Inheritance of Popping Volume and Associated Characters in Crosses Between Popcorn and Dent Corn

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The improvement of popcorn closely parallels that of dent corn but differs in that quality, as measured by popping volume, shape of popped kernel, tenderness, and flavor also are of extreme importance. The development of inbred lines and their recombination into desirable hybrids now has progressed to a level where a majority of the commercial popcorn acreage is planted with hybrid seed.

Most inbred lines of popcorn and their hybrids are lacking in certain agronomic characters, particularly in strength of stalk and resistance to root lodging. This defect probably is due to the lack of favorable genes for this character among the open-pollinated varieties from which the inbred lines have been isolated. The value of dent corn inbreds as parents in crosses to add lodging resistance to popcorn would be dependent upon the successful recovery in segregating generations of the popcorn quality characters. Backcrosses with popcorn lines as recurrent parents would favor the recovery of genes for quality with visual selection necessary for addition of genes for desirable stalk and root development from the nonrecurrent dent parent.

The basis of such a breeding program would be dependent upon the complexity of inheritance of the characters differentiating the two types of maize, upon the ability successfully to select for the characters in question, and upon the possible correlated inheritance of favorable and unfavorable recombinations. Since data bearing on these questions are not available in the literature, a series of crosses was made and studied in F1, F2, and backcrosses to both parents with special emphasis on popping volume—a character for which rather accurate measurements could be made on individual ears. The data from this study form the basis for the present investigation.

Although popcorn was grown in the western hemisphere before white men arrived (5), the literature dealing with specific phases of the current problem is relatively limited. Many of the early publications were concerned with the mechanism and cause of popping and will not be reviewed here.

Brunson (2) found a high correlation between lodging resistance and high popping expansion. A positive correlation between popping volume and crispness, measured by the decrease in volume of popped corn after pressing, has been demonstrated by Duncan (3).

From an extensive study of factors affecting popcorn quality, Willier and Brunson (6) concluded that several kernel characters the percentage of soft starch was most closely associated with popping expansion as measured in a yellow pearl variety. The correlation coefficient between popping volume and percent soft starch was found to be -0.58 from a study of 394 single ears. Large kernels give lower popping volume than small kernels, probably because large kernel size was associated with high percent soft starch (r = 0.42). Partial correlation, between popping volume and percentage of soft starch when various combinations of such characters as weight per 100 kernels, number of kernels per grain, and kernel length, width, and thickness were held constant, varied from -0.49 to -0.60, but none were significant.

In a review of popcorn breeding presented in the Yearbook of Agriculture, Brunson (1) concluded that the technique followed should be the same as that for field corn. In his opinion, popping quality is an important character, probably conditioned by many genes.

In crosses of popcorn inbreds selected for high and low expansion, Lyerly (4) found that popping expansion of an inbred line gave a fairly reliable index of its general performance in hybrid combinations.

Material and Methods

The materials used in this study consisted of dent corn superior in lodging resistance and of inbred and inbred lines of popcorn whose value had been determined in specific crosses as measured by yield and popping volume. Inbred lines of popcorn generally were not satisfactory for resistance. The dent and popcorn inbreds used together with some of their agronomic characteristics are presented in Table 1.

The original crosses were made in 1942 using dent corn as male parents. The F1 generation was grown in 1943 and crossed to the popcorn parent. Additional crosses of popcorn and dent corn were made in 1943 included.

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