The Effect of Incorporation Methods on Weed Control With Tillam in the Rocky Mountain Region

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Received for publication February 19, 1964

The value of incorporating herbicides into the soil has been thoroughly demonstrated. It is important to determine the most efficient means of incorporation, the most economic method, the most practical, and that method which enhances tolerance of sugar beets to the chemical. We have reached a point in sugar beet production where the uncertain labor picture poses a great challenge to raising a crop of beets with an absolute minimum or no hand labor at all. Many of us feel that we have the knowledge, mechanical equipment and herbicides to do the job.

Most Rocky Mountain farmers are constantly faced with rising costs and for the smaller acreage grower this equipment cost is serious.

This project was set up to compare the inexpensive methods of incorporation such as the Sinner and Ridgecover with the more expensive power driven Bye-Hoe and Eversman.

Considerable work has been done with numerous different incorporation devices but only a limited amount of information regarding actual field comparisons is available (1, 2, 3)[2].

Materials and Methods

Four incorporation devices were compared, using the herbicide Tillam (propyl ethyl n-butylthiolcarbamate—Stauffer Chemical Company) at two depths and two rates of application. The four incorporation devices represent two basic methods of incorporation, power-driven mixing and layering. The Bye-Hoe and Eversman tiller are power driven mixers and the Ridgecover and Sinner Tiller (also called Russ-Ken) represent the layering method of incorporation. The Bye-Hoe contains L-shaped knives and the Eversman has pegs which constitutes the primary difference between the two power driven tillers. These two provide complete mixing of the herbicide and soil. The Ridgecover method as used in these tests utilized discs in pairs to cover the herbicide. Tillam was sprayed ahead of the discs as a 7-inch band with the discs covering the sprayed band with soil. This forms a modified ridge on top of the herbicide. The Sinner Tiller method also places the herbicide in a flat band behind a furrow opener with the Sinner blades covering the chemical-treated bands with soil.

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[2] Numbers in parentheses refer to literature cited.

The herbicide treatments and methods of incorporation as shown in Table 1 were tested in 49 field trials in Montana, Wyoming and Colorado with each field trial considered as one replication. Data were obtained from 33 tests with 11 tests lost in one factory district due to a severe frost. Others were lost to hail and not being irrigated.

The treatments as shown in Table 1 need further clarification regarding depth of incorporation. For example treatment one reads "incorporate 1¼ inches" and this refers to the power driven Bye-Hoe and Eversman. When the Bye-Hoe and Eversman were 1¼ inches deep, the Sinner and Ridgecover were from ¼ to ½ inches deep. In treatment two the Sinner and Ridgecover were 1 to 1½ inches deep when the power driven equipment was 2⅜ inches deep.

Table 1.—Herbicide and incorporation treatments applied in Holly Sugar's Montana, Wyoming and Western Colorado areas in 1963.

Treatments: Bye-Hoe, Sinner Tiller, Ridgecover

1. Tillam 4# per acre—Incorporate 1¼ inches
2. Tillam 4# per acre—Incorporate 2⅜ inches
3. Tillam 5# per acre—Incorporate 1¼ inches
4. Tillam 5# per acre—Incorporate 2⅜ inches
5. No herbicide and no incorporation
6. No herbicide, incorporate 2⅜ inches

Treatments: Eversman

7. Tillam 4# per acre—Incorporate 1¼ inches
8. Tillam 4# per acre—Incorporate 2⅜ inches
9. Tillam 5 #per acre—Incorporate 1¼ inches
10. Tillam 5# per acre—Incorporate 2⅜ inches

Two tractors were set up to allow spraying, incorporating, and planting all in one operation. One tractor had the following incorporation devices arranged on the front tool bar as follows: Row 1—Sinner Tiller; Rows 2 and 5—Check, no herbicide and no incorporation; Rows 3 and 4—Bye-Hoe; Row 6—Ridgecover with discs. The second tractor had a front mounted Eversman incorporator with the following arrangement: Rows 1, 3, 4 and 6—Eversman incorporated; Rows 2 and 5—Check, no herbicide and no incorporation.

The herbicde Tillam was applied in a 7-inch band but the rates are expressed as pounds of active ingredient on over-all coverage. Monogerm seed was planted with an International Harvester 185 unit planter at a rate of 4 seeds per foot. Each treatment consisted of 6 rows 100 feet in length. Sufficient check rows were included in order to have an untreated row adjacent to each treated row. In obtaining weed data the adjacent check rows minimized weed population variations. Weed counts were

taken from an area 3 inches by 48 inches with the beet row in the center. Sugar beet counts included 10 feet of row. The plant population was classified as to sugar beets, broadleaved weeds, and grassy weeds, but the weed data are presented as total weeds.

Results and Discussion

Considerable difficulty was encountered in obtaining the deep depth of incorporation in the Montana tests due to high soil moisture content. This moist soil condition showed the Sinner to advantage. The Bye-Hoe, Eversman, and Ridgecover caused the moist soil to be exposed even more and this resulted in the planter discs and depth bands picking up the treated soil and sometimes leaving seed exposed and treated soil no longer in the band. The Sinner reacted somewhat differently as there was just enough dry soil on the surface so that with the furrow opener running shallow the Sinner blades had sufficient dry soil to cover the herbicide band resulting in better planter operation. However, this better planting operation was not reflected by improved weed control.

It was possible to obtain the two incorporation depths in Wyoming and Colorado. The two depths of incorporation in the Wyoming and Colorado tests resulted in an average of 8 percent more weed control for the deeper depth with very little influence on beet emergence. As a result of the small difference in weed control due to depth of incorporation, and obtaining only the shallow incorporation depth in the Montana tests, the data as presented in the following tables are not separated on the basis of depth of incorporation.

