RESEARCH ON DIFFERENT TYPES OF WINTER RAPESEED HYBRID VARIETIES IN POLAND

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INTRODUCTION

The development of hybrid varieties of rapeseed with the use of CMS *ogura* was one of the most important breeding objectives in the past few years in Poland. The lack of restorer lines with appropriate qualitative and agronomical traits was the factor limiting the utilization of CMS *ogura* and resulted at first in breeding of composite hybrid varieties. Kaszub and Mazur, the first composite hybrid varieties were registered in Polish Official Catalogue in 2001. They yielded at the level 110-113% of the standard. These varieties are characterized by good quality traits: glucosinolate content below 10 μM/g of seeds and oil content 46-47,5 %. Also was registered in 1999 spring composite hybrid variety Margo. In Poland apart from our own varieties German hybrid varieties of winter rapeseed are registered: Buffalo, Kasimir (1999) and Kronos (2001) created on the basis of MSL – Lembke system. The cultivation acrage of Buffalo and Kasimir has been very limited up to now because of the level of yielding, only 2-3% higher than the yield of standard population varieties. The best result of Margo was 116% of standard variety yield.

New varieties Mazur, Kaszub and Kronos will be cultivated at production scale in 2001/2002 for the first time.

The aim of the investigations conducted now by Oil Crop Department of IHAR is to obtain restorer lines for CMS *ogura* system with low glucosinolates content and good yielding ability (Bartkowiak-Broda, Poplawska 1999). Also different types of hybrids: composite, mixed and restored are investigated to study the glucosinolate content in sowing seeds and in consumption seeds harvested from F_1 plants.

MATERIAL and METHOD

Investigations of double low restorer lines for CMS *ogura* were carried out in $F_3 – F_6$ generations selected from hybrids between restorer line R and low glucosinolate male sterile lines (4.1 – 11.8 μM/g of seeds). Selection of genotypes with restorer gene alleles was carried out on the phenotypic expression and with the use of isozyme marker PGI-2 (Delourme, Eber 1992). It gave the opportunity to create mixed and restored hybrid varieties.

Different types of hybrids: restored, mixed and composite, created using CMS *ogura* were investigated in the field trials in three localities in 1998/1999 and in one locality in 1999/2000 in randomized block design with systematically distributed standard.

The analyses of glucosinolates were performed with the method of gas chromatography of silyl derivatives of desulfoglucosinolates (Michalski et al.1995).

RESULTS

The first restorer lines with stable expression and low glucosinolates content were selected in F_4 progeny of hybrids between CMS *ogura* lines with low glucosinolates content and restorer line characterized by glucosinolates content at the level 60 μM/g of seeds (Table 1) (Poplawska 2000).

The PGI-2 isozyme marker closely linked to the restorer gene is lost in some of the investigated restorer lines with low glucosinolates content selected in F_3 and F_4 progeny of mentioned hybrids (Table 2). The frequency of the occurrence of recombinants with restorer gene alleles and low glucosinolates content in the F_3 and F_4 progeny was very low about 2,5%. Because of that the selection of low glucosinolates restorer lines for CMS *ogura* system in advanced progenies is not effective with the use of PGI-2 marker.

Three different types of hybrids created with the use of CMS *ogura* system were investigated to study the glucosinolate content in consumption seeds.

The significant increase of glucosinolate content in consumption seeds was observed in restored and mixed hybrids. This phenomenon was not observed in composite hybrids (Figure 1). In consumption seeds harvested from F_1 plants of restored and mixed hybrids the significant augmentation only of alkenyl glucosinolate content was stated (Figure 2). It is connected with tight linkage between the radish introgression and high glucosinolate content in restorer lines (Delourme, Eber , Renard 1991) .

The level of indolyl glucosinolates content was not modified essentialy in F_1 and F_2 generations in any type of investigated hybrids (Figure 3).

Glucosinolates content of investigated hybrids was significantly dependent on genotypes and environmental conditions (Table 2).

The obtained results indicate that only the use of homo- or heterozygous restorer lines with extremly low glucosinolate content in breeding of restored hybrids allows to achieve hybrid seeds meeting the quality requirements of Polish standard.

