A. Kovacik,
V. Škaloud, CzSSR

CHANGES IN KERNEL-HUSK RELATIONSHIP IN SUNFLOWER INBREEDING-HETEROSIS SELECTION

The present trend of sunflower selection towards heterosis breeding has put some problems to breeders, the huskness being one of the important ones. The relationship between kernel and husk may be negatively changed under the influence of inbreeding, heterosis and the use of cytoplasmic male sterility and fertility restorers. Increase in huskness may be also related to the expansion of sunflower crops in new regions and its cultivation on highly fertilized and irrigated earth. In the present paper we deal with some problems concerning changes in kernel-husk relationship as a result of inter-line hybridization.

Experimental Results

Studying continuous inbreeding we have found a considerable decrease of kernel part in seed weight in I_1 Having reached homozygosis in I_5-I_6 the kernel part again increases almost up to the initial level. Comparing F_1 subcrosses with respective inbred generations we have found that sib-crossing does not considerably affect the kernel-husk relationship.

Inbreeding following sib-crosses continuously reduces the kernel part to F_5, the reduction being more pronounced than that in the case of inbreeding minimum without sibbing. In this case inbreeding minimum is expressed later and more obviously. Hence, sibbing results in such a state when inbred generations necessary for inbreeding minimum are started again but at a lower value of the trait than initial inbred generation.

That is why the kernel part reduces to a greater extent under the influence of inbreeding following sibbing than under continuous inbreeding.

Comparisons of different rates of sibbing have shown that inbreeding in its action does not significantly differ from crossing half-sib lines. Further we have found that crossing two clones originating from one plant reduces the kernel weight in the seed as compared with inbreeding. When sibbing is used the reduction is slowed down, and in the case of half-sibbing the kernel weight reaches the inbreeding level. When two unrelated lines originating from one population are crossed the proportion of the kernel weight surpasses that obtained by inbreeding. This extra is even more pronounced when two lines originating from different populations are crossed, that is, when both parents are different.

These general trends show that different forms of sibbing compared with inbreeding faster decrease the kernel part in the total weight of the seed. Half-sibbing and further increase of genotypic difference increase the kernel part.

Comparing the influence of inbreeding following two different types of crosses of different rates of relationship we may conclude that after sibbing we obtain a continuous reduction of kernel part in the seed weight in further inbred generations, while following the cross of two lines of the same population we obtain the kernel part reduction only in the first inbred generation. Finally, following the crossing of the lines of different populations reduction of the kernel part under the influence of inbreeding was not observed at all. These results show that homozygotation does not cease in sibbing, the variability of genotype is definitely expanded thus allowing a more perfect homozygotation than a continious inbreeding. Crossing lines of the same population or of different populations, on the other hand, leads to a state similar to the initial one before the start of

inbreeding.

Comparing parental lines with hybrids it is possible to determine the intermediary value of the kernel part even in hybrids expressing a high heterotic effect for other traits. Hybrids between lines originating from the same populations and weakly differing in huskness even expressed a reduction of the kernel part compared with the parents and showed a negative heterosis. Here the pattern is the same as in subbing where we cross two related genotypes with almost similar huskness and obtain reduction of the kernel part. The hybrids of the lines from two different populations with high huskness showed an intermediary pattern, the value of the kernel part coming closer to the value of the parent with a higher huskness percentage. Crosses of unrelated lines with low huskness also gave an intermediary value of the kernel part but the latter was closer to the parent with a higher proportion of the kernel.

Studying reciprocal crosses we observed in most cases a considerable influence of the male parent on the increase or decrease of the kernel percentage. In the case where the parental line showed a higher kernel percentage compared with the maternal one the hybrid expressed a higher part of the kernel, and vice versa, if the male parent possessed a lower kernel part the hybrid showed the lower kernel percentage. This phenomenon in linear hybridization is in accord with a similar one previously found in inter-varietal hybrids (Kovacik, 1958).

Heterotic effect for the kernel part in the total weight of the seed was not expressed at all. When comparing hybrids with the parent with lower huskness we observed kernel percentage reduction in all hybrids. As a rule, general combining ability of parental lines with low huskness is respectively expressed in hybrids, that is, hybrids show low huskness.

Though, some exceptions necessitate determination of specific combining ability even for this trait.

In one group of hybrids we have studied the relation of the kernel part per the seed's weight to other yield components. The correlation showed that huskness is not closely related to oil percentage or to the weight of 1000 seeds. On the contrary, huskness is rather closely related to the head diameter and to the weight of seeds from one head. Large heads with a high seed yield had an increased proportion of the husk to the weight of the seed. As a result of heterotic effect hybridization clearly increases the seed yield, but the kernel part in the weight of the seed is remains at the level of the mean parental value. These relationships show that with the yield increase the husk percentage grows more than the kernel proportion per weight of seeds.

If we compare the two main parts of sunflower seed we see that the weight increase is mostly accounted for by that of the achene's husk. From the point of view of oil yield this is the result of a negative influence of inbreeding-heterosis selection of sunflower. To obtain the necessary ratio between the kernel and husk in hybrids it is necessary to utilize parents with a large kernel percentage.