

Maleic Hydrazide and Topping of Overwintered Sugar Beets—a Potential Means of Reducing The Beet Virus Reservoir

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Introduction

Ample evidence indicates that both the beet yellows and beet mosaic viruses are primarily associated with overwintered beets as a source of virus for new plantings. Yet it has become a common practice to overwinter large acreages of sugar beets for spring harvest in many beet-growing areas of California and other far western states of the USA with mild winters. Although this has allowed a much more efficient utilization of processing facilities and is now an economically established practice, it has contributed to a greatly increased incidence of the beet viruses in areas where old and new plantings are present simultaneously (2)².

As the results of Duffus (2) and others suggest, a distance of a few miles between overwintered and newly planted beets will materially reduce the incidence of the beet yellows and mosaic viruses. Thus, an effort has recently been made to separate the overwintered acreage from those in which beets are planted in early spring, or to harvest all beets in an area before making new planting. Frequently, however, because of the technical difficulties encountered, it has been impossible to harvest all overwintered beets in an area before new plantings are made. As it seems reasonable to assume that the leaves and shoots of infected plants are the chief sources of virus acquisition by aphids, an investigation has been made to test the feasibility of holding overwintered beets in the field for limited periods without tops.

The shoot depressant effects of maleic hydrazide sprays and mechanical removal of tops, each alone, and in combination, were evaluated during the time of year when peak aphid flights occur. The results of this investigation are presented herein.

Materials and Methods

Test plots of sugar beet, variety Spreckels Sugar 202H, were planted on May 9, 1964, in beds on 40-inch centers with two rows of plants to each bed. Each plot consisted of four beds

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² Numbers in parentheses refer to literature cited.

50 feet in length. The plots were laid out to leave two untreated beds between adjoining plots to act as a buffer to virus spread by aphids. On June 15, the plants were thinned to a distance of 8 inches within the row. This was followed by a side dressing of ammonium sulfate sufficient to give 200 pounds of nitrogen per acre. The beets were then maintained with occasional irrigation until the following spring when the tests were carried out.

The plots were sprayed with maleic hydrazide on March 15, 1965. Two concentrations of the materials sufficient to give 3 and 6 pounds per acre were applied in an aqueous solution with a wetting agent using a commercial orchard sprayer. The volume of spray applied, approximately 350 gallons per acre, was adequate to drench the foliage thoroughly. The tops were removed from the appropriate plots on April 6, using an ordinary roto-beater as commonly used in a commercial operation before harvest. Plots of topped and non-topped plants at each concentration of maleic hydrazide and comparable non-sprayed plots were replicated six times for the test.

The regrowth of shoots on previously topped plants was measured on May 5, a few days before harvest. The length of the longest shoot on each plant in the two center rows of each plot was recorded.

The plots were harvested on May 11. Only the center two beds of each plot were harvested by lifting the roots of each plant using a two-pronged fork. The excess soil was removed before the roots were weighed. Two ten-beet samples were taken from each plot for sucrose and tare soil determinations.

Results

Maleic hydrazide markedly inhibited the sprouting and regrowth of shoots on sprayed beets (Table 1). Topped beets which were not sprayed with maleic hydrazide resprouted promptly after topping, whereas the appearance of sprouts on sprayed beets was delayed considerably. No new shoots were observed on the beets sprayed with 6 pounds per acre maleic hydrazide for more than two weeks after topping.

Very few of the topped beets were damaged due to rot. In most cases the cut surface of the crown dried out to form a relatively tough protective layer and only a very few roots were lost because of rot or fermentation.

The number of beets with regrowth was also markedly reduced by maleic hydrazide sprays. Whereas more than 90% of the topped beets without maleic hydrazide formed new shoots,

Table 1.—Effect of maleic hydrazide sprays on yield and development of new shoots on overwintered sugar beets with and without tops.

