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GENETIC PREREQUISITES OF ORDINARY SUNFLOWER FOR THE CREATION OF THE PRODUCTIVE MULTI-HEAD TYPE

In Czechoslovakia's climatic conditions one limiting factor for breeding effective oil-bearing sunflower varieties is above all excessive moisture during the ripening of seeds. Relatively more early-ripening varieties are therefore more efficacious there, because they can produce a bumper seed yield even under a shortened period. Sunflower types possessing such properties can be used in regions with a cooler climate, and also in regions in which long draught during increased demands for sunflower moisture hampers effective growth.

Such sunflower types are above all short in height and early ripening. These properties, however, are directly connected with smaller heads and the number of seeds, as well as with the yield per head. Decreased yield can partially be made up for by an increase in the number of plants per unit of area and by growing two or more heads of equal value on one plant.

Sunflower production populations are as a rule represented by one-head, non-branchy type, while the new ideotype is represented by branchy plants. The branchy types current in sunflower populations cannot be used to attain the multi-head ideotype because the heads ripen at different periods and are located at varied heights on the plants which prevents mechanised harvesting. These deficiences are however excluded in the above four types of sunflower with many heads.

Multi-Head Forms Potentially Possible to Attain Sunflower Ideotype

Two multi-head types based on branchiness and the other two on the bifurcation of heads. The so-called palmette branchiness is a type with one or two large branches behind the cotyledonous leaves. The branches take shape very soon, so that their heads do not almost differ in size from the main head. Adjacent heads are several centimetres below and ripen at the same as the main head. There is no other bran branchiness either on the main stalk or on the branches. The palmette branchiness satisfies the basic requirements for creating the sunflower multi-head ideotype, while its defects include large branches which hamper inter-row cultivation. The so-called fascicular branchiness is similar in its characteristics to palmette branchiness, but differs from it in that the opposite leaves are separated from the main stalk at a higher point. This makes for the plants' certain definite density and facilitates inter-row cultivation. In addition the branches are nearer to the top. From the angle of the ideotype, the first form of the bifurcation of the head means that both heads are similar in the type of ripening and size (when this form is represented by two big heads on the stalk's top). The main drawback is the modification in the realisation of particular features. The repetitious occurrence of this form has not yet been obtained in progenies of inbred plants.

The second type (the bifurcation of the head and the formation of an additional small head) is conditioned by heredity. The two heads are not equal in size, yet they ripen at the same time. The small head grows on the lower side of the receptacle of the main head, its diameter being roughly one quarter of that of the main head. One positive feature of the two types of bifurcation described is the smaller

volume of the plants than is the case of multi-head types based on branchiness.

Genetic Aspects of Some Multi-Head Types

The impact of inbreeding on the occurrence of the hereditary determined three multi-head types leads to a relatively rapid homozygotisation of this feature with the bifurcation of the head and the additional smaller head. The recessive basis of the feature can be judged by the circumstances of the inbreeding.

Fascicular branchiness can also in all probability be explained recessively, but the number of genes responsible for the realisation of the features concerned is apparently larger than in the preceding case. In the case of fascicular branchiness the situation becomes more complex due to the appearance of several modification phenotypes of the occurrence of the feature. These differences within the framework of the general phenotype of fascicular branchiness can be seen in the height of the branches' basis. The length of the juncture of the stalk with the branches can vary from 2 cm over the cotyledonous leaves to 5 cm under the stalk's top. A more frequent occurrence of fascioles has been noted in the lower third of the stalk and the nearest correspondences between separate modifications of fascicular branchiness has not yet been found. It can only be said that in both extreme cases the height of the branches' basis has been found in progenies with a different modification of this feature.

Palmette branchiness is not uniformly manifested in relation to the non-branchy phenotype. The population in which branchiness is only represented by the palmette type has a predominance over non-branchy phenotype. In the progeny of palmette branchy plants non-

Table

The Effect of Continuous In-breeding on the Homozygotisation of Different Multi-Head Types

Selection by realisation of a feature		Selection versus the realisation of a feature	
Generation	% of fascicular branchy plants	% of plants with an additional small head	% of palmette branchy plants
I_1	3.3	10.5	88.3
II_2	36.8	40.0	25.0
I_3	54.2	77.8	24.0
I_4	60.0	56.2	41.2
I_5	68.9		15.8
I_6	71.4		0
I_7	85.7		

branchy phenotypes are bifurcated not more than in 5 or 8% of replacement and the bulk of branchy plants are not bifurcated at all. In non-branchy plants a proportion of the palmette branchiness of the phenotypes is bifurcated after several in-bred generations in the progenies. A single non-branchy progeny was obtained only in the sixth in-bred generation.

When correlations are studied between palmette branchiness and the non-branchy phenotype from the population in which the standard-type branchiness takes over the palmette type, palmette branchiness is observed as recessive against the non-branchy phenotype.

From the angle of obtaining a multi-head sunflower ideotype it can be expected that following the crossing of the uni-head type with favourable production properties with some of the above types the multi-head type will in all cases be manifested as a recessively hereditary one. Owing to this the breeding of the multi-head production type necessitates the abandoning of the lines whose genotype does not contain genes conditioning the ordinary types of branchiness, and crossing them with some of the hereditary determined multi-head types mentioned above.