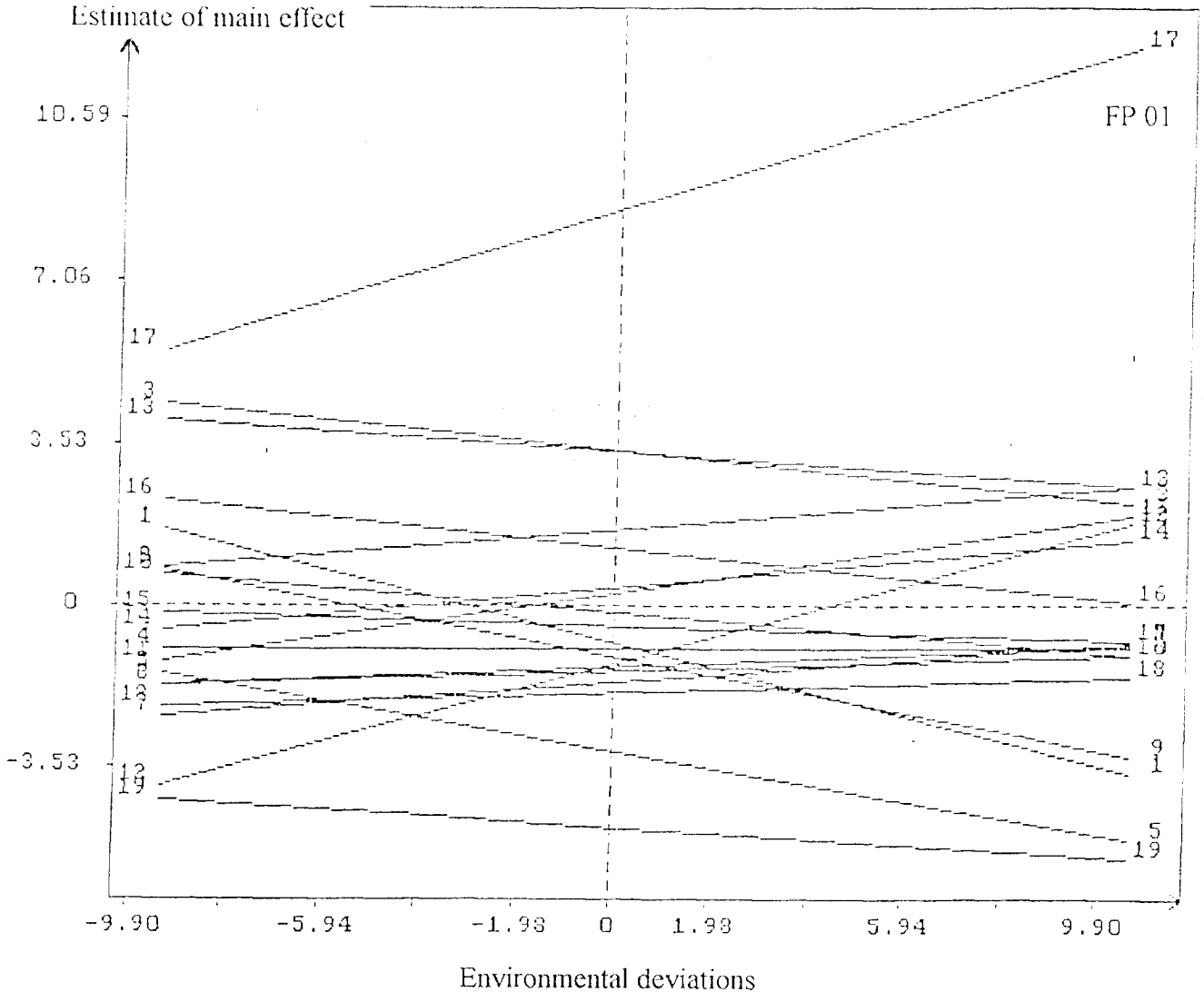

Table 5. Analysis of yield components for **hybrid plants** in composite hybrids on isolated plots

Composite hybrid	Mean no of pods		Mean yield per plant [g]	1000 seed weigt [g]
	seted	nonseted		
FP 01 + BOR	325.8	109.5	15.5	4.1
FP 01 + BOLKO	247.9	83.2	12.3	4.5
FP 01 + POLO	284.9	83.7	12.4	4.2
FP 01 + MARITA	272.7	83.5	14.3	4.0
FP 01 + LAH 390/92	332.6	120.2	15.5	4.5
FP 01 + MAH 15	234.7	61.8	10.9	4.3
FP 01 + BK 5918/90	291.7	92.9	14.8	4.9
FP 01 + BKP 2587/91	268.1	88.6	12.7	5.0
FP 01 + PB 3450/92	218.2	61.2	10.0	4.0
FP 01 + PB 2040	246.5	63.5	12.1	4.4
MEAN	272.3	84.8	13.1	4.4

Table 6. Analysis of yield components for **pollinator plants** in composite hybrids on isolated plots

Composite hybrid	Mean no of pods		Mean yield per plant [g]	1000 seed wieght [g]
	seted	nonseted		
FP 01 + BOR	116.8	49.4	6.9	3.9
FP 01 + BOLKO	83.2	54.6	6.2	4.7
FP 01 + POLO	134.6	53.5	6.1	4.1
FP 01 + MARITA	112.4	56.2	7.6	4.0
FP 01 + LAH 390/92	117.1	54.5	6.7	4.0
FP 01 + MAH 15	109.4	68.4	8.2	4.2
FP 01 + BK 5918/90	84.7	59.1	6.0	4.5
FP 01 + BKP 2587/91	130.7	51.8	7.0	4.7
FP 01 + PB 3450/92	152.7	49.8	8.7	4.1
FP 01 + PB 2040	120.9	47.5	8.1	4.4
MEAN	116.3	54.5	7.2	4.3

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