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CHANGES IN FATTY ACID COMPOSITION OF SEED OIL OF RAPE HYBRIDS DUE TO DECREASING PROPORTIONS OF ERUCIC ACID

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Extensive investigations carried out lately on the change in fatty acid composition of rape seed oil have shown that this composition is dependent on genetic factors rather than on thos of the environment and cultivation (APPELQVIST, 1968).

The paper is concerned with the genetic factors and aimes at finding what changes occur in fatty acid composition as the erucic acid content in rape hybrid oil decreases from 1 to 0 percent. It is a continuation of the author's previous paper (WOYKE & KRASNODEBSKI, 1971) on fatty acid composition changes due to the decreasing share of erucic acid from over 50 to 1 per cent.

Material and Methods

The investigations were performed on seed oil from the F_8 and F_9 hybrids of Skrzeszowicki winter variety and the zero erucic form of Liho spring variety. The hybrids came from the breeding field of the institute.

Fatty acid composition analyses were conducted on PYE Unicam-104 gas-chromatograph with a flame ionization detector and a steel column 5 feet long and 4 mm in inner diameter. The column was packed with a mixture of equal parts of 10 % PEGA (polyethylene glycol adipate) on Chromosorb W and 12 % DEGS (di-ethylenen glycol succinate) on Chromosorb W. Carrier gas - argon - flow rate 35 ml/min, auxiliary gases: hydrogen - flow rate 35 ml/min, air flow rate 450 ml/min. The temperatures of the column, detector and sample injector were 190° C, 240° C and 200° C respectively.

The oil extracted from the seeds with ether was saponified and esterified using 0,5 N methanol KOH solution and 14 % methanol BF_3 solution (boron trifluoride). The ester dose chromatographically analysed was 5 ul.

The contents of 7 fatty acids normally exceeding 1 % were read in chromatograms. The fatty acid composition of 153 hybrids with less than 1 % of erucic acid and of 145 zero erucic acid hybrids were chromatographically analysed.

Results

The changes in fatty acid composition owing to the decreasing share of the erucic acid from 1 to 0 % are presented in Table 1.

On comparing the fatty acid composition of erucic acid free hybrids and of those containing an average of 0,54 % of erucic acid some slight changes in the contents of other fatty acids could be noticed. The mean shares of

Table 1: Fatty acids mean share ($\bar{x}$), their share fluctuation (min.-max.) and variation coefficient (V%) in dependence on erucic acid share

Hybrids	Characteristics	Palmitic acid $C_{16:0}$	Stearic acid $C_{18:0}$	Oleic acid $C_{18:1}$	Linolic acid $C_{18:2}$	Linolenic acid $C_{18:3}$	Eicosenoic acid $C_{20:1}$	Erucic acid $C_{22:1}$
less than 1% erucic acid	$\bar{x}$	4,38	1,76	56,75	23,60	11,00	1,97	0,54
	min-max	3,50-5,54	1,19-3,31	49,12-64,97	18,24-28,74	7,65-15,36	1,27-5,13	0,08-0,98
	V%	9,68	15,85	5,13	8,68	14,69	20,71	43,09
zero erucic acid	$\bar{x}$	4,45	1,76	58,07	22,50	11,53	1,69	0,00
	min-max	3,13-5,83	0,98-2,49	48,36-64,59	16,48-32,99	6,50-15,70	0,63-4,11	-
	V%	10,48	15,77	5,58	10,67	14,50	21,89	-

oleic, linolenic and palmitic acids increased by 1,32 %, 0,53 % and 0,07 % whereas those of linolic and eicosenic acids decreased by 1,10 % and 0,32 %, respectively. It was only stearic acid whose mean share did not change (Table 1).

The share fluctuations of the acids studied and their variation coefficients (V%), except for linolic acid, did not differ much in the two kinds of hybrids. The variation of the erucic acid share was, of course, the greatest (V=43 %), that of the eicosenoic acid share was rather great, those of stearic and linolenic acids were hardly so great while that of the oleic acid was the smallest. The absence of the erucic acid was accompanied by an increased variation of linolic acid share which found its expression in lowering its minimal content by 1,7 % and raising its maximal content by 4,3 %.

The fatty acids correlation and respective regression coefficients in the two kinds of hybrids are shown in table 2.

The largest share of the oleic acid was correlated with those of the other acids except for the erucic one, the correlation with stearic and eicosenoic acids being significant only in zero erucic hybrids. All the correlations were negative but the weak one with stearic acid. The correlation with linolic acid was the strongest, that with linolenic acid was strong, that with palmitic acid being strong in low erucic hybrids but weaker in zero erucic ones.

There was no correlation between the oleic and stearic acids as in the results by KRZYMANSKI and DOWNEY (1969).

More interesting than the behaviour of the oleic acid share was that of the linolic and linolenic acids. As the erucic acid withdrew, the mean linolic acid share decreased and that of the linolenic acid slightly increased. This was accompanied by an increase in the variation also expressing itself in a desired higher maximal linolic acid content and lower minimal linolenic acid content. Although the higher linolic acid content is correlated with the higher linolenic acid content (THIES, 1968) in the hybrids under study this correlation was not found despite its occurrence in younger generations ($F_{1,2,3}$) of the same hybrids with larger erucic acid share variation (WOYKE & KRASNODEBSKI, 1971). This correlation was found weak by KRZYMANSKI & DOWNEY (1969), pretty strong in 2 out of 4 populations by STEFANSSON and STORGAARD (1969). It can thus be thought to depend on the genetic features of the material bred, which would corraborate THIES' assumption (1968) that there may be found some materials in rape with their fatty acids composition breaking this correlation.

Conclusions

The results of fatty acids composition changes of rape hybrids due to decreasing erucic acid share from 1 to 0 % allow to draw the following conclusions:

1. The withdrawing erucic acid share was positively correlated only with that of eicosenoic acid.
2. The oleic acid share was negatively correlated with those of the linolic, linolenic, eicosenoic and palmitic acids.
3. No correlation was found between the shares of linolic and linolenic acids.

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