Phenotypes and Grain Yield Associated with Brachytic-2 Gene in Single-Cross Hybrids of Dent Corn

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ALTHOUGH the introduction of dwarfing genes into normal corn has not consistently given satisfactory hybrids, the considerable work on the introduction of the brachytic-2 gene into widely used normal inbreds (1, 2, 4) has recently increased interest in this area.

The major characteristic of the brachytic-2 dwarf type is that the length of stalk is much reduced without a corresponding reduction in size of the other major plant parts. This brachytic characteristic is controlled by a single recessive gene.

The work reported here is the result of a study to evaluate several agronomic characteristics associated with the transfer of the brachytic-2 gene into normal inbred lines and expressed in single crosses.

MATERIALS AND METHODS

Three normal single crosses and their brachytic-2 (br-2) counterparts were utilized: M14 X Oh43; Hy2 X L317; and Ill.A X W22.

The sources of the brachytic gene used were as follows:

- Hy2<sub>br-2</sub>-from Oakes dwarf.
- M14 and L317<sub>br-2</sub>-from a composite containing germ plasm of Hahn 6 dwarf, R6<sub>br-2</sub>, and Oakes dwarf.
- Oh43, Ill.A<sub>br-2</sub>, and W22<sub>br-2</sub>-from a composite of R4<sub>br-2</sub>, Conn.127 dwarf, SW1 dwarf, and Oakes dwarf.
- L317. Hy2, Ill.A, and W22 represented 3 backcrosses to the recurrent parent, while Oh43 and M14 had 4 backcrosses to the recurrent parent.

All inbreds involved were selfed at least four generations following the last backcross and undoubtedly some selection took place.

The design was a randomized split-plot with four replications. Corn types were used as main blocks in order to avoid the shading effect of normal hybrids on the shorter br-2 ones. Row space was increased from 3½ feet within the plot to 5 feet between the blocks of different type hybrids.

Individual plots consisted of four 20-foot rows with 20 plants per row. The spacing between rows was 42 inches and between plants in the row 12 inches. The seed was treated with Captan 75.

Fertilizer elements applied were 100 pounds N, 30 pounds P, and 58 pounds K per acre.

All stalk and leaf characteristics were measured on the same 10 representative plants per individual plot.

The leaf from the same node as the uppermost ear was called the ear-leaf. Its area was computed as leaf length times greatest width times a leaf area factor for each type and hybrid. The leaf area factor was derived from the actual area of the leaf, as determined by outlining on graph paper, divided by the product of the length times the greatest width. Since all test material was F<sub>2</sub>, the determination was made on only 4 ears for each type and hybrid. The respective leaf area factors are shown in Table 1.

Data on ear and kernel characteristics were obtained from about 20 primary ears in each plot. Grain yield at 15½% moisture and its component data came from the material in the 2 middle rows in each plot.

RESULTS AND DISCUSSION

Stalk characteristics—The presence of the br-2 gene reduced rate of height increase, but did not affect the general height-increase pattern (Figure 1). Final stalk height in the br-2 hybrids was about two-thirds that of the normal hybrids.

The growth of these corn plants may be separated into two mechanisms: (a) the probable control of the growth rate pattern by multiple genes classified as quantitative inheritance; and (b) the conditioning of a second component of total growth by a single qualitative gene, br-2.

Brachytic hybrids are usually criticized for their low placement of ear on the stalk. In this study, ears of br-2 types in Hy2 X L317 and Ill.A X W22 were placed acceptably high on the stalk (Table 2) if 60 cm. is used as a criterion for the minimum acceptable ear height (4).

The very highly significant F value for variance ratio of normal and brachytic ear height of Ill.A X W22 is in direct contrast to stalk height, which shows no difference. Hy2 X L317 shows comparable F ratio values for types for stalk height as well as ear height. It is interesting that the coefficients of variation are consistently larger for ear height than stalk height, although both measurements were made on the same plants.

The data in Table 2 indicate that the hybrid with higher ear placement in the normal type also produced the higher ear placement in its corresponding brachytic hybrid. Thus,

Table 1—Leaf area factors for normal and brachytic-2 types of 3 single cross corn hybrids.

<table>
<thead>
<tr>
<th>Type</th>
<th>M14 x Oh43</th>
<th>Hy2 X L317</th>
<th>Ill.A X W22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.65</td>
<td>0.76</td>
<td>0.64</td>
</tr>
<tr>
<td>Brachytic</td>
<td>0.66</td>
<td>0.75</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Figure 1—Stalk height of normal and brachytic-2 types of 3 single crosses at several stages of growth. Each point is an average of 40 plants.

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