Progress continues on the Inman plan which uses crosses between lines which have an increasing number of interchanges in common.

C. R. Burnham and Paul Yagyu

7. Segregation for quantitative characters in crosses with multiple interchange stocks.

Tests for possible association between quantitative characters and a 06 and a 08 were repeated in 1961. The general plan was to test F_1's made up as (Inbred A x 06 Inbred B) and also as (Inbred B x 06 Inbred A). Parents, F_1's, F_2's and backcrosses to each parent were grown in a trial with 4 replications. Growth conditions were much more favorable than in 1960 (Newsletter #35 p. 87).

A preliminary examination of the data shows a difference for one of the F_1's but not for the other for height to base of tassel. This showed a significant difference in the 1960 trials.

Paul Yagyu and C. R. Burnham

Assisting in the above work also were Ken Kasha, Jerome Arnold, and Gerald M. Welch. The work with multiple interchanges and related studies was supported by a Rockefeller Foundation Grant.

8. Dominance of genes controlling grain yield in corn.

Comstock and Robinson (1952) outlined an experimental approach for investigating level of dominance in the action of genes controlling quantitative traits which utilizes populations derived from crossing two homozygous lines. They pointed out that linkage equilibrium of genotypic frequencies cannot be anticipated in early generations of such a population. They further demonstrated that estimates of genetic variances would be affected by linkage disequilibrium so that the proposed measure of dominance would be biased upward until equilibrium was established. In order to investigate the effect of linkage disequilibrium upon estimates of dominance they recommended that data be obtained for the same single cross population in the F_2 generation and again in later generations when linkage equilibrium will have been approached.

This approach has been effectively employed at North Carolina (H. F. Robinson and co-workers) and at Nebraska (C. O. Gardner and J. H. Lonnquist) in studies on grain yield. Overdominance would have been inferred on the basis of F_2 generation data in these studies if the possible effect of linkage had not been considered. However, results from their advanced generation evaluations conclusively indicate that linkage disequilibrium existed and had the anticipated effect. Level of dominance estimates in the most advanced generations studied were fully compatible with the hypothesis of only partial dominance at all loci. However, these results do not preclude the possible existence of a range of dominance effects, i.e., partial dominance at many loci, but with overdominance at a sufficient number of loci to be of consequence with respect to population dynamics. The purpose of this study is to obtain more decisive information to distinguish between these two possible situations.

The experimental plan is to augment the approach reviewed above by selection in such a way to shift gene frequencies so that loci exhibiting partial to complete dominance will contribute progressively less to the results. Initial gene frequencies at segregating loci will be 0.5 in populations derived from crossing two homozygous lines. Continued selection should cause frequencies for the non-overdominant loci to approach either 1.0 or zero. In the case of overdominance selection favors the heterozygote so that gene frequency approaches an equilibrium value that will be in the range 0.2 to 0.8, unless the heterozygote advantage is very slight. If overdominance (of genes affecting grain yield) is present in more than a trivial amount its detection in this way will be more probable. Conversely, if negative results are obtained, the case against overdominance will be enhanced.

F_2 generation backcross matings have been made in two single cross populations for evaluation of genetic variances and corresponding level of dominance for grain yield in 1962. The population exhibiting the greatest level of dominance will be continued for this study. Following advancement to the F_5 generation this population will be divided into two groups: a control group which will be advanced by sib mating and a select group which will be subjected to full sib progeny test in every other generation of sib mating. Effectiveness of selection for increased grain yield will be determined in field trials following each cycle. The F_2 and advanced generations of the control group will be evaluated for estimation of level of dominance. The control and select groups will be evaluated for comparison of dominance estimates upon completion of three selection cycles when both groups are in the F_{11} generation. Completion of this study is expected to require a minimum of five years with the utilization of an overwinter nursery.

J. C. Sentz

9. Inheritance and linkage relations of genes for a serpentine character in Zea mays.

An S_2 culture from the cross A495 x Red 30 made in 1958 produced plants with varying degrees of undulation in the lower portion of the stem. The extreme type has a serpentine appearance. The A188 interchange series is being used to determine location of the gene(s) controlling this character.

Alejandro Violic
E. H. Rinke

10. Association test between interchanges and multiple ear character.

Inbred E41 produces two almost identical ears per stalk. The pedigree indicates the multiple ear character was derived from Minnesota 13 variety. In order to determine the locus (loci) responsible for this character the 22 stocks of the all arms interchange tester series in A188 background (selected by Burnham and Longley) were crossed with E41 with the heterozygous interchange stocks as female parents. Semisterile F_1's were backcrossed to A188 and also crossed to F_1's within the stock.

Johng K. Lim
E. H. Rinke