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Table 1

Characteristics of restorer lines with low glucosinolate content in F_4 –F_5 progeny

F_4		F_5	
Line	Glucosinolate content [µM/g seeds]	Line	Glucosinolate content [µM/g seeds]
2555	9,8	1145	16,1
		1241	14,5
		1321	16,8
		1361	17,4
2966/1	8,4	1166	12,1
		1652/2	9,9
2966/5	6,5	1654/2	20,5
		1654/3	8,9
		1223	9,9
		1263	12,3
		1303	10,2
		1343	19,0
		1383	14,2
2966/6	8,5	1655/1	13,8
		1655/2	14,1
		1655/3	15,8
		1655/4	21,1
		1225	15,9
		1265	9,7
		1305	11,6
		1345	17,0
2966/7	10,1	1170	17,8
		1656/1	20,3
		1307	12,5
3733/2	12,0	1705/1	18,3
		1705/2	16,4
		1705/3	11,6

Table 2

Glucosinolate content in plants of F_3, F_4 progeny with lost marker PGI-2

Line	Number of plants with lost marker PGI-2	Glucosinolate content [µM/g seeds]
2403	5	12,6
2415	3	17,1
2417	3	17,8
2962/10	1	18,5
2425	11	12,5
2551	8	13,0
2427	1	13,4
2553	5	4,8
2965	2	6,8
2973/4	1	15,4
2973/8	1	16,3
2557	1	9,1
2455	8	10,1
2581	5	7,7
3001/5	1	19,5
2707	2	16,2
2990/4	1	6,4
2990/5	1	6,9
2996	10	6,4
2521	1	10,6
Total	**78**	

Table 3

Variance analysis of different types of hybrids in field trials

	Degrees of freedom	Sum of square	Mean square	F calculated
Glucosinolate content [µM/g of seeds]				
Environments	2	50,37	25,18	11,47**
Genotypes	31	991,84	31,99	14,61**
Interaction genotypes × environments	62	275,74	4,45	2,03**
Regression environment	31	172,94	5,58	2,55**
Regress deviation	31	102,80	3,32	1,51*
Experimental error	279		2,19	
Aliphatic glucosinolate content [µM/g of seeds]				
Environments	2	48,19	24,09	12,74**
Genotypes	31	1074,33	34,66	12,74**
Interaction genotypes × environments	62	295,69	4,77	18,34**
Regression environment	31	195,39	6,30	2,52**
Regress deviation	31	100,30	3,24	3,33*
Experimental error	279		1,89	

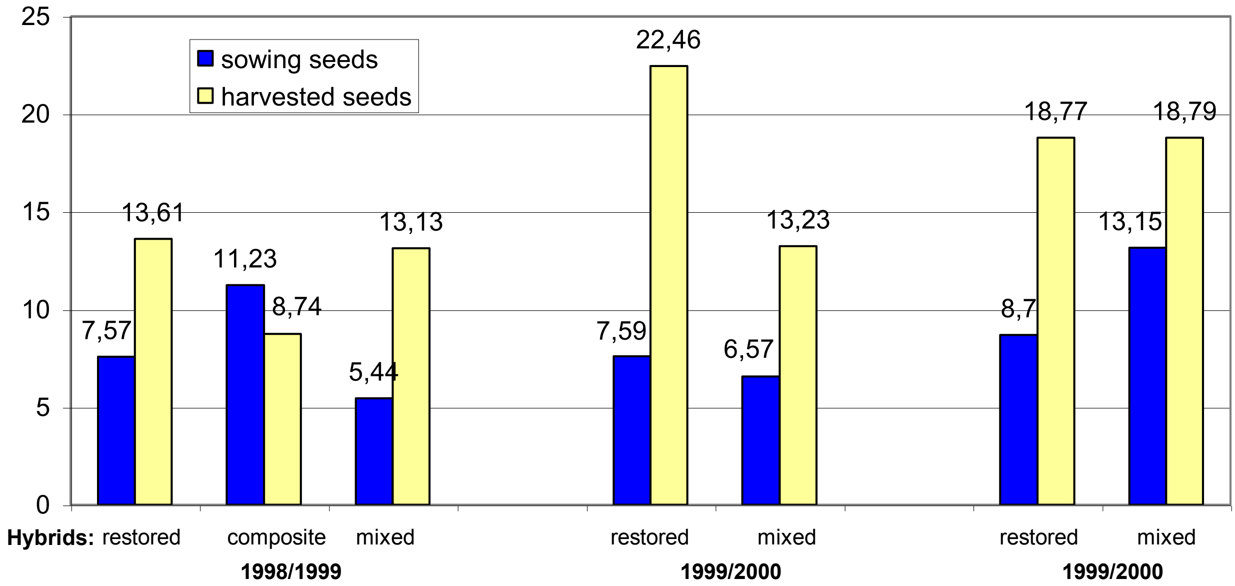
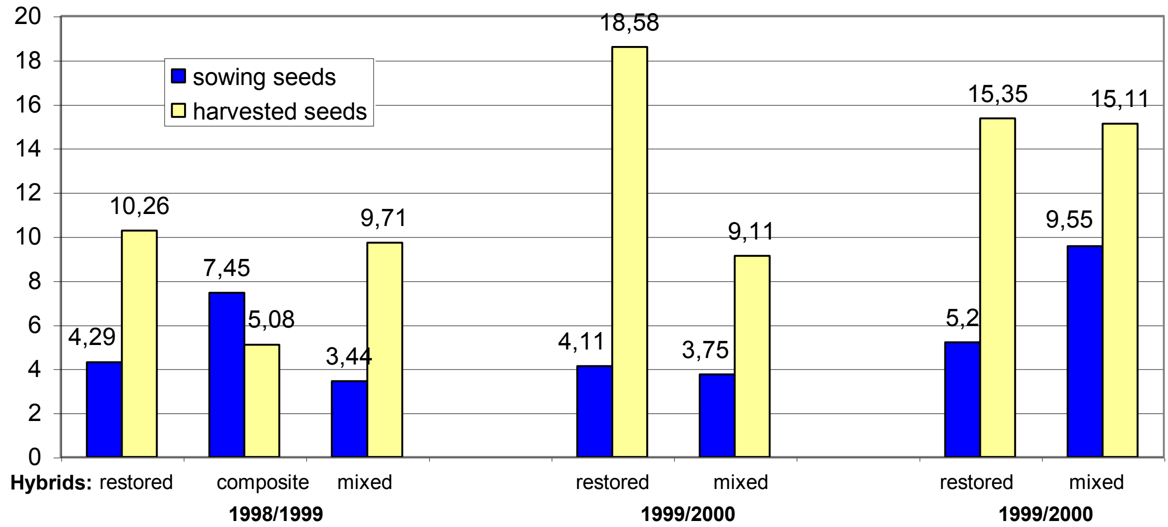


