Effect of Incorporation Methods and Carrier Type of Endothal (TD-66) On Control of Weeds In Sugar Beets[1]

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Chemical control of weeds in sugar beets, particularly those weeds in the adjacent three to four inches of the row, has received considerable attention the last few years. However, the final results are not always easily predicted at the time the chemicals are applied. Part of this variability probably is due to the incorporation method and the type of carrier used for the herbicide. It is the purpose of this paper to report results of research on the above factors.

Studies of the mixing characteristics of various incorporation devices in 1960 (3)[3] indicated that the rototiller mixed the granular carrier the most uniformly into the soil. The finger weeder gave fairly uniform lateral distribution with a higher concentration of carrier near the surface of the ground than at the bottom of the operating depth of the fingers.

The distribution pattern of the rotary hoe showed heavier concentrations of carrier near the surface than at operating depth and in the vicinity of penetration of the tooth. The Sinner weeder (Figure 4), which consists of a row-crop ditcher shovel 6 inches in width with a spray nozzle or a granular distributor and covering blades mounted behind, caused the carrier to be concentrated on a strip 6 inches wide at the operating depth of the shovel (1 to 1½ inches). This strip is then covered with soil by the covering blades. The no-incorporation-front method resulted in some incorporation of the carrier by the furrow opener, the covering chains, and the press wheel. The carrier is applied in a band behind the press wheel for the no-incorporation-rear method.

Experimental Procedure

Methods of Incorporation

The effect of incorporation methods on control of weeds in sugar beets by the Endothal (TD-66) herbicide was studied at

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[3] Numbers in parentheses refer to references.

two locations in Wyoming during 1961—at Torrington, where the experiment was begun April 18, and at Powell, where the experiment was begun April 21.

The experiments were of the randomized-block design, with treatments replicated four times. There were 26 plots, 2 rows wide and 75 feet long, in each replication. One of the rows in each plot was treated and the other was not treated. The treatments were made up of 1. two herbicide formulations—spray and granular (30/60 RVM attapulgite, 2½% active ingredients); 2. two rates of application—1 lb and 2 lbs of active ingredient per acre, band basis; and 3. six methods of incorporation—rototiller (RT), rotary hoe (RH), finger weeder behind the planter (FWR), Sinner weeder (SW), no incorporation ahead of the planter furrow opener (NIF), and no incorporation, carrier applied behind the press wheel (NIR). Each replicate had two check plots.

The finger-weeder-rear (Figure 1) device was developed for testing during 1961 because the results secured during 1960 (4) suggested a need to study a method which would give shallow incorporation of the herbicide behind the planter unit to reduce the concentration of the herbicide around the sugar beet seed.

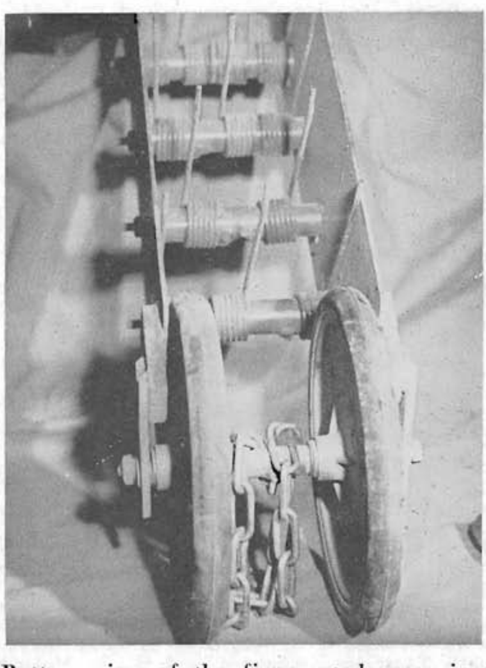

Figure 1.—Bottom view of the finger-weeder-rear incorporation unit. Figure 2 shows the unit mounted on the experimental planter.

Figure 2.—Equipment used for planting the two-row plots. The finger-weeder-rear incorporating unit is shown.

The various incorporation devices and planters (Figure 2) were mounted on a tool bar. One of the planters was used to provide for an untreated row between each treated row. The drive wheels of the two planters were connected by a flexible shaft to insure equal plate speeds for each planter. The planters were set to space the seed approximately 3 inches in the row. A University of Wyoming distributor (Figure 3) was used to distribute the granules, and spray nozzles were placed to give a 6-inch band of spray. Details of this distributor have been reported earlier. (2)

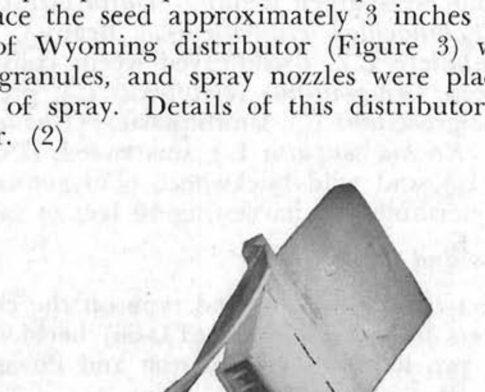

Figure 3.—The University of Wyoming distributor mounted behind the shovel of the Sinner weeder incorporation unit. See Figure 4 for a picture of the covering blades.