Treatment ^a	Percent with shoots ^b	Average length of shoots	Root yield	Percent sucrose	Sucrose yield
		Inches			Tons/A
<i>With tops</i>					
No maleic hydrazide	—	—	35.31	12.2	4.30
3 lb/A maleic hydrazide	—	—	34.67	14.0	4.88
6 lb/A maleic hydrazide	—	—	34.00	14.0	4.78
<i>Tops removed</i>					
No maleic hydrazide	91.9	6.5	31.95	11.8	3.78
3 lb/A maleic hydrazide	85.5	4.1	32.13	12.3	3.98
6 lb/A maleic hydrazide	48.5	2.5	33.98	12.5	4.25
LSD .05			N.S	0.8 ^c 1.1 ^d	0.45 ^c 0.55 ^d

^a Plots were seeded on May 9, 1964, sprayed with maleic hydrazide on March 15, the tops removed on April 6, and plants harvested May 11, 1965.

^b Percent of topped beets with new shoots at the time of harvest.

^c For differences among MH treatments for the topping treatment.

^d For differences among MH treatments for different topping treatments.

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this was reduced to about 85% with 3 pounds of maleic hydrazide per acre and to less than 50% with 6 pounds of the material per acre (Table 1). In addition, the length of shoots were considerably reduced as a result of spraying. This is a reflection of the slow rate of regrowth which occurred, and was particularly apparent at the higher concentration of maleic hydrazide (Table 1).

There was essentially no difference in sucrose yields from beets sprayed with maleic hydrazide at the rate of 6 pounds per acre followed by topping when compared with untreated beets. The sucrose yields in tons per acre for these two treatments were 4.25 and 4.30, respectively, (Table 1). This result suggests that with maleic hydrazide sprays, beets can be maintained without tops for a period of several weeks and yet produce the same yields as conventionally treated fields.

The data indicate that the loss in both tonnage and percent sucrose associated with topping can be prevented by maleic hydrazide sprays. Topping alone was obviously undesirable as it reduced sugar production largely through its effect on sugar concentration, but this detrimental effect of topping was apparently reversed by maleic hydrazide (Table 1).

The maleic hydrazide sprays appeared to improve sugar production when the beets were not topped (Table 1). This result

may be due to the effect of maleic hydrazide as a growth inhibitor. As the overwintered beets were beginning to produce seed stalks at the time the present experiments were carried out, it is probable that the new growth served to deplete a portion of the sugar reserves in the roots.

Discussion

Wittmer and Hanson (3) and others have reported maleic hydrazide to be a fairly effective inhibitor of the respiratory loss of sucrose in beets and have noted its effect in suppressing sprouting and new growth on stored beets. Cornford (1) obtained results indicating the material may be useful in depressing shoot development on overwintered mangold and fodder beets in storage and suggested its use in preventing the development of shoots which serve as sources of the beet viruses to their aphid vectors. The results reported herein indicate maleic hydrazide may be of similar use for overwintered beets in the field. Although the concentrations of the material used herein did not wholly suppress sprouting, the new shoots were markedly delayed in their development, and only about one-half as many beets developed shoots as the untreated plants.

No attempt was made to test the ability of aphids to acquire virus from plants without tops but presumably the probability of virus acquisition by aphids would be greatly diminished.

The use of maleic hydrazide and topping on large acreages of overwintered sugar beets may not be economically feasible but it might be a useful means of reducing the reservoir of the beet viruses where only a few overwintered fields remain unharvested during peak aphid flights in areas normally used for early spring planting of beets.

Literature Cited

- (1) CORNFORD, C. E. 1955. Maleic hydrazide as a shoot depressant for clamped mangolds and fodder beets. *Plant Pathol.* 4: 89-90.
 - (2) DUFFUS, J. E. 1963. Incidence of beet virus diseases in relation to overwintering beet fields. U. S. Dept. of Agri. *Plant Disease Repr.* 47: 428-431.
 - (3) WITTMER, S. H., and C. M. HANSON. 1951. The reduction of storage losses in sugar beets by preharvest foliage sprays of maleic hydrazide. *Agron. J.* 43: 340-341.
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