Table 2 presents the percent weed control and percent beet stand reduction as influenced by incorporation methods, namely Bye-Hoe, Eversman, Sinner and Ridgecover.

All methods of incorporation resulted in very good weed control. The Ridgecover method gave slightly less weed control than the other three methods and was also the most severe in beet stand reduction with the other methods being comparable. The beet stand reduction for Ridgecover is greatly influenced by the Montana tests where because of the very moist soil conditions the Ridgecover method brought up ribbons of moist soil resulting in a very poor seed bed.

The increase of herbicide rate from four pounds to five pounds increased weed control 6.6 percentage points and increased beet stand reduction 5.8 percentage points. All incorporation methods followed a similar pattern in weed control and beet stand reduction when the herbicide rate was increased.

In order to present somewhat more detailed influence of incorporation methods on weed control, Table 3 presents data for three locations.

To illustrate the variation of performance by incorporation methods at different locations, the Sinner gave the least weed control at Sidney but was best at Worland and Riverton. However, in overall average weed control, all four are very comparable, as shown in both Table 2 and Table 3.

Table 4 presents the effect of incorporation methods on sugar beet emergence.

All four methods of incorporation resulted in reduced beet emergence as compared to the check. The data show the power driven incorporation methods to advantage, with about two more plants emerging in every 10 feet of row. This advantage could not be distinguished in the field but counts brought out this difference.

It is of interest to observe from these tests that beet seedlings were affected when weed control was obtained. In no test was there an exception to this due to incorporation method. This seedling effect is an inward cupping appearance of the cotyledonary leaves. When cupping was severe, usually on light soils,

Table 2.—The percent weed control and percent beet stand reduction due to the listed incorporation methods at two herbicide rates in Holly Sugar's Rocky Mountain area in 1963.**

Incorporation method	Tillam rate*	Percent weed control	Percent beet stand reduction
Bye-Hoe	0	27.0	4.0
	4	73.0	10.0
	5	79.0	14.0
Eversman	0	18.0	5.0
	4	76.5	7.5
	5	79.5	15.5
Sinner Tiller	0	25.0	7.0
	4	68.5	12.5
	5	80.0	21.0
Ridgecover	0	15.0	13.0
	4	68.5	12.5
	5	74.5	25.5
Average of all	0	21.2	7.2
Incorporation	4	71.6	13.2
Methods	5	78.2	19.0

*Expressed as pounds of active ingredient on overall coverage but applied as a seven inch band treatment.

**Averages of 29 tests.

the power driven incorporation methods showed a lesser degree of damage. In general Tillam gave very good over-all weed control with beet seedling reaction being a temporary effect. The following weed species were being controlled: Foxtails (*Setaria* spp.), Barnyard grass (*Echinocloa crusgalli*), Wild oats (*Avena Fatua*), broadleaved weeds, Pigweed (*Amaranthus retroflexus*), Lambsquarter (*Chenopodium album*), and Nightshade (*Solanum* spp).

Table 3.—The percent weed control due to the listed incorporation methods at two herbicide rates at three locations in 1963.

		Incorporation methods			
		Percent weed control			
Location*	Tillam rate**	Bye-Hoe	Eversman	Sinner tiller	Ridgecover
Sidney	4	68	73	44	62
	5	76	70	60	70
Worland	4	80	68	78	78
	5	84	83	89	78
Riverton	4	85	82	90	87
	5	86	84	91	92
Sidney Average	....	72	72	52	66
Worland Average	....	82	76	84	78
Riverton Average	....	86	83	90	90
Total Average	....	80	77	75	78

*Sidney, Montana—average of 9 tests; Worland, Wyoming—average of 7 tests; Riverton, Wyoming—average of 6 tests.

**Expressed as pounds of active ingredient on overall coverage but applied as a seven inch band.

Table 4.—The effect of different methods of incorporation on sugar beet emergence with two rates of Tillam in the Rocky Mountain area in 1963.

		Incorporation methods				
		Average beet emergence per 10 feet of row				
Location	Tillam rate*	Bye-Hoe	Eversman	Sinner tiller	Ridgecover	Check
Sidney	4	16	20	17	12	20
	5	14	19	17	12	20
Hardin	4	18	20	18	15	20
	5	19	20	18	13	20
Worland	4	33	33	34	30	37
	5	30	28	32	30	36
Riverton	4	22	21	17	18	25
	5	21	20	16	18	23
Torrington	4	32	34	30	36	33
	5	32	33	28	32	31
Total Average	....	23.7	24.8	22.7	21.6	26.5

*Expressed as pounds of active ingredient on overall coverage but was applied in a seven inch band.

Summary

A number of herbicide trials using Tillam were conducted comparing four methods of incorporation, (Bye-Hoe, Eversman, Sinner Tiller, and Ridgecover) in Holly's Montana, Wyoming and Colorado areas.

A good sampling of factors influencing weed control was obtained in covering a three state area. These factors were as follows: differences in soil types, soil moisture content, seed bed condition, air temperature, irrigation and rainfall, and cultural practices.

The two depths of incorporation provided almost similar beet emergence results with the deeper depth providing eight percent more weed control. This could not be observed without counts.

Very good weed control was obtained with all four methods of incorporation, all of them being equally effective.

All four methods of incorporation caused a reduction in sugar beet emergence but this difference was usually very difficult to observe except in a few tests. The emergence results gave the Bye-Hoe and Eversman an advantage of 9 percent more seedlings than the Sinner and Ridgecover method. This may not be true when using a herbicide with a greater range of beet tolerance.

From the data obtained in these tests, it indicates that the inexpensive layering methods of incorporation will do as good a job in weed control as the more expensive power driven incorporators in the Rocky Mountain area.

Literature Cited

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