Role of Height in Corn Competition

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AGRONOMISTS and corn growers have historically noted that a small or runt corn plant in a field of normal corn produces less grain than adjacent tall plants. The causal agents for the runt plant could be many: delayed germination, insect or disease attack, or cultivation damage. The question arises as to how the runt plant would produce grain if it were a healthy one and vigorously competed with the taller plants for the ecological factors: moisture, nutrients, light, and carbon dioxide.

The use of a brachytic 2 type dwarf plant having the same germ plasm as its taller counterpart would seem to offer an excellent method for measuring plant competition between tall and short plants in the cornfield. Therefore, a study of competition between rows, between hills, and within hills was conducted at Urbana, Illinois.

MATERIALS AND METHODS

Illinois 513, a brachytic dwarf version of U.S. 13, was compared to normal U.S. 15. The dwarf plants averaged 72 inches in height and the normal plants averaged 106 inches. Pollination was noted to occur on the same dates. The study was conducted for two years (1959-1960) at Urbana, II., on Flanagan silt loam of high fertility. Eighty pounds of nitrogen per acre was applied and disked in prior to planting.

Two separate experiments were conducted. In the first, competition between adjacent rows of corn containing dwarf or normal plants was studied. Rows, 40 inches apart, were planted in a north-south direction. The corn was drill-planted at a heavy rate of high fertility. Eighty pounds of nitrogen per acre was applied and disked in prior to planting.

Admittedly the height difference of approximately 30 inches between the 2 types of corn was great in this experiment, but the results indicate that if a mixture of corn varieties of approximately the same height in corn performance trials, since tall varieties would benefit and short varieties would suffer in such yield comparisons. In this trial, the short variety bordered by a tall variety was adversely affected far more than the tall variety bordered by a short variety was benefited. A single row of dwarf bordered by normal yielded 36% less than when bordered by dwarf. Conversely, a single row of normal bordered by dwarf yielded only 6% more than when bordered by tall corn. This indicates that while shading from adjacent rows can seriously reduce corn yields, extra light does not greatly increase yield.

Utilizing the yields in Table 1, an acre of normal-height corn would produce 91.1 bushels. An acre of corn in which 2 rows of normal were alternated with 2 rows of dwarf would produce only 73.7 bushels, while alternate single rows of normal and dwarf would produce only 70.4 bushels.

The grain yields from combinations of dwarf and normal plants within a hill and in alternate hills are shown in Table 2. The yields from solid plantings of normal corn were higher than any combination of dwarf and normal in either the 2- or 3-plants-per-hill planting patterns. Alternate hills of normal and dwarf plants did not show yields significantly different from those of planting systems with a combination of normal and dwarf plants within a hill.

The percent of total yield produced by each plant component in the planting systems are illustrated in the bars of Figures 1 and 2. In the 3-plant hills composed of 1 dwarf and 2 normal, the dwarf contributed only 10% of the total yield. Conversely, 1 normal plant with 2 dwarf plants made up 58% of the total yield.

Theoretically, a combination of normal and dwarf plants should yield the same as when grown with their own kind. In the 2-plant hills of similar type each normal plant yielded at the rate of 60.0 bushels and each dwarf plant at the rate of 46.7 bushels. This is a total of 106.7 bushels, which is more than either of the actual 2-plants/hill combinations tried. Likewise in the 3-plants/hill system a theoretical yield of 104.3 bushels might be expected. Actually, all combinations produced a smaller yield. While the individual normal plants produced more in combination with dwarf plants than when grown with each other this increase was not enough to overcome the yield loss of the individual dwarf plant in the combination.

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