CO1974AGR09

INVESTIGATION ON NATIVE AND FOREIGN WINTER RAPE VARIETIES IN POLAND

C. Muśnicki

In the years 1969-1973 comparative investigations in field trials were carried out on agronomic value of 3 Polish and 6 foreign high-erucic winter rape varieties by Centralny Ośrodek Badania Odmian Roślin Uprawnych (The Research Center for Varieties of Agricultural Crops) - shortly COBORU. In the last 3 or 2 years of the report period the investigations included two low-erucic varieties, and in the last year - one zero-erucic line. The varieties are specified in Table 1. The field trials were made each year in 22-29 experiment stations scattered all over Poland, the regions with larger rape cultivation areas being represented by more stations.

All the varieties were evaluated in regard to their seed-yield, fat content in seeds, fat yield, 1000 grain weight, winter hardness and plant height. The values obtained for each variety were compared to Brilland (Górczański) variety regarded as standard in Polish climate conditions. The data for each variety were expressed in relative values in regard to those obtained of standard variety in the same experiments. Table 1 shows that the Brilland significantly exceeded all the compared varieties in seed and fat yields. As to fat content it was only the Halix variety that came up to standard. Moreover, the Brilland was characterized by a high 1000 grain weight, being matched in this respect only by the Halix and Pollux varieties. It was, however, somewhat less winter hard than the Fero variety grown in this country in the regions with more severe winters. Marcus and Forto, French and Dutch varieties, as well as Wipol, Polish low-erucic variety, were significantly less winter hard than the Brilland, too. The winter hardness of the Sinus and K-2040 could not be assessed in the field as the winters in the trial years happened to be mild. Out of the varieties investigated, the Pollux grew the highest, while the Halix, Forto, Sinus and Wipol grew lower than the Brilland.

The analysis of the elements making up the yield structure carried out in 5 experiments in Agricultural Academy of Poznań (Table 2) revealed that the Brilland owed its high yield, above all, to its large seeds (a high 1000 grain weight), as the number of seeds in a silique as well as the number of siliques in an area unit were both smaller than of some native and foreign varieties. The differences in seed yields of some varieties, as demonstrated in Tables 1 and 2, are indicative of higher soil requirements of Halix, Rapol, Wipol, Sinus and K-2040. Those varieties, in better soil conditions of the Agricultural Academy experiment station, had higher yields and came up nearer to the standard than in the field trials of COBORU. The data listed up in Table 2 also indicate that the Polish varieties Fero and Wipol were less lodging resistant than the foreign ones while the Brilland was so only in comparison to Marcus from France and Halix and K-2040 from Poland.

Table 1: Results obtained in field trials of COBORU

Varieties	Number of trials	Seed yield	Fat content	Fat yield	1000 grain weight	Winter hardness	Plant height
A. High erucic							
Brilland=Górczański /PL/	119	26,7q/ha	46,7%	1102 kg/ha	5,3 g	$6,7^{\circ}$ +/	134 cm
/Standard/		=100	=±0,0	=100	= 100	= 100	= 100
Fero=Skrzeszowicki /PL/	119	96^{x}	$-1,2^{xx}$	93^{xx}	90^{xx}	104^{x}	98
Halix=Dolnośląski /PL/	119	92^{xx}	-0,4	91^{xx}	98	100	94^{xx}
Pollux=Gross Lüsewitzer /GDR/	96	97^{x}	$-1,6^{xx}$	92^{xx}	98	102	105^{xx}
Rapol /GFR/	91	93^{xx}	$-0,9^{x}$	92^{xx}	94^{xx}	98	99
Norde /Sweden/	67	90^{xx}	$-2,5^{xx}$	85^{xx}	92^{xx}	100	97
Marcus /France/	55	86^{xx}	$-0,7^{x}$	85^{xx}	83^{xx}	93^{xx}	100
Forto /Holland/	55	81^{xx}	$-2,2^{xx}$	78^{xx}	80^{xx}	90^{xx}	91^{xx}
Panter /Sweden/	46	96^{x}	$-1,1^{xx}$	93^{xx}	92^{xx}	101	101
B. Low-erucic and 0-erucic							
Wipol /PL/	82	67^{xx}	$-2,2^{xx}$	64^{xx}	80^{xx}	86^{xx}	90^{xx}
Sinus /Sweden/	36	80^{xx}	$-3,1^{xx}$	75^{xx}	83^{xx}	-	94^{xx}
K-2040 /PL/	29	76^{xx}	$-3,3^{xx}$	70^{xx}	85^{xx}	-	99

