Comparison of Hills and Rows for Evaluating Soybean Strains

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PLANTING in hills instead of rows for soybean evaluation may be necessary when either the seed supply is short or the number of entries is large. The hill method requires less seed and land per plot than does the row method. These are important considerations in early generation testing or in heritability studies where seed supply may be short and the number of entries is often large.

Hill plantings have been used in the breeding and evaluation program of corn (3, 5) cereals (1, 4) and sorghums (7). Ross and Miller (4) reported significant correlations for grain yields of varieties grown in rows and hills in 6 out of 9 comparisons. They found greater variability in hill than in row nurseries and concluded that for small grains hill nurseries have supplementary value for present test methods.

Sents (6) reported that soybeans grown in rows were higher in yield, later in maturity and taller when grown in hills. Ranking of varieties by the two methods was similar for plant height and maturity, but not consistently so for seed yield. Comparisons among hills containing different plant numbers suggested that plant density may be an important factor in employing the hill method for soybean evaluation.

The purpose of this study was to compare the relative performance of soybean varieties when planted in replicated nurseries in which a plot was either a row or a hill.

MATERIALS AND METHODS

Soybean varieties of group I and II maturity were compared for seed yield and other characters when planted in hills and in rows. The range in maturity for group I varieties was Chippewa — 2 to + 6 days and for group II varieties was Hawkeye — 6 to + 2 days. Varieties of group I maturity were tested for 4 years, 1954 to 1957 inclusive, and those of group II maturity for 3 years, 1955 to 1957 inclusive. The varieties included in a maturity group were the same each year except in 1954 when 1 variety in group I was not planted and in 1955 when an additional variety was planted in group II.

A plot in a row nursery consisted of a single row, 18 feet long, from which the center 16-foot section was harvested. The seeding rate was approximately 200 seeds per row, which is equivalent to 1 bushel per acre. These plots were spaced 3 feet apart. A plot in a hill nursery consisted of a single hill of either 15 or 10 plants, where all the plants were harvested. Twenty-five to 30 seeds were planted per hill, in a circular area approximately 6 inches in diameter, and thinned to the appropriate number shortly after emergence. The hill plots were spaced 3 feet apart in both directions. In all years, 15-plant hills were used, and 10-plant hills were included in the 1956 and 1957 trials.

The tests were planted on May 21 in 1954, May 17 in 1955, May 22 in 1956, and on June 17 and 22 in 1957 for groups I and II, respectively. In all years the hill nurseries were located adjacent to the row nursery of the same maturity group. A randomized complete block design with four replications was used for each test. All trials were located on Miami silt loam at the University Hill Farms, Madison, Wis.

For all characters differences in the mean response or 1956 and 1957 data the comparisons are not orthogonal since one replication was used. No protein or oil data were obtained in 1956 or 1957 for the 15-plant hills. The following characters were studied: seed yield, plant height, days from emergence to maturity, lodging index, and percent of oil and protein in the seed. Height was measured as the distance from the ground to the tip of the stem at or near maturity. Date of maturity was taken as the date when approximately 95% of the pods were ripe and most of the leaves had dropped. Date of maturity was not taken in 1956 because of a killing frost on September 20. The lodging index was based on a scale of 1 (erect) to 5 (prostrate) and was taken at or near maturity. Chemical analyses were made by the U. S. Regional Soybean Laboratory at Urbana, Ill.

In this paper, differences were considered significant when the probability was less than .05, unless otherwise stated.

RESULTS AND DISCUSSION

Seed yield and other characters, averaged over varieties, of soybeans planted in rows and in hills are presented in Table 1. The mean plant height of soybeans when grown in rows was significantly greater than that for soybeans when grown in hills during 1956, whereas in other years differences in plant height were small and nonsignificant. For all other characters differences in the mean response of soybeans grown in hill and row plots were small and showed no definite pattern. Prior to maturity, lodging was usually greater in the hills than in the row plots; but at maturity this difference was not evident.

The relative performance of varieties grown in row and hill plots was determined by the interaction between varieties × types of nursery (Table 2) and by inter-method correlation coefficients (Table 3). For both the 1956 and 1957 data the comparisons are not orthogonal since one hill nursery was compared with the other hill nursery and both with the row nursery. Accordingly, the level of significance indicated tends to be overestimated.

Table 1—Response for several characters of soybeans planted in rows and in hill nurseries, averaged over varieties, Madison, Wis.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of varieties</th>
<th>Yield, bu./A.</th>
<th>Height, inches</th>
<th>Maturity, days</th>
<th>Lodging index</th>
<th>Protein, %</th>
<th>Oil, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>R*</td>
<td>H1</td>
<td>H0</td>
<td>R</td>
<td>H1</td>
<td>H0</td>
</tr>
<tr>
<td>1954</td>
<td>7</td>
<td>38.6</td>
<td>38.4</td>
<td>-</td>
<td>38.7</td>
<td>38.4</td>
<td>-</td>
</tr>
<tr>
<td>1955</td>
<td>6</td>
<td>29.7</td>
<td>25.6</td>
<td>-</td>
<td>34.6</td>
<td>31.1</td>
<td>-</td>
</tr>
<tr>
<td>1956</td>
<td>5</td>
<td>35.9</td>
<td>27.1</td>
<td>25.0</td>
<td>30.5</td>
<td>28.6</td>
<td>27.2</td>
</tr>
<tr>
<td>1957</td>
<td>9</td>
<td>45.5</td>
<td>36.4</td>
<td>30.3</td>
<td>31.9</td>
<td>33.3</td>
<td>34.2</td>
</tr>
</tbody>
</table>

* R denotes row nurseries; H1 and H0 denote hill nurseries containing 15 and 10 plants, respectively. ** Days from emergence to maturity.