PROGRESS IN WORKS ON UTILIZATION OF MALE STERILITY IN BREEDING OF WINTER RAPE /BRASSICA NAPUS L./

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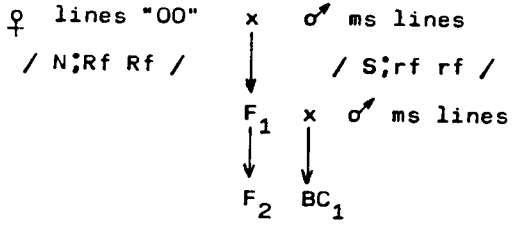
Researches conducted in Poland and abroad revealed that pronounced heterosis of seed yield occurs in rape hybrids / 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12/. The utilization of heterosis in breeding is possible by use of self-incompatible or male sterile lines. At present we are working on two types of male sterility /ms/: one introduced from Bronowski spring variety, second from male sterile radish.

Male sterile forms originating from Bronowski variety were selected in F_2 generation of cross between normal rape with S; RfRf genotype and Bronowski variety with F;rfrf genotype. These plants were characterized by a very weak vigour and displayed great variability in sterility degree. This sterility is not complete. It is manifested by considerable shortening of anthers, by delayed pollen grain formation and by delayed dehiscence of anther sack or by lack of anther sack dehiscence at all.

After several years of selection 60 zeroerucic lines with lowered glucosinolate content and displaying male sterility in high degree were obtained /table 2/. A part of them was examined on ability to cross-pollination by use of erucic acid as a marker. They were sown in one row plots separated by rows of high erucic pollinator /Gorczanski/. These lines were intercrossed in various degree. The related lines displayed however similar cross-pollination percentage /table 1/.

The main problem connected with this form of male sterility is to obtain maintaining lines, since the possessed rape lines and varieties proved to be good restorers. So far ms plants were maintained by self-pollination in the last stage of flowering or by hand pollination with their own pollen or in sib-breeding. Works to obtain maintainers were performed according to the following scheme:



In F_2 and BC_1 generations test crosses were conducted to select lines with maintaining ability and with expected genotype N;rf rf. In 1981 twenty three lines completely or partially maintaining male sterility were selected. These lines do not contain erucic acid and are characterized by low glucosinolate content /table 3./. Because the maintainer lines are recurrent pollinators it would be essential to possess such lines with good yielding ability and with double low quality. Therefore the obtained maintainers still need further improvement by back-crossings with the best double low lines.

Male sterile rape form with sterility introduced by interspecific crosses with male sterile radish was obtained in 1974 in France. We have received seeds of male sterile line from France in 1978. This line had been maintained for two years by Primor variety. These plants are completely male sterile with the total lack of pollen production.

Main problems connected with this form of male sterility are the absence of restorers and chlorophyll deficiency. Breeding for obtaining restorer lines is conducted by interspecific crossings of ms plants with Raphanobrassica Chopinet containing restorer genes. White flowering plants producing viable pollen were found in F_1 generation of these crosses. No symptoms of chlorophyll deficiency was observed on these plants and it may help to solve this difficult problem. Obtained plants were selfed, intercrossed and crossed with lines of double low rape.

The increase in chlorophyll content also is attempted by crosses between male sterile plants and high green lines of double low rape. Erucic acid content and glucosinolate content were considerably lowered and winterhardiness was improved in male sterile lines originating from radish in the course of three backcrossings with double low winter rape lines /table 4/.

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Table-1 : Mean percentage of cross-pollination for male sterile lines originating from Bronowski.

Family	Lines	Cross-pollination %	Mean for families
I	1158	49,0	49,0
II	1160	79,0	79,0
III	1164	42,5	39,3
	1166	35,5	
	1168	36,0	
	1170	39,2	
	1172	43,3	
IV	1174	55,5	49,7
	1176	43,0	
	1178	55,0	
	1180	45,5	
V	1182	52,0	48,6
	1184	45,3	
VI	1186	33,0	40,4
	1188	47,8	
VII	1190	36,7	38,8
	1192	37,2	
	1194	45,0	
	1196	37,3	
	1198	38,0	
VIII	1202	64,1	68,2
	1204	72,9	
IX	1206	73,6	68,0
	1208	64,3	
	1162	66,0	

Table-2 : Erucic acid and glucosinolate contents in male-sterile lines originating from Bronowski variety-1981.

	Erucic acid	Butenyl ITC	Pentenyl ITC	Vinyl-oxazo-lidinethione
	percent	m g / g f. f. d. m.		
max.	1,6	7,20	1,68	7,01
min.	0,0	0,00	0,00	0,37
mean	0,3	2,76	0,88	3,81

Table-3 : Erucic acid and glucosinolate contents in maintaining lines selected in 1981.

	Erucic acid	Butenyl ITC	Pentenyl ITC	Vinyl-oxazo-lidinethione
	percent	m g / g f. f. d. m.		
max.	0,8	0,54	0,16	0,86
min,	0,0	0,07	0,00	0,11
mean	0,1	0,27	0,06	0,53

Table-4 : Erucic acid and glucosinolate contents in male-sterile plants with radish cytoplazma-1981.

	Erucic acid	Butenyl ITC	Pentenyl ITC	Vinyl-oxazo-lidinethione
	percent	m g / g f. f. d. m.		
max.	21,5	2,34	1,14	4,34
min.	0,0	0,25	0,04	1,18
mean	8,9	1,08	0,47	2,82