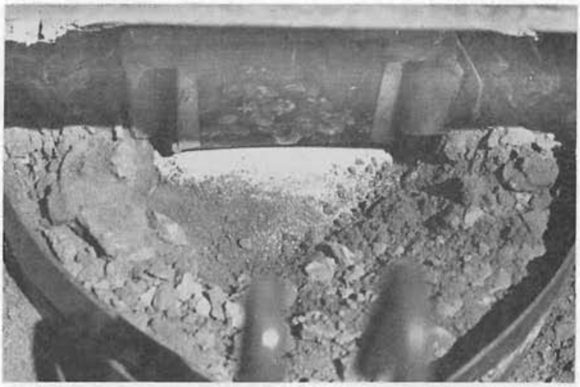

Figure 4.—The Sinner weeder incorporation unit. Figure 3 is the bottom view of the distributor and shovel.

Weed and beet population counts were taken when the sugar beets were in the 2- to 4-leaf stage of growth. The weed counts were taken from an area 20 feet in length and 6 inches wide, 3 inches on either side of the beet row. The plant population was classified as to (A) sugar beets, (B) broadleaved weeds, and (C) grass weeds. Grasses most commonly found growing in the sugar beet plot were green foxtail, *(Setaria viridis* Beauv.), barnyardgrass, *(Echinochloa crusgalli* (L.) Beauv.), and witchgrass *(Panicum capillare* L.). Broadleaved weeds consisted mainly of rough pigweed, *(Amaranthus retroflexus* L.), prostrate pigweed, *(Amaranthus graecizans* L.), lambsquarters *(Chenopodium album* L.), kochia, *(Kochia scoparia* L.), smartweed, *(Polygonum pennsylvanicum* L.), and wild buckwheat, *(Polygonum convolvulus).* Yield was determined by harvesting 10 feet of each treated row.

Granule Size and Type

The effect of granule size and type on the control of weeds in sugar beets by the Endothal (TD-66) herbicide was studied at the same two locations, Torrington and Powell.

The experiments were of the randomized-block design with treatments replicated four times. There were 22 plots, 2 rows in width and 75 feet long, in each replication. The treatments were made up of (A) five herbicide formulations—spray, 16/30 LVM (calcined attapulgite granules), 16/30 RVM (non-calcined granules), 24/48 LVM granules, and 24/48 RVM granules; and (B) two rates of application—1 pound and 2 pounds of active ingredient per acre, band basis. At the 1-pound rate, it is estimated that there would be one granule per .091 cubic inch of soil for 16/30 size granules and one per .0135 cubic inch of soil for the 24/48 size.

All formulations were incorporated to an approximate 1½-inch depth by a 6-inch width rototiller incorporation device. The equipment used for planting the sugar beet seed and metering the spray and granules was the same as described in the previous section. Weed and beet population counts and beet yields were taken with the same procedure described earlier in the section on the effects of incorporation methods.

The cultivation effect of the incorporation devices on weed control was not separated from the chemical effect in these studies.

Results and Discussion

Incorporation Methods

The results of the weed counts, beet-stand counts, and yield data for the various incorporation methods are shown in Figures 5 and 6[4]. The percent control was determined from the counts in the treated row compared with the untreated row in each plot.

The treatment effects for broadleaf-weed control, grass-weed control, and sugar beet seedling stand were statistically significant. In each case, a large portion of the treatment differences was accounted for by the treatment versus check and by incorporation versus no-incorporation effects. The 2-pound application rate did not result in better weed control or reduce the beet

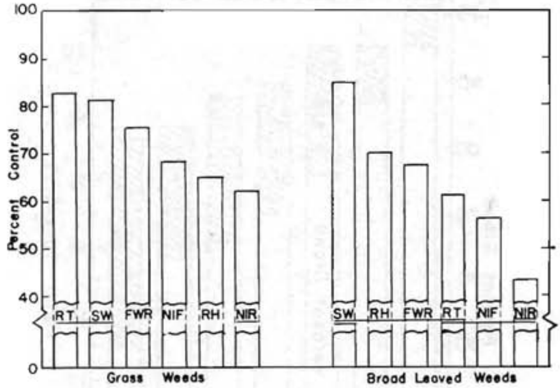

Figure 5.—The percent control of weeds in sugar beets by Endothal for various methods in incorporation, Torrington and Powell experiments combined. See the footnote for an explanation of the statistical inferences.

[4] With reference to Figures 5, 6, 7, and 8, the values are placed in descending order from left to right. A break in the underline denotes statistically significant differences between the component underlined parts at the 5 percent level. For example, the SW, RH, FWR, RT method of incorporation resulted in significantly better broadleaved-weed control than the NIR method and the SW method was significantly better than the RT, NIF, and NIR methods.

