Effect of Gibberellic Acid on Sucrose, Purity and Weight of Sugar Beets

DONALD F. PETERSON[1]

Received for publication April 25, 1960

Gibberellic acid has been reported to increase rate of growth in many plant species (5)[2]. Initial experiments with gibberellic acid on sugar beets were concerned with increasing the rate of seed stalk production (1). Following this, several workers reported the effect of gibberellic acid on sucrose and weight of the sugar beet root (2, 3, 4). Peterson (3) reported that applications of 100 and 500 p.p.m. of gibberellic acid reduced sucrose and tended to increase yield. Nelson and Wood (2) showed that a 10 p.p.m. application resulted in a root yield increase significant at the 1% level and a sugar production increase significant at the 5% level. Stout (4) concluded that gibberellic acid reduced sugar percentage and respiration rate of root tissue when applied to the growing points of large sugar beets in the field.

In our work previously reported (3), applications of gibberellic acid made in July, August and September, resulted in reduced sucrose content. It was our thought that by making applications of gibberellic acid earlier in the growing season, this sucrose reduction might be avoided. Also, earlier spring applications might increase leaf surface more rapidly during the longest days of the year, resulting in increased production. This paper reports results from such tests conducted in 1958 and 1959.

Materials and Methods

Applications of gibberellic acid were made in concentrations of 10, 100, and 500 p.p.m. at the rate of 12 gallons per acre. Each concentration was applied from one to four times with the second, third and fourth applications occurring 5, 10 and 15 days after the initial application was made on June 12. Thus, plots given the initial application received 10, 100 or 500 p.p.m. at the rate of 12 gallons per acre. A second set of plots was treated twice at 12 gallons per acre with concentrations of 10, 100 or 500 p.p.m. The third and fourth sets of plots were treated three and four times respectively with concentrations of 10, 100 or 500 p.p.m. of gibberellic acid at the rate of 12 gallons per acre.

The tests in both years were of randomized complete block design. Plot size was one row 25 feet long. There were six replications of each treatment. One guard row was planted between each plot to prevent adjacent plots from being affected

---

[1] Plant Breeder, Holly Sugar Corporation, Sheridan, Wyoming.

[2] Numbers in parentheses refer to literature cited.

at time of spraying. All treatments were made with a hand sprayer. The entire plot was harvested for yield and sucrose determination.

Experimental Results

Data for the two years was combined for analysis. The year by treatment interaction was not significant. Significant treatment differences were obtained for all characters studied. Table 1 gives the data for the treatments studied.

Table 1.—Performance Data for Plant Spray Treatments Using Gibberellic Acid at Sheridan, Wyoming, in 1958 and 1959.

Conc. P.P.M.[1]	No. of Applications	Sugar/Acre Lbs.	Beets/Acre Tons	Sucrose %	Thin Juice Purity %	Bolters %	Beets/100 Ft. Row
10	1	5553	18.7	14.9	93.5	.2	127
10	2	5546	17.7	15.1	93.1	.3	119
10	3	5319	17.8	14.9	93.3	.2	122
10	4	5213	17.6	14.8	93.1	.9	118
100	1	5420	18.0	15.0	92.7	.1	117
100	2	5210	17.6	14.8	92.9	.1	120
100	3	5307	18.0	14.7	93.2	1.3	122
100	4	5324	17.9	14.9	92.6	5.0	121
500	1	5194	17.8	14.6	92.4	4.0	122
500	2	4970	17.4	*14.3*[2]	92.3	7.5	121
500	3	*4556*[2]	*15.8*[2]	*14.3*	92.6	31.6	122
500	4	*4605*	*15.7*	14.7	*91.8*[2]	58.4	118
Check[3]		5272	17.8	14.8	92.9	0	117
L.S.D. (5%)		439	1.1	.5	.8		

[1] Gibberellic acid at the rate of 12 gallons per acre.
[2] Italicized values differ significantly from the check.
[3] No material applied.

Yield reductions occurred when three and four applications of 500 p.p.m. of gibberellic acid were applied. There was also an indication of sucrose reduction with two and three applications of 500 p.p.m. of gibberellic acid although the four applications of 500 p.p.m. treatment was equal to the check. These reductions are reflected in lower sugar per acre for the three and four 500 p.p.m. applications. Thin juice purity was lowered significantly with four applications of 500 p.p.m. of gibberellic acid. Bolting increased materially in the higher rates of treatment.

Summary

In 1958 and 1959 spray applications of gibberellic acid were made on sugar beet plants in the last half of June at Sheridan, Wyoming.

Single and multiple applications of 10 or 100 p.p.m. produced no crop response. Two, three and four applications of 500 p.p.m. tended to reduce tonnage, sucrose, sugar per acre and thin juice purity and to increase percent bolting. These data indicate that it is doubtful that gibberellic acid applied early in the growing season under the conditions of these tests will have a role in increasing sugar beet production.

Literature Cited

(1) GASKILL, J. O. 1957. A preliminary report on the use of gibberellic acid to hasten reproductive development in sugar beet seedlings. Jour. Amer. Soc. Sugar Beet Tech. IX (6) : 521-528.

(2) NELSON, R. T. and WOOD, R. R. Studies of chemical treatments on sugar beets including gibberellic acid, 2,4-D, and maleic hydrazide. Jour. Amer. Soc. Sugar Beet Tech. X (1) : 76-79.

(3) PETERSON, DONALD F. 1958. Effect of gibberellic acid on germination, sucrose, and yield of sugar beets. Jour. Amer. Soc. Sugar Beet Tech. X (1) : 53-55.

(4) STOUT, MYRON. 1959. Some effects of gibberellic acid on the physiology of sugar beets. Jour. Amer. Soc. Sugar Beet Tech. X (4) : 305-310.

(5) WITHWER, S. H. and BUKOVAC, M. J. 1958. The effects of gibberellin on economic crops. Econ. Botany XII (3) : 213-255.