x significantly different from standard at P=0,05
xx significantly different from standard at P=0,01

+/ when 9° = winter killed less than 5 % plants
when 1° = winter killed more than 95 % plants

Table 2: Yield structure in experiments of Agricultural Academy in Poznań

Varieties	Elements of yield structure			Seed yield	Lodging resistance
	Number of siliques per sq. m.	Number of seeds per silique	1000 grain weight		
Brilland (standard)	2879 = 100	19,9 = 100	5,219 = 100	29,9 q/ha = 100	$6,5^{o}$ * = ± 0,0
Fero	109	96	90	95	- 1,1
Halix	105	98	99	102	+ 0,5
Pollux	102	99	95	96	- 0,1
Rapol	108	98	93	99	- 0,1
Norde	106	95	91	92	- 0,4
Marcus	101	110	77	88	+ 0,3
Forto	101	105	76	82	- 0,5
Panter	110	93	93	96	- 0,6
Wipol	97	108	77	81	- 1,1
Sinus	109	95	80	84	± 0,0
K-2040	96	107	84	87	+ 0,5

* when 9^{o} = no lodging
when 1^{o} = total lodging

In the experiments carried out for 6 successive years in the Agricultural Academy of Poznań detailed observations and measurements were made of 14 features characterizing 9 Polish , 10 Swedish, 6 German, 3 French, 2 Dutch and 2 Russian winter rape varieties. The were: seed yield, number of plants per m^2 at harvest, top bud elevation above ground before winter, plant losses during winter, length of stem forming period [1], length of flowering period, length of ripening period, lodging resistance, plant height at harvest, number of siliques per plant, number of seeds per silique, 1000 grain weight, fat content in seeds and straw yield. On the basis of those determinations were calculated the correlation coefficients among all the morphological characteristics of winter rape, multiple correlation coefficients between the seed yield and 13 morphological features observed at partial coefficients of multiple regression (Tables 3 and 4).

Out of the features directly conditioning the seed yield the effect of plant number in an area unit, of silique number in an area unit and of 1000 grain weight proved to be significant (Table 3). The values of the correlation coefficients indicate that the seed yield decreased as the plant number in an area unit increased because the silique number per plant and the seed number per silique decreased. At optimal density the plants branched better and not only formed as many siliques in an area unit as those densely growing, but also contained more seeds in a silique. The number of plants in an

1) from the beginning of spring vegetation to the beginning of flowering

Table 3: Correlation coefficient among morphological characteristics of winter rape

