2. Competitive pollen tube growth.

Competitive pollen tube growth studies provided by making use of pollen mixtures from yellow and white sources were reported previously (M. N. L. 1958, 1959). Pollen mixtures in which one or the other component was doubled in amount were studied and the results indicate that where the superiority of say the yellow component was clearly observed when equal amounts of the two components were used, the yellow pollen retained its superiority significantly even though the pollen from the white source was doubled in amount. Hence, it would appear that slight differences which would normally occur when making up pollen mixtures would not affect the results materially, and that the differences observed in such studies must be mainly of a genetic nature.

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3. Pollen tube growth and combining ability.

As reported in a previous number of the newsletter, our studies on the behavior of maize pollen in pollen mixtures (from plants carrying different endosperm colors) led us to suspect that a correlation existed between combining ability and the capability to produce an excess of progeny over that of the other pollen in the mixture. Certain Russian workers reported the same suspicion. This has been tested in a pollen mixture and yield trial experiment with 103 entries. It was found that no such correlation existed between the ratios of kernels produced by the two types of pollen and the ratios of the yields of the pairs of progenies. A significant correlation was found, however, between the ratios of progenies produced on different female parents by the same pollen mixture and the ratios of the progeny yields.

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4. Comparison of two methods for estimating additive and dominant components of genetic variance for yield.

In an experiment designed to test five open pollinated South African maize varieties for differences in additive (G) and dominant (D) components of genetic variance for yield, two methods were used. The first method was based on a comparison of intra-class correlations of full sib and half-sib families as proposed by Fisher (1918) as reported in last year's newsletter. The second method used is similar to that of Comstock and Robinson using biparental progenies, analyzed according to the method developed by Comstock and Robinson (Biom. 4:254). The results of both methods are given in table 1.

Table 1. Estimates, derived from two methods, of dominant (D) and additive (G) components of genetic variance for yield in different varieties of maize.

Variety	First method (full sib-half sib comparison)			Second method (biparental progenies)		
	No. of Progenies	D	G	No. of Progenies	D	G
Anveld	48	13.00	3.60	60	-2.48	6.84
Teko	52	1.20	7.72	116	-0.44	4.96
Sahara	48	-5.64	7.92	72	0.20	4.20
Robyn	48	0.12	8.20	80	11.16	0.16
American white flint	58	-6.92	4.16	75	-4.88	9.64

Although the main aim of this experiment, namely the comparison of different varieties with respect to their dominant and additive variance components, was not achieved satisfactorily, the data did allow a comparison of the two methods which seem to be in fair agreement with each other. Estimates of D for individual varieties using either method seem to fluctuate around a positive value quite small when compared to that of G. Differences between varieties are not consistent over different methods but are probably due to sampling errors (as indicated by the negative values which by definition are impossible.)

The high G:D ratio obtained agrees with the results of Robinson et. al. (Genetics 40:45) and the same conclusion may be drawn, nl. that true overdominance can hardly explain the amount of hybrid vigour commonly found in maize.

An assumption to which the theory employed in the above studies was subject is the lack of epistasis. Cockerham (Genetics 39:859) indicated that correlations between relatives contain only small proportions of the existing epistasis. Epistasis, therefore is not expected to bias the estimates of D and G much unless the amount of epistasis is considerable. Available data (Comstock, C. S. H. Symp. Quant. Biol 20:93) give little evidence for epistasis. Jinks (Her. 9:223) by means of the diallel method concluded that epistasis was important only in those maize inbreds that showed outstanding combining ability. The use of non-selected material to avoid upward bias of dominance estimates as a result of epistasis seems advisable.

Genotype-environment interaction could very well be an important source of error or bias in the above experiments. An extensive study with local maize variety crosses by van Schaik et. al (S. A. J. Agr. Sci. 1:423) stressed the importance of environmental interaction with heterosis. Rojas and Sprague (Agron. J. 44:462) found a large amount of environmental interaction with the specific combining ability for yield variance in maize.

In conclusion it may safely be stated that in non-selected open pollinated material of the type used in the experiments reported here the assumptions of no effective linkage or epistasis are plausible but that genotype-environmental interaction may have a pronounced effect on the results.

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5. Effect of inbreeding on variability of yield.

An extensive experiment was carried out to examine the effect of inbreeding on the variability of yield of five South African open pollinated varieties (Sahara, Teko, Anveld, American white flint and Robyn). Twenty of each of the following strains were developed from each variety:
1. Half-sib matings, F = 0.125
2. Full sib matings, F = 0.25
3. S_1-full sib mating, F = 0.375
4. S_1, F = 0.50
5. S_2, F = 0.75.

The experimental field was subdivided into 20 blocks. One strain taken at random from each of the five different degrees of inbreeding of each of the five varieties was grown in two separated replications within each of the twenty blocks. Two replications of each of the open pollinated (S_0) varieties and a single cross (F_1 of the two homozygous strains A441-5 and A 272) were included in each block as well. The 31 strains within each replication were allotted positions at random (total no. of plots was 1240). Table 1 shows the mean yields per plot of the twenty strains replicated twice for each variety for the different inbreeding coefficients.