1. Preliminary results of tests designed to detect non-allelic gene interaction (Epistasis) in maize.

A definite answer to what type or types of gene action are involved in heterosis and quantitative inheritance has proved elusive. Experiments designed to obtain estimates of gene number, and degree of dominance have, in many cases, assumed that non-allelic gene interaction or epistasis was not involved. Epistasis would contribute to the non-additive portion of the genetic variance. These tests would be somewhat in error if epistasis were involved.

The proposed test to determine the presence of epistatic gene action involves crossing two inbred lines and the single cross between the two inbreds onto an unrelated tester as shown in the following example.

	Expectation based on Dominance	Over-Dominance		Epistasis
W9	x Tester	90	90	90
38-11	x Tester	100	100	100
(WF9 x 38-11)	x Tester	95	95	100

Based on theoretical expectation, with any degree of dominance or over-dominance, the sinale cross x tester cross will always equal the mean of the two inbred x tester crosses. However, if the performance of the single cross x tester cross deviated significantly from the mean of the two inbred x tester crosses, non-allelic gene interaction or epistasis must be involved.

This test determines the amount of epistasis that exists in the single cross, however the epistatic effect is reduced by one-half because of segregation. For example, if the single cross x tester cross differs from the mean of the two inbred x tester crosses by five bushels, then ten bushels of the yield of the single cross itself might be ascribed to epistatic gene act-ion.

The test provides a minimum estimate of epistasis since the tester genotype may mask or cover up some epistatic alleles in the single cross. However, regardless of the tester genotype, if a significant deviation is detected between the single cross x tester and the mean of the two inbred x tester crosses, some sort of non-allelic gene interaction must be involved.

Some tests of this type were conducted in 1954, but were not harvested because of extreme drouth. The table below gives results of the 1955 tests conducted in replicated plots at two locations with the exception of group IV which was tested at one location.

Group	Pedigree	Yield Bu.	Epistatic Deviation[1]	Ear Height In.	Epistatic Deviation[1]
	(B10 x C103)WF9	81.4		31.3	
I	B10 x WF9	70.9	+4.9	26.9	+3.1**
	C103 x WF9	82.2		29.5	

	L.S.D. 5%	5.3		1.8	
	(WF9 x 38-11)Hy2	77.6		25.9	
II	WF9 x Hy2	73.4	+1.6	26.7	-1.5**
	38-11 x Hy2	78.6		28.2	
	L.S.D. 5%	N.S.		1.1	
	(Hy x Oh41)WF9	81.0		31.5	
III	Hy x WF9	77.1	+3.3	27.2	+3.1**
	Oh41 x WF9	78.3		29.7	
	L.S.D. 5%	N.S.		1.2	
	(L578 x GT112)F44	77.3		51.1	
IV	L578 x F44	71.1	+3.8	52.4	+3.7**
	GT112 x F44	76.0		42.5	
	L.S.D. 5%	5.4		1.4	
	(WF9 x C103)Hy2	72.1		21.1	
V	WF9 x Hy2	74.3	-5.7	21.4	-.3
	C103 x Hy2	81.3		21.5	
	L.S.D.	N.S.		N.S.	

**Significant at .01 level.
[1]Indicates amount the single cross x tester deviates from the mean of the inbred x tester crosses.

Four of the five groups tested gave significant evidence of epistasis for ear height. None of the five groups gave significant deviations for yield. However, under a more favorable and less variable testing environment I feel significant results may have been obtained for yield.

It may be noted that group II showed "negative" epistasis for ear height. It is possible to have negative epistasis deviation and still the effect in the cross would show positive or plus heterosis for the character concerned.

Loyal F. Bauman