

# Experimental and Commercial Results With Tillam<sup>1</sup> for Weed Control in Sugar Beets

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## Introduction

Tillam (propyl ethyl-n-butylthiolcarbamate), a soil-incorporated selective herbicide closely related to Eptam<sup>4</sup> (ethyl di-n-propyl-thiolcarbamate), has been used extensively in experimental and commercial applications in California during the past two years. Eptam was originally tested for weed control in beets but under certain commercial practices it was found that the margin between weed control and beet injury was too narrow. The findings with Eptam led to a program designed to find a compound similar in activity but with a wider safety margin. This program resulted in R-2061 (Code number used for Tillam) being tested as a preplant soil-incorporated herbicide in small-scale field trials at various locations in the United States in 1959. Results from these trials were sufficiently encouraging to warrant an expanded program in 1960.

## 1960 California Program and Results

An extensive field testing program was undertaken in California with the majority of the trials applied in the Sacramento Valley. Trials were, however, applied in all other beet-growing areas of the state. The trials were located so that various soil types, moisture situations and irrigation practices were involved. At most locations Eptam and Tillam were each applied at 2, 4, and 8 lbs per 50 gallons of water per acre. These rates were on an over-all solid coverage basis and with band treatments, the rate per crop acre was reduced according to the width of the band treated and the row spacing. All applications, spraying and incorporation, were accomplished with commercial equipment. In all trials, each treatment was a minimum of one-half acre in size. Incorporation of the chemicals into the soil was accomplished within minutes of application using various types of equipment. Solid coverage treatments on flat ground were incorporated by discing or by spike-tooth harrowing. Where band applications were made on both flat and bed planted beets, incorporation was

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<sup>4</sup> Eptam is Stauffer's registered trademark for an herbicide.

accomplished with Bye-Hoes, Cultros, Chattins or ground-driven rotary hoes.

Results showed that beets were significantly more tolerant to Tillam than to Eptam and that good weed control could be obtained with 4 lbs per acre of Tillam under a wide variety of conditions, providing thorough soil incorporation immediately followed application. Data on weed control, stand of beets and growth of beets were obtained early in the season (just prior to thinning) and additional data were obtained throughout the season which included yield data and weed control at harvest time. Data on early weed control, beet stand and beet growth from two trials are presented in Tables 1 and 2.

Table 1.—Weed control and beet growth with Tillam and Eptam five weeks after application and seeding.<sup>1</sup>

Chemical	Lbs/A	Beet Stand <sup>2</sup>	Visual Rating of Stand	% Control		
				Growth <sup>3</sup>	Water grass	Red-root Pigweed
Tillam	2	28	Excellent	10	80	69
Tillam	4	26	Excellent	10	100	90
Tillam	8	24	Excellent	7	100	100
Eptam	2	28	Excellent	9	95	80
Eptam	4	17	Good	5	100	95
Eptam	8	14	Poor	2	100	100
Check		25	Excellent	10		

<sup>1</sup> The soil type was clay loam and incorporation was done with a Bye-Hoe.

<sup>2</sup> Stand per 3 ft of row (avg of eight random counts).

<sup>3</sup> Growth rated on a scale of 0 to 10 with 10 being normal compared to the check and 0 being death.

Table 2.—Weed control and beet growth with Tillam and Eptam 4 weeks after application and seeding.<sup>1</sup>

Chemical	Lbs/A	Beet Stand <sup>2</sup>	Visual Rating of Stand	Growth <sup>3</sup>	Control of	
					Water grass	Lambsquarters
Tillam	2	25	Excellent	10	Good	Fair
Tillam	4	26	Excellent	10	Excellent	Excellent
Tillam	8	23	Excellent	6	Excellent	Excellent
Eptam	2	23	Excellent	10	Excellent	Fair
Eptam	4	22	Excellent	7	Excellent	Excellent
Eptam	8	16	Poor	3	Excellent	Excellent
Check		24	Excellent	10	....	

<sup>1</sup> The soil type was sandy loam and incorporation was done with a spike-tooth harrow.

<sup>2</sup> Stand per 3 ft of row (avg of eight random counts).

<sup>3</sup> Growth rated on a scale of 0 to 10 with 10 being normal compared to the check and 0 being death.

The data show control of water grass, red-root pigweed and lambsquarters but other trials showed that a number of annual grasses and broadleaves were controlled with the 4-lbs per acre rate. In addition, excellent control of yellow nutgrass was obtained with the same rate. Over a variety of conditions, the best weed control was obtained with a Bye-Hoe where band treatments

were made and with cross discing where solid treatments were made. Similar results were obtained with commercial applications in 1961 and are discussed in detail below.

Beet stands were not affected by any rate of Tillam at any location. At most locations, Eptam severely reduced the stands at 8 lbs per acre with slight to moderate stand reduction at the 4-lb rate. Early growth of beets with Tillam was not affected at the 2- and 4-lbs per acre rates, and at the 8-lb rate, only slight to moderate early stunting occurred. Depending upon moisture and other growing conditions, this stunting was not visible 3 to 6 weeks after application and seeding. Eptam severely reduced early growth in most trials at the 8-lb rate and at 4 lbs per acre, early growth reduction was usually moderate.