Figure 1 Glucosinolate content in different hybrid types of winter rapeseed

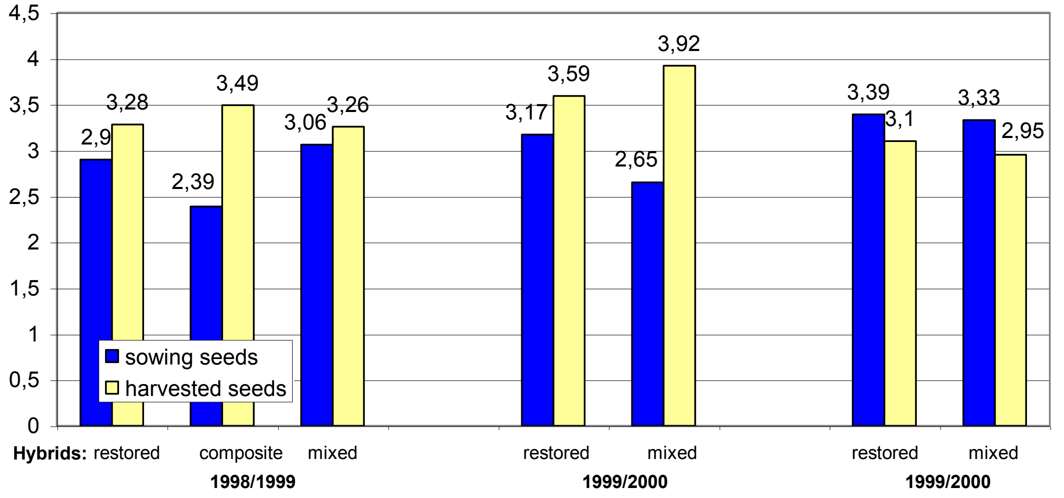
sowing seeds F cal.	**11,59****	**1,24**	**4,87****
harvested seeds F cal.	**11,95****	**9,82****	**0,47**

Fig 2- Alkenyl glucosinolate content in different hybrid types of winter rapeseed



sowing seeds F cal.	**6,31****	**0,28**	**4,53****
harvested seeds F cal.	**11,95****	**27,87****	**0,01**

Fig 3 - Indolyl glucosinolate content in different hybrid types of winter rapeseed



sowing seeds F cal.	**2,10**	**2,15**	**0,06**
harvested seeds F cal.	**1,07**	**2,83**	**1,12**