If similar results are obtained in more critical experiments, which we are developing, one could conclude that non-allelic interactions can be important for yield in maize.

Furthermore, it seems clear that, if epistasis exists, it will have a higher probability of expression in crosses between less related races. This is true because in interpopulational hybrids the loss of linkage equilibrium can occur alone as a consequence of differences in genic frequencies between the parental populations. Such a linkage disequilibrium can result in epistasis having a direct effect on the means of racial crosses.

Practically, if heterosis and divergence are curvilinearly related as in the figure, then the use of measures of divergence based upon knob data (or other comparable data) should be useful in the prediction of heterosis values (i.e., yield level) of maize hybrids.

REFERENCES

Blumenschein, A. 1968. Estudo das Origens e Relações de Parentesco dos Milhos do Leste da América do Sul, a partir dos Knobs Cromossômicos. (In press).

Gardner, C. O. and S. A. Eberhart. 1966. Analysis and interpretation of the variety cross diallel and related populations. Biometrics 22 (3): 439-452.

Kato, T. A. 1964. Some cytological studies on several Mexican races of maize. M.Sc. Thesis. Raleigh, N.C. USA. North Carolina State of the University of N.C.

Moll, R. H., J. H. Lonnquist, J. V. Fortuno and E. C. Johnson. 1965. The relationship of heterosis and genetic divergence in maize. Genetics 52: 139-144.

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2. Preliminary experiment in relation to the effects of gamma-rays on hybrid vigor in corn.

Seeds of two inbred lines of flint and dent corn were gamma-rayed with an approximate dose of 3,700R, and in 1967, the following crosses were carried out as well as selfing of Do, Dr, Fo and Fr:

♂ x ♀	
Do x Fo	
Dr x Fo	Fo : non-irradiated seeds of flint corn
Dr x Do	Fr : irradiated seeds of flint corn
Do x Fr	Do : non-irradiated seeds of dent corn
Dr x Fr	Dr : irradiated seeds of dent corn

In 1968, seeds of the above nine combinations were sown according to a balanced lattice design 3x3 with four replications and the following characters were measured on seventy competitive plants on the average per plot:

plant height
survival
width, length and thickness of grain
length and diameter of ear
ear weight

In the statistical analysis, an adjustment for stand was made, when necessary, through a covariance analysis. For those characters where the lattice analysis showed efficiency, the adjustments for block effects were made, otherwise the randomized block analysis was used.

Furthermore, the following contrasts were tested by the "t" test to estimate the effects of gamma-rays on inbred lines and on the amount of heterosis:

$$Y_1 = \overline{Fr} - \overline{Fo}$$
$$Y_2 = \overline{Dr} - \overline{Do}$$
$$Y_3 = \overline{DoFr} - \overline{DoFo}$$
$$Y_4 = \overline{DoFr} - \overline{DrFo}$$
$$Y_5 = \overline{DrFo} - \overline{DoFo}$$
$$Y_6 = \overline{DrFr} - \overline{DrFo}$$
$$Y_7 = \overline{DrFr} - \overline{DoFo}$$

The effect of radiation on heterosis in a particular cross between two inbred lines was also estimated by the following contrast:

$$Y_8 = \underbrace{\left(\overline{DrFr} - \frac{\overline{Dr} + \overline{Fr}}{2}\right)}_{\text{heterosis in a cross between two irradiated inbred lines}} - \underbrace{\left(\overline{DoFo} - \frac{\overline{Do} + \overline{Fo}}{2}\right)}_{\text{heterosis in a cross between two non-irradiated inbred lines}}$$

Table 1 shows mean values of the various characters and Table 2 shows the "t" values of the various contrasts. The ear production increased 5.2% significantly in the cross "Dr x Fr" compared with the cross "Do x Fo". The experiment is being repeated this year.

Table 1

Mean of the various characters

Do: non-irradiated dent corn, Dr: irradiated dent corn, Fo: non-irradiated flint corn, Fr: irradiated flint corn.

	plant height (m)	survival number	grain width (mm)	grain thickness (mm)	grain length (mm)	ear diameter (mm)	ear length (mm)	ear weight (gr)
Do	1.40	510	7.05	3.43	11.08	36.80	100.90	31.40
Dr	1.54	580	7.00	3.45	11.13	36.90	105.95	35.00
Fo	1.34	388	7.34	4.68	8.71	31.94	135.88	44.20
Fr	1.44	458	7.30	4.63	8.83	32.05	136.75	42.60
Dr x Do	1.46	537	7.10	3.65	11.00	36.45	107.80	30.82
Do x Fo	2.44	615	7.88	3.38	11.65	41.40	134.60	81.37
Dr x Fo	2.48	538	8.03	3.40	11.55	40.95	144.05	92.75
Do x Fr	2.37	587	7.93	3.35	11.45	40.55	139.70	80.29
Dr x Fr	2.42	610	8.00	3.38	11.60	41.60	139.20	86.41

Table 2

"t" values of the various contrasts

	plant height	survival	grain width	grain thickness	grain length	ear diameter	ear length	ear weight
Y_1	0.65	3.88**	1.01	0.82	0.56	1.27	0.72	0.18
Y_2	1.24	3.43**	0.10	0.24	0.38	0.31	1.46	0.42
Y_3	1.99	1.31	0.10	0.24	1.38	2.04	1.48	2.14*
Y_4	1.30	2.30*	1.52	0.41	0.19	1.67	1.26	0.90
Y_5	3.30**	3.25**	1.41	0.16	1.19	0.36	2.74*	3.04**
Y_6	2.75*	3.39**	0.33	1.41	0.44	0.33	0.00	5.60**
Y_7	0.54	0.22	1.72	0.00	0.75	0.04	1.33	2.56*
Y_8	0.33	3.18**	1.76	0.23	1.00	0.46	0.42	2.33*

*significant at the level of 5%
**significant at the level of 1%

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