Characteristics	Confidence interval for the mean of 6 years	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Number of plants per m^2 at harvest	41-51	-													
2. Top bud elevation above ground before winter -mm	24,6-29,6	-	-												
3. Plant losses during winter %	25,7-33,6	-	.325	-											
4. Stem formin period - days	42-45	.618	-.174	.273	-										
5. Flowering period - days	24-26	-.131	.744	.405	-.223	-									
6. Ripening period - days	32-33	-.312	-.062	.459	.178	-.426	-								
7. Lodging resistance-grade +	6,2-6,7	-.617	.470	.236	-.542	.274	-.101	-							
8. Plant height - cm	135 - 140	-.415	.207	.128	.243	.363	-.299	-.134	-						
9. Number of siliques per plant	77-92	-.809	.078	.101	-.545	.114	-.269	.489	-.436	-					
10. Number of siliques per m^2	3085-3224	.057	.401	.055	.001	.450	.046	.032	-.012	.186	-				
11. Number of seeds per silique	19,0-19,8	-.258	.080	.744	.221	.188	-.501	.193	.130	.090	-.321	-			
12. 1000 grain weight - g	4,67-4,90	-.049	-.222	-.423	-.127	-.395	.636	-.025	-.291	-.199	-.250	-.502	-		
13. Fat content in seeds - %	44,6-45,1	.110	-.154	.208	.194	-.479	.610	.060	-.427	.009	.006	-.191	.354	-	
14. Straw yield - q/ha	60,5-62,8	.020	.177	.134	.151	.228	.087	.053	-.104	-.079	.200	-.107	.083	.041	
15. Seed yield - q/ha	28,3-29,5	-.225	.240	-.333	.128	.220	.263	.168	-.153	-.001	.380	.154	.369	.199	.451

Note: The correlation coefficient higher than .198 significant at P = 0,05
The correlation coefficient higher than .257 significant at P = 0,01 /underlined/

+/ when 9^o - no lodging
when 1^o - total lodging

Table 4: Multiple correlation between seed yield and some morphological characteristics of winter rape at P = 0,05

	Characteristics	Multiple correlation coefficients	Partial regression coefficients (normalized)
1	1000 grain weight - g	0,3591	0,5057
2	Flowering period - days	0,5127	0,5259
3	Stem forming period - days	0,5967	0,3862
4	Number of plants per m^2	0,7155	-0,2741
5	Ripening period - days	0,7480	0,2712
6	Number of seeds per silique	0,7758	0,3089
7	Straw yield - q/ha	0,7905	0,2235
8	Plant height - cm	0,8035	-0,2080

area unit had no significant effect on the 1000 grain weight. The 1000 grain weight decreased as the number of seeds per silique as well as the number of siliques per plant and area unit increased.

Out of the features bearing an indirect effect on seed yield, that of winter hardness and length of spring development period proved to be significant. Of decisive importance for the winter hardness of a variety in Polish climate conditions was not only its absolute frost resistance, but also the altitude at which the top bud was elevated above ground before winter. It was pointed out in the calculus of multiple correlation that out of the 13 features investigated, the seed yield is significantly effected upon, directly or indirectly, only by the eight specified in Table 4. Those features accounted for 80 % of the seed yield (r = 0,8035), the share of the 5 remaining ones being as small as 1 %. Out of the 8 features bearing a significant effect on the seed yield, that of the 1000 grain weight was the greatest, then came the length of flowering period, the length of stem forming period and the number of plants in an area unit followed by the length of ripening period, the number of seed per silique, the straw yield and the plant height.

The regression equation of seed yield taking into consideration all the eight above mentioned features is as follows:

$$Y = -16,1750 + 2,7570\, x_1 + 0,3704\, x_2 + 0,1904\, x_3 - 0,0371\, x_4 + 0,2318\, x_5 + 0,4559\, x_6 + 0,1190\, x_7 - 0,0558\, x_8$$

References

1. ELANDT, R. (1964): Statystyka matematyczna w zastosowaniu do doświadczalnictwa rolniczego. PWN Warszawa

2. MATYSIAK, Z. (1974): Rzepak i rzepik ozimy - wyniki doświadczeń odmianowych z lat 1968/69 - 1972/73. COBORU-Słupia Wielka nr. 5, 39, 72, 113 (in press)

3. MUSNICKI, Cz. (1974): Luczkiewicz T. - Współzależność i odziedziczalność niektórych cech u rzepku ozimego (Brassica napus var. oleifera) (in preparing to the press)

4. TORSELL, B. (1959): Hardiness and survival of winter rape and winter turnip rape.
Vaxtodling (Plant Husbandry) 1-168