A Field Study of Three Growth Retardants on Sugarbeets

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In 1968 Wort and Singh (13)[2] reported that preharvest foliar application of inhibitors of amino acid and protein synthesis could result in increased sucrose content. This contention was further supported in a series of papers by Singh and Wort (8,9) and Wort and Singh (14) reporting decreased leaf area, increased percent sucrose, and decreased total and protein nitrogen in the root 7 to 21 days following foliar application of vanadyl sulfate, pyrocatechol, and maleic hydrazide. They suggested that under field conditions, particularly in the presence of excess available nitrogen, increased percent sucrose and possibly increased total sucrose would result from the use of these materials.

Wittwer and Hansen (11,12) observed no effect of maleic hydrazide on percent sucrose one year but increased sucrose the next year with no effect on yield in either year. Furthermore, Peto et al. (4) obtained increased sucrose content and reduced growth from a midsummer maleic hydrazide treatment but no significant differences from applications made later in the season. Increased percent sucrose and yield were observed by Mikkelsen et al. (2) from some of their maleic hydrazide treatments. No significant effect of maleic hydrazide was found by Nelson and Wood (3) while Schreiber and Ferguson (6,7) and Poostchi and Schmehl (5) obtained increased percent sucrose with a corresponding reduction in tonnage. Poostchi and Schmehl (5) also found significant but small increases in sucrose content and recoverable sucrose from foliar applications of pyrocatechol but no effect of vanadyl sulfate. The following study was initiated in order to determine the effects of these growth inhibitors under Maine conditions.

Materials and Methods

The KleinWanzlebner IS-922 variety was seeded at 2.6 inch spacing in 28 inch rows on May 24, 1968. The soil was a Caribou loam with pH 5.5 located in Presque Isle, Maine. One thousand pounds of 10-15-15+0.25B and 1 ton lime were broadcast and harrowed in prior to planting. Beets were hand thinned to about 8 inches. Pyrazon and TCA were applied preemergence and cultivation and hand hoeing were performed as needed for weed control.

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[2]Numbers in parentheses refer to literature cited.

The five treatments (Table 1) were arranged in 8 randomized complete blocks. Plot size was two 30 foot rows, 24 feet of which were harvested. Treatments were applied October 9, 1968 in approximately 50 gallons of water per acre with a wetting agent. A Scott-Urschel harvester was used to harvest on October 16, 1968. The beets were washed, trimmed, weighed, and analyzed for sucrose in the tare laboratory of Maine Sugar Industries on October 18, 1968. Yields were analyzed by variance with 5 percent confidence level.

Table 1.—Sugarbeet response to growth retardants applied seven days prior to harvest.

Treatment	Material Lbs/A	Number Per 100 Ft.	Roots T/A	Sucrose %	Sucrose Lbs/A
Control (Water)	—	137	10.75	19.77	4250
Vanadyl Sulfate	3	139	11.94	19.62	4680
Pyrocatechol	3	136	10.46	19.84	4140
Maleic Hydrazide-30	3	127	10.77	19.53	4200
Maleic Hydrazide-30	10	139	11.02	19.73	4340
		n.s.	n.s.	n.s.	n.s.

Results and Discussion

In contrast to the results obtained by other workers (2,3,4,5,6,8,9, 12,14), our data show no measurable differences resulting from the treatments (Table 1). Sucrose content of all treatments was excellent though yields low. The low yields may be attributed in part to the medium acid soil (pH 5.5) since Hepler and Hutchinson have found that the optimum pH for sugarbeets on Caribou soil is above 6.0 (1). The short, cool and relatively dry season (Table 2) also limited overall yields. Higher temperatures, particularly early in the season, are necessary for higher tonnage although the late season climate was nearly ideal for sucrose accumulation (10).

Table 2.—Temperatures and rainfall, Presque Isle, Maine, 1968.

Date	Average Temperature Minimum	Maximum	Mean	Rainfall Inches
May 24-31	40.1	66.8	53.4	0.29
June	48.7	70.7	59.7	1.62
July	53.4	79.9	66.6	3.37
August	47.8	71.1	59.5	2.38
September	46.8	70.0	58.4	0.93
October 1-9	39.7	61.6	50.6	0.64
October 10-16	40.4	61.0	50.7	0.10
Total				9.33

The rationale supporting the use of amino acid and protein synthesis inhibitors prior to harvest is to counteract either mismanagement of the nitrogen regime and/or climatic-induced formative growth. Neither of these two conditions was present in this experiment. A nitrogen experiment in the same field exhibited typical reduction in percent sucrose as a function of increased nitrogen (Figure 1). This

regression predicts that 100 pounds of fertilizer nitrogen would reduce the sucrose 0.57 percent. It may be argued that though the amount of fertilizer nitrogen applied was optimum for total yield, it was still sufficient to induce a measureable reduction in sucrose content.

The literature published in the past 20 years on the use of growth retardants on sugarbeets does not present a strong case for their commercial application. Differences noted, if any, have been neither consistent nor impressive. Generally, increased percent sucrose has accompanied compensating reduced tonnage as noted for maleic hydrazide. Neither Table 1 nor the data of Pootschi and Schmehl (5) supports the suggestion that foliar application of pyrocatechol or vanadyl sulfate will result in marked increases of sucrose content under field conditions as suggested by Singh and Wort (8,9). Since most suggestions for the use of growth retardants are designed to provide a system anatagonistic to overfertilization with nitrogen, it is suggested here that a frontal attack on the nitrogen management problem should be economically and aesthetically more rewarding.

Summary

The growth retardants vanadyl sulfate, pyrocatecol, and maleic hydrazide applied to the foliage seven days prior to harvest in a field experiment affected neither yield nor percent sucrose. The high average sucrose, 19.70 percent, resulted from temperature and moisture conditions particularly favorable for high sucrose accumula-

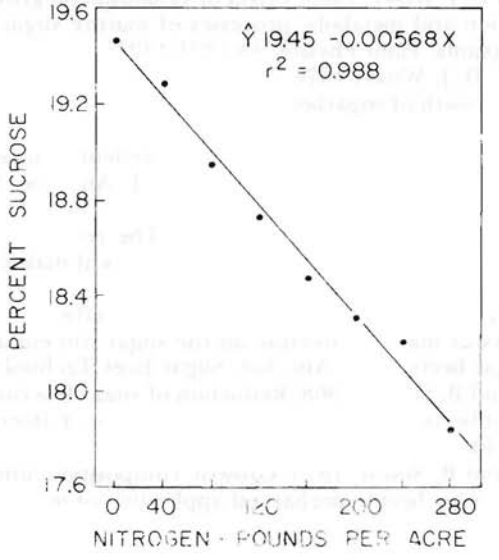

Figure 1.—Regression of percent sucrose on amount of nitrogen applied per acre.

tion. The fertility management followed as recommended practice, which normally produces less than maximum sucrose content, did not allow for excessive vegetative growth. Nitrogen management rather than growth retardants offers greater potential for the control of sugarbeet quality.

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