Backcross Response of Two Mature Plant Traits for Certain Corn-Teosinte Hybrids

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CONSIDERABLE research has been done on evaluating hybrids between Zea mays (L.) and teosinte-Zea mexicana (Schrad., ex. Reeves and Mangelsdorf), (12). Such investigations have dealt chiefly with observations on chromosome pairing relationships and genetic linkage studies (1, 2, 3, 4, 5, 7, 8, 9, 11, 14), using only one or two strains of teosinte. Generally, the evidence presented has shown few differences between the two species for these characters. Rogers (13) was the first to show that strains of teosinte differed in their genetic contributions for certain traits when hybridized with a multiple gene marker stock of maize. The differences found between strains, in Roger's work, were related to the geographical location of a strain.

Quantitative measurements of the dissimilarities between strains or types is useful in assessing intraspecific variability and setting species limits. The experimental approach in this investigation was to study the response of certain metric traits when geographically distinct strains of teosinte were backcrossed to a homozygous maize inbred. The purpose of the investigation was to detect any differences in response between strains of teosinte, as a result of backcrossing corn-teosinte hybrids to the maize parent. Differences between strains in response to backcrossing were measured by comparing backcross population means and linear and quadratic regressions for all populations.

MATERIALS AND METHODS

Five different strains of teosinte used in this investigation were Chalco, Chapingo, Guerrero 243 and 249, Guatemala, and Honduras.* Geographic origin was the criterion used in selecting the five strains. The Chalco, Chapingo, and Guerrero strains are of Mexican origin. Four strains were collected from indigenous plant colonies in their specified regions. In addition, the four strains represented a range of types within the species. The Chalco strain was grown for one generation at Ames, Iowa and was represented by selfed seed produced there. The two Guerrero teosintes (243, 249) represent two different seed sources of the same strain.

During the summers of 1959 and 1960, F1 hybrids were produced between the five strains of teosinte and the corn inbred Hy2. To produce hybrids it was necessary to subject teosinte plants to short-day photoperiods, following methods devised by Emerson (4) and Melhus et al. (10). No major problems were observed in crossing the five strains of teosinte with Hy2.

The backcross generations were produced in 1961 and 1962, utilizing the Florida winter nursery and summer crop at Urbana. All backcross seed tested in the experiment was produced in Florida in 1962. This was done to minimize natural selection for photoperiod response at Urbana. However, BC2 seed used to produce the BC3 generation for testing was produced at Urbana. Five to 8 families were maintained for all populations and backcross generations. All plants were casually selected for backcrossing in order to eliminate bias from visual selection. Seed of the two families used for planting was randomly selected.

The metric traits used to evaluate the material were kernels per row, based on the observation that teosinte usually has eight to ten kernels per row. However, means for these two traits were recorded on five internal plants within a plot. All plots were bordered on each end. In addition, border plots separate all generations tested. All plots were thinned to seven plants. Excellent final stands were obtained for all populations.

The data, based on plot means, were analyzed by the analysis of variance procedure for a split plot design. Six replicates were used. The main plots of the design consisted of the six different populations. Subplots were the six different populations. Subplots were further divided into two each for the given population and generation. In addition, linear regression values were obtained. The regression coefficients were calculated with the character dependent on the inbred or percentage of the recurrent parent for a given inbred. Correlation coefficients were calculated for unequal increments by the method developed by Grandage (6). Duncan's multiple range test was used to test for differences between linear regressions for different populations.

RESULTS AND DISCUSSION

A gradual increase in kernels per row was observed for the first four backcross generations (Figure 1). The population involving Guatemala teosinte had fewer kernels per row was the BC3. This generation, on the other hand, usually has eight to ten kernels per row. Half of the BC2 and BC3 generations were higher than expected in all six populations. The backcross response for weight of the BC1 generation.

The population comparisons indicate that certain populations were different with regard to the contribution of the various teosintes to the hybrids and backcross generations. Analysis of variance mean squares associated with the geographical comparisons are presented in Table 1. The population involving Guatemala teosinte...

![Figure 1. Backcross generation means for kernels per row.](image-url)