Performance of Recovered Popcorn Inbred Lines Derived from Outcrosses to Dent Corn

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Improvement of popcorn by inbreeding and subsequent hybridization now has become a standard procedure with this crop. Yellow endosperm inbred lines extensively used have been obtained from such existing open-pollinated varieties as South American, Yellow Pearl, Queens Golden, and Supergold, while Japanese Hullless has been the most common source for white endosperm inbred lines.

Most of the popcorn inbred lines, when compared with dent corn, are relatively inferior in resistance to root lodging and stalk breaking largely because the open-pollinated varieties from which they originated also were lacking in these desirable qualities. In general, popcorn inbreds are relatively productive, thus lack of stalk strength has not been a manifestation of inbreeding depression.

Among available dent corn inbred lines several have been developed that possess excellent stalk qualities, both as inbreds and in hybrid combinations. It seemed quite logical, therefore, to attempt the improvement of popcorn inbreds by incorporating into them genes for lodging resistance from dent corns. Because of the importance of high popping volume and quality in the commercial utilization of popcorn, such an improvement program would suggest the backcross approach using popcorn inbred lines as the recurrent parent.

The data to be presented in this paper are based on a study initiated in 1941. Data on the inheritance of popping volume and associated characters obtained in the earlier phases of this breeding program have been published by Crumbaker, Johnson, and Eldredge (1). More recently, Grissom (2) has presented additional data on crosses between popcorn and dent corns using populations developed both at the Iowa Agricultural Experiment Station and the Texas Research Foundation. These previous reports have shown that high popping volume can be recovered in F<sub>2</sub> and backcross populations from crosses between dent and popcorn, that a highly significant correlation exists between kernel characteristics and popping volume, and that popping volume and kernel characters associated with popping volume have a relatively high heritability. These conclusions all have a direct bearing on the effectiveness of using dent corns as a source of germ plasm for the improvement of popcorn.

The basic principles of convergent improvement were presented originally by Richey (4). In subsequent reports by Richey and Sprague (5) and by Murphy (6) it was shown that the recovered lines performed in crosses substantially as would be expected at successive generations of backcrossing. Evidence presented in these studies indicated that dominance of recovered lines in crosses was expected on a basis that dominant favorable genes had been added from the nonrecurrent to the recurrent parent. Evidence presented in these studies indicated that a few recovered lines performed better in crosses to popcorn than did the recurrent lines.

The priority of recovered lines in crosses was explained on the basis that dominant favorable genes had been added from the nonrecurrent to the recurrent parent. Evidence presented in these studies indicated that some recovered lines would be expected to yield high-yielding crosses between the original inbred parents. Evidence presented in these studies indicated that some recovered lines would be expected to yield high-yielding crosses between the original inbred parents. Evidence presented in these studies indicated that some recovered lines would be expected to yield high-yielding crosses between the original inbred parents. Evidence presented in these studies indicated that some recovered lines would be expected to yield high-yielding crosses between the original inbred parents.

In the present study, data will be presented on the performance of several groups of recovered popcorn inbred lines representing one and two generations of backcrossing to the popcorn parents following the original dent corn inbreds. These recovered popcorn inbreds were self-pollinated from four to five generations of backcrossing and were tested for combining ability in crosses to unrelated popcorn single crosses.

Materials and Methods

The popcorn lines used in these studies were selected from a series of single, three-way, and double crosses. In which these lines were satisfactory in yield and quality, but the majority of them were unsatisfactory in resistance to root lodging. In an attempt to correct this defect, these lines were crossed to a number of the best lodging-resistant dent corn inbreds available when the program was initiated. The five popcorn lines (Nos. 3, 6, 7, 8, 9, and 10) were crossed with the first group (Nos. 5, 12, 13, 16, 17, 18, and 21) in 1942. Because the breeding and selection procedures used with the two groups of inbred lines were somewhat different, the methods for each are described separately.

Group 1

The six lines in this group were crossed to dent corn inbreds in the following combinations:

<table>
<thead>
<tr>
<th>Dent Corn Inbred Lines</th>
<th>Popcorn Inbred Lines</th>
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<tbody>
<tr>
<td>3 × W22</td>
<td>8 × Oh28</td>
</tr>
<tr>
<td>6 × W22</td>
<td>9 × WF9</td>
</tr>
<tr>
<td>7 × I205</td>
<td>10 × 38–11</td>
</tr>
</tbody>
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The F<sub>1</sub> crosses were backcrossed in 1942 to the dent corn parents, and individual plants in the BC<sub>1</sub> progeny carefully selected in 1943 for visual resistance to lodging by brace root development and general stem strength. A population of approximately 1500 BC<sub>1</sub> plants in an average of 150 selected plants were pollinated with the same dent popcorn recurrent parent.

Seed from all backcrossed ears was popped, and a test reduced the number of potential BC<sub>2</sub> lines.