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TRENDS AND PROSPECTS OF BREEDING OIL-BEARING SUN- FLOWER IN POLAND

Poland's soil-climatic conditions are considerably less favourable for sunflower than in the major regions of this crop in Europe. This especially concerns temperature which is 14.9°C in Poznan from April to September, which is 4°C less than in Krasnodar. The sum of mean temperatures is over 10°C from April 15 to September 15 and in 1972-1974 fluctuated from 2140°C to 2290°C; only in 1975 was it exceptionally high, reaching 2646°C.

The rainfall in June, which is more heavy than in Krasnodar, and a considerably lower temperature of the air create conditions that do not favour sunflower pollination. During maturation (the end of August) air temperature is also very low and is not conducive to the drying up of plants. Crop dessication is therefore necessary before harvesting.

These difficulties do not exclude, however, the possibility of cultivating oil-bearing sunflower in certain regions of the country, but they make breeding a much more complicated affair and set up many other major obstacles.

The appropriate selection of forms assuring the highest possible and significant yields is of basic importance for the future of sunflower production in Poland. Very few data have so far been collected to enable one to compare the productive value of population and synthetic varieties and of line hybrids. But if we take into account that Poland's natural conditions are not so favourable for sunflower we will be led to say that most attention has so far been paid to less capricious and more adaptable

varieties-populations. At the same time, our own research and data from other countries confirm a very high potential yield of hybrids. It is however pointed out that this potentiality manifests itself under the optimal environmental conditions.

Oil sunflower breeding in Poland is aimed at obtaining varieties or hybrids giving no less than 200 kg/ha of seeds in the field, having over 45% of oil in seeds and whose period of vegetation (from sowing to yellow ripeness) is no more than 130 days a year. The plants' height is planned to be not more than 120-125 cm.

These basic parameters are represented in Table 1 against the background of their general variability (something that has been revealed in Poland in various breeding materials) and against the background of the mean values of some characters exhibited by the Polish variety Wielkopolski in state trials between 1971 and 1974 (Z. Matysiak, 1971-1975).

This variety is another step towards adapting sunflower for cultivation in this country. It is of low height, early ripening and had a high yield in the COBORU state trials. Its mean seed yield was 243 kg/ha in 1973-1975 and was 21 kg/ha more than the yield of the Voskhod variety, 51 kg/ha more than the yield of the Salyut variety and 15 kg/ha more than the yield of the Avangard variety (Z. Matysiak, 1971-1975).

Table 2 presents results of our own experiments at the Borovo Experimental Station in 1973-1975 in which foreign hybrids or varieties divided by groups were compared in relation to the Wielkopolskie variety. There were few forms with the height close to that of the Wielkopolskie (HS-18; HS-20; HS-90; HS-262-73; 34Fca) and their yields were similar to that of the latter.

High varieties and hybrids generally had a higher seed yield. However, some of them did not differ from the Wielkopolskie variety in

the seed and oil yield.

Among the forms with a high yield there were in particular hybrids HS-62M (Fundulea), 86Fca; 26C₃ (Clermont Ferrand) and varieties

Record and Avangard.

The results of the experiments were an added proof of the correctness of breeding varieties-populations of the Wielkopolskie type. They also underlie a further research into early and low hybrids with a steadily high yield.

The breeding of population varieties helps steadily improve the Wielkopolskie variety and on the other hand to obtain promising materials as a result of intervarietal crossing.

This purpose is above all served by the new Soviet high yield and oil varieties with a shortened period of vegetation, such as Voskhod, Avangard, Salyut, and Chernyanka 66.

A most important problem of heterosis breeding in this country is the obtention of inbred lines with the excellent performance of major characters, i.e. those that have sufficiently high yield, are resistant to diseases and have a high combining ability.

Heterosis as expressed in the height of plants requires plants of not more than 100 cm in height to be selected for crossing, whereas heterosis aimed at enhancing the content of seed oil makes it possible to use lines with a small oil content (41-42%). The length of the vegetation period in F₁, approximated to the earlier parental form, facilitated the adaptation of hybrids to the Polish climatic conditions. In 1975, 840 lines were tested at the various levels of inbreeding (J₁ - J₁₈), 79% of which were lower than 110 cm.

Sample variety-line hybrids compared in the 1973-1974 experiments have enabled us to conclude that some lines have a very high

Table 1

Variability of the Major Traits of Sunflower
in Poland, Aims of Breeding and Character-
ization of the Wielkopolskie Variety

Trait	Variability interval	Aim of breeding	Mean indices of variety Wielkopolskie I
Vegetation period, days	100-160	<130	138
Plant height, cm	45-190	<125	126
Seed yield, kg/ha	80-500	<200	234
Oil yield, kg/ha	20-220	>90	94
Oil content in seeds, %	30- 54	>45	45.2
Huskness, % ...	19- 51	<25	27.6

combining ability. It should be stressed that record seed (over 400 kg/ha) and oil (over 190 kg/ha) yields were obtained not only in the combination with over 140 cm in height, but also in the plants whose height was considerably lower.

It is planned to obtain hybrids exclusively on the basis of cytoplasmatic male sterility (CMS). In 1975, 89 lines were transferred onto the CMS basis, of which 14 were transferred after 4-5 back-crosses. In 1976 the first line hybrids will be obtained.

Component lines of synthetic varieties are being selected on a limited scale. Sample synthetics have so far been obtained. These, however, did not bring the expected results

Table 2

Differentiation of Foreign Sunflower Varieties and Hybrids in
Relation to the Wielkopolskie Variety (V)

1973-1975 experiments

Group	Varieties (O)	Height	Seeds yield	Oil yield
	Hybrids (M)	1973 1974 1975	1973 1974 1975	1973 1974 1975
$O/M \rightarrow /W + txs_D /$	O	6 6 3	3 3 1	4 4 1
	M	12 5 37	11 1 24	9 1 12
$O/M = /W + txs_D /$	O	2 2 4	3 3 3	3 2 2
	M	2 2 3	6 6 16	5 6 29
$O/M < /W - txs_D /$	O	1	1	1
	M			
Number of hybrids of varieties				
Number of combinations compared	21 13 45	21 13 45	21 13 45	21 13 45
Mean indices of traits of the Wielkopolskie variety / W /	104 124 cm	121 cm	270 kg/ha	180 kg/ha
	250 kg/ha	120 kg/ha	80 kg/ha	120 kg/ha

as their yields were at the level of the Wielkopolskie variety or even lower.

The population varieties cultivated in Poland largely provide the seed yield of 200 to 250 kg/ha. In the years to come breeding will be geared to raising the potential yield to roughly 250-300 kg/ha, i.e. by 50 kg/ha. Such an increase is possible in the Wielkopolskie variety and quite feasible in the hybrids. In Poland the seed yield will be only a fraction lower than in the south of Europe, though it will be very difficult to obtain such a high mean oil content in seeds as is available, for instance, in Krasnodar.

Apart from breeding, improved agronomy also presents many opportunities for raising sunflower yields. Yields of production experimental crops were 158 kg/ha in 1969-1974, which is an average of 71% of collective sample productivity in state commercialized experiments.