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SUNFLOWER COLLECTION SERVES PLANT BREEDING

A collection of cultivated sunflower arranged in the N. Vavilov USSR Plant Breeding Research Institute from samples taken from all over the world numbers more than 1,200 samples, while some 300 samples undergo preliminary studies.

500 collection samples are studied at the Institutes three experimental stations. The Kuban Experimental station studied the whole sunflower collection in 1974-1975. The results are now processed by computers according to a special programme and will be presented as reference books.

We use a stage-by-stage system of evaluation and studies of the sunflower collection. Agronomical practices are the same on all breeding farms. Working plots are 10-12 m², placing of plants are 70x70, two in a nest.

The first stage is a preliminary study. This is mostly a new initial material obtained by means of exchange and picking during expeditions. The basic phenological observations, detailed description and dynamics of development, and major measurements are conducted at the first stage. The place of a sample in the system of intraspecific classification, type and prospects of its use are determined. The duration of studies is 1-2 years. The best samples are transferred to the second stage.

The second stage is devoted to profound studies. The farm consists of sheaves compiled according to the vegetational duration: early average and late matured, and the types of usage for varietal, heterosis and ensilage breeding. The basic difference from the first

stage lies in the evaluation of cropping power per unit of area. Two replications are used.

The studies last 2-3 years. Selected samples are passed on to the third stage of studies evaluation of the general combining (GCA). A topcross method is largely used in combination with chemical castration of maternal plants by gibberelline solution at the 0.005% concentration. The methods have been publicised and we do not therefore deal with them in detail. Hybrids F_0 are obtained on separated plots in necessary quantities. 16 testers and, over 100 samples have been studied as maternal forms. Hybrids F_1 have been studied on the check farm in three replications. The standard Peredovik variety is sown in each of 8 plots. The GCA level is determined by the 5 mark - scale as compared to the standard, which makes it possible to single out practically valuable combinations (Table).

Maintaining collection samples in living and unchangeable state in terms of population is a very important task which constitutes a special programme that will not be discussed here.

The collection is very diverse and in the majority of morphobiological features the differences between samples are enormous, e.g. dwarfs from 0.8 m and giants up to 4.5 m, early samples maturing on the 60th day from seedlings and late with the maturation period of over 140 days. Varietal breeding has not made practical use of this vast genofund, for practically all Soviet-bred varieties have been created as a result of recurrent selection from one initial population. The use of the collection in variety breeding is now hampered by the "huskness barrier": all Soviet-bred varieties are thin-husked (20-25%) and all collection samples are rough-husked (32% and more).

In the recent decade the "yield barrier" has been in the way of further progress of breeding. To overcome it both by varietal and

Table

Scale of Evaluating the CA According
to the Seeds' Cropping Ability

Combining ability	Mark	Hybrid cropping capacity in % to the standard Peredovik variety	<u>Example</u> Placing accor- ding to seed cropping abi- lity of F ₁ hy- brids in 1973
Very low	1	to 85	4
Low	2	86-95	19
Average	3	96-105	81
Good	4	106-115	89
High	5	over 115	39
			The cropping ability of the standard 25.6 <u>+0.6 c/ha</u>

especially heterosis breeding it is necessary to use the genofund on a wide scale. It has been experimentally proved that crossing of genetically different forms gives the maximum heterosis effect. Samples with a high and good GCA have been singled out. The GCA frequency in the portion of the collection under study is 8%. Among the Soviet varieties these are largely varieties bred by the VNIMK Armavir Experimental Station: Sputnik, Armavirets, Armavirsky 1813. From foreign varieties they are K-820 (from Yemen), K-2035 (from Argentina), K-2042 (from France), K-2080 (from Iran), K-2153 (from Finland), and others. However, direct use of these samples as parental forms is not effective due to the huskness barrier (rough husk is dominant and in some cases there is economically negative heterosis in this feature).

We proved experimentally on the collection samples K-1538, Armavirsky 1813, K-1113 from France, K-2040 from Argentina, K-2176 from Morocco and on some others that the husk decrease to the optimal level (22-25%) is possible during 3-4 generations. This opens up vast prospects for the use of the collection in breeding practices.

The use of quantitative features of the best collection samples is a must. A lot of water flow under the bridges before plant breeders give a due evaluation of the diverse initial material. The use of qualitative features is already possible in hybrid seed production. Work to single out marker features from the collection, their identification and singling out of heredibility patterns has been done for several years. Over 20 marker features have been made homozygous and artificially created; many of them are inherited according to a monofactorial pattern and can be easily used in practice. Of special interest are colour mutations which can be easily found even in a big mass of sunflower.

The collection of cultivated sunflower is acquiring greater importance in practical breeding. However, the vast opportunities of the sunflower genofund that are mainly concentrated in the annual wild forms are still not used properly; it is they, we firmly believe, that will promote further fundamental progress in sunflower breeding.