PRESENT-DAY hybrids have considerably more stalk lodging resistance than the open-pollinated varieties they replaced. Present hybrids, however, do not have ideal levels of resistance and there is need for further improvement. Limitations of current evaluation techniques have often restricted improvement to modest levels.

The most commonly used procedure for evaluating lodging resistance is to count lodged plants at harvest. By this procedure, plants are classified into two groups, lodged and not lodged. This system provides a measure of the gross character, lodging, but provides little if any information concerning the relative importance of component factors. Plants may lodge because of disease or insect susceptibility, poor mechanical strength of stem tissue, or interrelations of these or other factors.

The field-count method has served satisfactorily in the past as evidenced by the improvement which has been made; however, it has become increasingly difficult to make additional progress. The field-count method is seriously dependent upon environmental forces. As material becomes upgraded, optimum environmental forces do not occur with satisfactory frequency for continued progress. Continued improvement for lodging resistance may well depend upon evaluation techniques which are largely independent of environmental forces.

Zuber and Grogan (38) have introduced two measurements, crushing strength and rind thickness, which show promise of providing meaningful relationships between stalk strength measurements and lodging resistance. These are quantitative measurements which can be obtained independently of the lodging environmental forces.

The purposes of this study were to apply recurrent selection procedures to two synthetic populations of corn, to establish selection progress for stalk lodging susceptibility and resistance, to examine changes for concomitant variables (i.e., crushing strength and rind thickness in this report), and to relate the findings to breeding for stalk lodging resistance. An additional objective was to list pertinent literature relating to the lodging problem in corn.

LITERATURE REVIEW

Mechanical methods have been used for obtaining strength measurements which are related to stalk and root lodging of corn. Durrell (4) placed stalks horizontally on a support spaced 6 inches apart with the node midway between them. He applied downward pressure on the node with a lever device and recorded breaking strength for the first five nodes above the ground. Breaking strength of 213 nodes varied from 6 to 350 pounds. From lower to higher nodes, strength decreased successively. Nodes showing fungal infection had about one-half the strength of uninfected nodes. McRostie and MacLachlan (26) determined strength of four successive internodes per plant by breaking, crushing, and penetration measurements. The lowest internode free from brace roots was the lowest internode examined. Resistance to breaking, crushing, and penetration decreased successively from low to high internodes. Resistance of internodes to crushing appeared to have the highest correlation with resistance to lodging.

Zuber and Grogan (38), using a specially designed saw with two circular blades, cut 2-inch sections from the second and third internodes above the soil level of mature stalks. Each section was placed on end in a hydraulic press and the pounds pressure required to crush a section was recorded as crushing strength. Crushing strength was significantly correlated with stalk lodging at —.53 and —.82. Thickness of the stem rind was also significantly correlated with stalk lodging at —.57 and —.81.

Foley (9) determined breaking force of 6-inch stem sections for 9 hybrids. All stalks required about the same force in August. In October hybrids susceptible to stalk rots retained about one-fifth normal strength. Lower internodes were stronger than upper internodes.

Khanna (18) and Khanna and Prasai (19) used a puncture device to test the hardness of sugar cane rind. Various devices have been used for measuring lodging resistance in the cereals. Pertinent literature relating to lodging in cereals has been reported by Norden and Frey (28). Resistance of plants to pulling from the soil has been used for root lodging evaluations (11, 30, 36).

Russell (32) suggested that stalk breakage has at least two components, viz., susceptibility to disease and mechanical strength of the stalk, and suggested that each has a different genetic base. Zuber et al. (39) did not find a significant correlation between

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