COMPARATIVE INFLUENCE OF GIBBERELLIC ACID AND OF PLANT POPULATION ON DISTRIBUTION OF POTATO TUBER SIZE

J. C. BISHOP AND HERMAN TIMM

Cultural procedures that assure the production of more uniformly medium sized and fewer large potatoes are sought by growers who supply potatoes for the fresh market, chip processing, or seed. Such potatoes are desirable, since less grading for size is necessary and they are less susceptible to development of hollow heart. Large potatoes used for chips require closer supervision during frying, since such chips have a tendency to double over and not cook uniformly. Also, when cut mechanically, large tubers are less valuable as seed, because of the increased likelihood of planting seed pieces without eyes.

Increasing the plant population by closer seed planting has been a means of restricting production of oversize tubers (1, 5). However, seed required per acre is increased. The use of gibberellic acid has been suggested as a means for producing more uniformly medium sized tubers (4, 7) without increasing seed needs.

In the present study the effectiveness of gibberellic acid in influencing the size of potatoes was compared with that of seed-piece spacing. Comparative costs and value returned were considered.

MATERIALS AND METHODS

Plantings were made on a Hesperia sandy loam soil at Shafter, California for 3 years between 1962 and 1964. Dates of planting and harvest are shown in Table 1.

Certified, sprouted seed potatoes were soaked 5 minutes in 0, 1, 5, or 10 ppm gibberellic acid (GA). The seed was then cut into approximately 1½ oz pieces. These were held in sacks in common storage for 24 hours, then planted 6 inches deep and 6 or 12 inches apart in paired rows 50 feet long with an assist-feed potato planter. Nitrogen and phosphorus were banded 2 inches to the side and below the seed at a rate recommended for the area (6).

A randomized block design with three or four replications per treatment was used. Seed pieces of the 'Kennebec' cultivar were planted each year, and 'White Rose' was planted 2 years of the investigation. Cultural practices used, except as noted above, were those recommended by Davis (2).

Potatoes from each plot were graded mechanically to remove tubers under 1⅛ inches in diameter. Deformed tubers were sorted out, and the remaining tubers were sized with hand rings into grades of 1⅛ to 2¼, 2⅛ to 3, and over 3 inches in diameter. To facilitate comparison of tuber sizes, a tuber size index was formulated. Each size designation was given a value based upon an approximation of the mean tuber weight.
Table 1.—Dates of planting and harvest of potatoes at the U.S.D.A. Cotton Research Station, Shafter, California.

<table>
<thead>
<tr>
<th>Date planted</th>
<th>Date harvested</th>
<th>Days' growth after planting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962 March 8</td>
<td>June 13</td>
<td>97</td>
</tr>
<tr>
<td>1963 March 1</td>
<td>June 21</td>
<td>112</td>
</tr>
<tr>
<td>1964 March 2</td>
<td>June 25</td>
<td>115</td>
</tr>
</tbody>
</table>

in the size designation. This value was multiplied by the calculated hundred-weight yield in sacks per acre, and the sum of all was divided by the total yield in sacks per acre of nondeformed tubers. The result was termed "tuber size index;" the higher the index, the greater the proportion of large-size tubers. A typical calculation follows:

\[
\begin{align*}
(24 \text{ sacks per acre under } 1\frac{3}{4} \text{ inches}) \times 15 &= 360 \\
(44 \text{ sacks per acre } 1\frac{3}{4} \text{ to } 2\frac{1}{4} \text{ inches}) \times 30 &= 1,320 \\
(244 \text{ sacks per acre } 2\frac{1}{4} \text{ to } 3 \text{ inches}) \times 70 &= 17,080 \\
(43 \text{ sacks per acre over } 3 \text{ inches}) \times 120 &= 5,160 \\
355 \text{ total sacks per acre} &= 23,920 \\
23,920/355 &= \text{ a "tuber size index" of } 67.4.
\end{align*}
\]

The data were evaluated statistically by analysis of variance.

**RESULTS**

No marked variation in weather conditions prevailed during the 3 years of trial plantings. Plant emergence occurred within 30 days after planting and was generally similar for all seed treatments. Seed treated with GA produced more stems per hill as the concentration increased from 5 to 10 ppm. Growth of plants from seed treated with 10 ppm GA initially was spindly, but resumed normal development with time.

The influence of GA and seed piece spacing on total and U. S. No. 1 yield of 'White Rose' and 'Kennebec' potatoes is shown in tables 2 and 3. Only the data for 0 and 5 ppm GA at 6- and 12-inch seed spacings were used in the analysis. Yield response to 1 ppm GA was similar to that of nontreated seed each year, and GA at 10 ppm adversely affected tuber yields and was included only for comparison in the first year of the study. The data from GA at 1 and 10 ppm are included in Table 4, which summarizes the effect of treatments on tuber size index.

The influence of GA on U. S. No. 1 tuber production was greater than upon total yield, as was also the influence of lengthening the growing season of the plants. In 1962, with 97 days' growth (Table 1), the yield of U. S. No. 1 tubers was lower with GA than without GA, but total yield was not similarly affected (Tables 2 and 3). In 1963 and 1964 the growing seasons were 112 and 115 days, respectively, and differences in yield of U. S. No. 1 tubers due to GA were not discernible.