SW stands for Sinner weeder, RH for rotary hoe, FWR for finger-weeder-rear, RT for rototiller, NIF for no incorporation, carrier applied in front of planter, NIR for no incorporation, carrier applied behind the planter press wheel, and CH for check plot.

stand more than the 1-pound rate. Over all, there were no differences between the granular and liquid carriers.

Analysis of the weed-control results indicated a distinct advantage for certain methods of incorporation of the chemical. The Sinner weeder (SW), which placed the herbicide in a layer 1 to 1½ inches below the surface, appeared to be the most effective method of placing the carrier of the chemical. Incorporation by the finger-weeder-rear method was effective for weed control and ranked well on the basis of the beet-seedling stand. This method appears to have promise where chemicals are used that have relatively close tolerances on the basis of toxicity to the crop. The above results are attributed to the fact that the shallow incorporation above the beet seed resulted in less toxicity to the beets and at the same time gave relatively good weed control.

On the basis of the results secured for the Sinner-weeder method of incorporation, it would appear that placing the herbicide in a layer, 1 to 1½ inches below the surface of the ground, is an effective way of placing the carrier (either liquid or granular) of Endothal (TD-66).

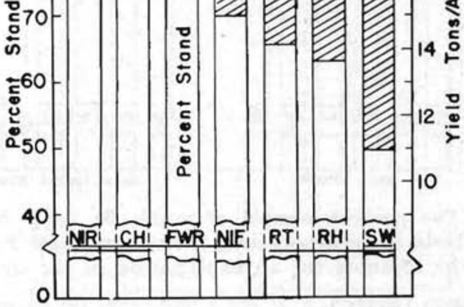

Figure 6.—The yield of sugar beets and percent sugar beet seedling stand for various methods of incorporating Endothal, Torrington and Powell experiments combined. The statistical data refer to the sugar beet seedling data. None of the yields for treated plots were significantly different than the yield of the check plots. See footnote for an explanation of the statistical inferences.

A complex statistical analysis on sugar beet yield data for Torrington and Powell combined (Figure 6) indicated that none of the treatment yields was significantly different than the yield of the check plots. However, the yield for the Sinner-weeder treatment was significantly less than the yield of the check plots at Powell. Figure 6 suggests a decrease in yield with the lower sugar beet seedling stands even though the yield differences were not significantly different.

Granule Size and Type

The results of the percent control grass and broadleaved weed for various types of carriers for Endothal (TD-66) are shown in Figure 7 and the results of the beet-seedling counts and the sugar beet yields are shown in Figure 8.

The percentage weed control was not significantly different between the 1-pound and 2-pound rates, although the counts showed fewer weeds for the 2-pound rate.

The treatment effects for broadleaved and grass-weed control and sugar beet seedling stand were statistically significant; however, most of the treatment effect was attributed to the treatment versus no-treatment comparison.

The differences between treatment due to granule sizes and type, and granules versus spray, were not statistically significant on the basis of sugar beet yield, sugar beet seedling stand, or weed control.

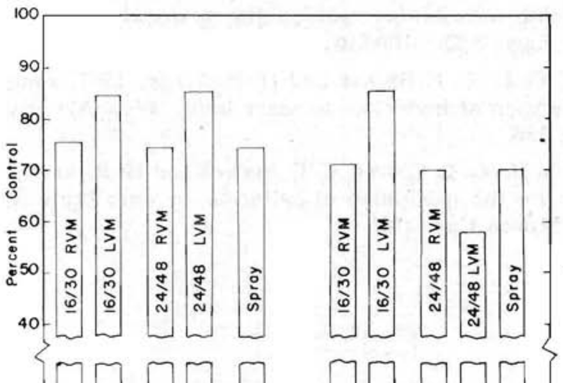

Figure 7.—The percent control of weeds for different sizes and types of granular formulations of Endothal and for spray formulations of Endothal, Torrington and Powell combined. The treatment differences were not statistically significant.

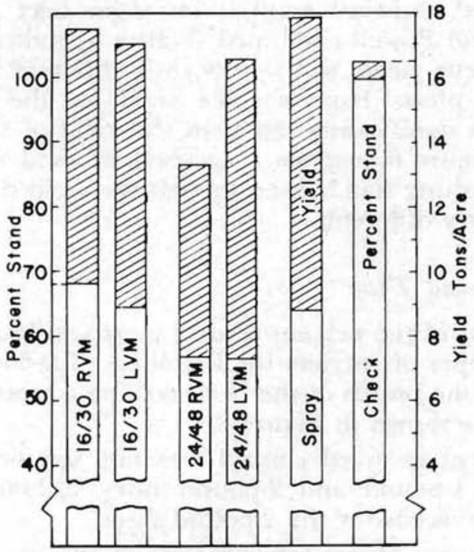

Figure 8.—The yield of sugar beets and percent sugar beet seedling stand for different sizes and types of granular formulations of Endothal and for spray formulation of Endothal, Torrington and Powell experiments combined. The treatment differences were not statistically different.

References

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