A summary of yield data obtained from four trials is presented in Table 3. Only the Tillam 4-lb per acre treatments and the checks were sampled for beet tonnage and sugar content. At all four locations, the yield of sugar was greater with the Tillam treatment.

Table 3.—Effect of Tillam at 4 lbs per acre on beet tonnage and sugar content.

Trial No.	Soil Type	Tons of beets/A		% Sucrose		Lbs of sugar/A	
		Tillam	Check	Tillam	Check	Tillam	Check
7	Sandy loam	10.91	9.57	14.4	13.6	3,142.1	2,603.6
9	Clay loam	24.11	17.85	16.4	16.5	7,908.0	5,890.5
12	Light peat (15.1% O.M.)	23.90	21.26	13.9	13.0	6,644.2	5,527.6
16	Light peat (16.1% P.M.)	16.42	14.98	14.0	14.0	4,594.8	4,194.4
Totals		75.33	63.66	58.7	57.1	22,289.1	18,215.5
Averages		18.83	15.91	14.7	14.3	5,575.6	4,562.2
Differences			2.92		0.4		1,018.3

Soil residual of Tillam at 4 lbs per acre was determined by sampling a number of the treated fields. Soil samples were obtained at intervals throughout the season and immediately bioassayed. The bioassaying was done in a greenhouse using cultivated oats, a highly Tillam-susceptible crop, as the test plant. A total of ten locations were sampled to cover conditions varying from sprinkler irrigation to furrow irrigation and from sand to clay loam to light peat soils. The oats germinated and grew normally at least by the sixteenth week after treatment at all locations. Other data, experimental and commercial, show that recommended rates of both Eptam and Tillam pose no problem to subsequent susceptible crops, providing adequate moisture has been available for the treated crop to produce satisfactorily.

### 1961 California Program and Results

During the 1961 season, field experiments were continued in some areas in addition to an experimental sales program in all areas. Under the experimental sales program, a total of 6,000 acres of beets was treated with the majority of the acreage in the Sacramento Valley. Commercial applications were made, however, in all beet-growing areas which cover both spring and fall plantings. The results are discussed below under appropriate headings:

A. *Rates of Application:* The rate of application used was 4 lbs on all mineral soils and 6 and 8 lbs per acre on peat soils. These rates were used on an over-all solid coverage basis and with band treatments, the rate per crop acre was reduced according to the width of the band treated and the row spacing. In many fields, 8 lbs per acre were applied to a small portion as a check on beet tolerance. On mineral soils there was no injury wherever the 8-lb rate was used but in two cases where only the 4-lb rate was used, slight reduction in early growth occurred. On peat soils there was no injury from either the 6- or 8-lb rates.

B. *Incorporation:* Excellent results were obtained wherever Tillam was immediately and thoroughly incorporated into the soil. Delayed, and/or poor incorporation resulted in varying degrees of weed control ranging from no control to near commercial control.

The majority of applications were band treatments using a Bye-Hoe for incorporation. The Bye-Hoe was found to be the best tool under a wide variety of conditions as discussed below under "Soil Factors." The Cultro and Chattin were found to be effective only on peat soils and light, sandy soils. With solid treatment for flat planted beets, cross discing was uniformly effective. Spike-tooth harrowing three to four times with each harrowing at a right angle to the previous one was effective if the soil were quite loose and friable.

C. *Bed Shaping and Planting:* The main causes of poor control on bedded beets were: failure to form the beds prior to application, removing treated soil from the bed-top with sled planters and moving untreated soil from the furrows onto the treated bed during the planting operation.

D. *Soil Factors:* Soil moisture and mineral soil types did not affect results except indirectly as they influenced incorporation. This was true with all equipment other than the Bye-Hoe. With equipment other than the Bye-Hoe, adequate incorporation becomes more difficult the heavier and wetter the soil. One trial on clay loam soil was applied where the soil had free water on the

surface and was above field capacity in the top four inches. Even under these conditions, excellent weed control was obtained when incorporation with a Bye-Hoe was done immediately after spraying. Mineral soil types ranged from light sands to the heavy clay-high salt soils of the Imperial Valley.

Organic soils did not affect the results until the organic matter content exceeded 20%. The 4-lb per acre rate gave good results at organic matter contents up to 20% and in the 20 to 30% organic matter content range, 6 lbs per acre were required for good weed control. At organic matter contents above 30%, a rate of 8 lbs per acre was required for satisfactory weed control.

Following application, all types of soil moisture conditions prevailed. Following application to dry, moist and wet soils, conditions ranged from immediate rainfall, sprinkler irrigation or furrow irrigation to no additional moisture for a period of two weeks or longer. In all cases, excellent results were obtained where incorporation was done immediately and properly.

E. *Weeds Controlled*: A number of annual grasses were controlled with the major ones being water grass (*Echinochloa* spp.) and wild oats (*Avena fatua*). Of the annual broadleaf weeds controlled by the 4-lb rate of Tillam wherever the rhizomes were (*Chenopodium album*), nettle-leaf goosefoot (*Chenopodium murale*), red-root pigweed (*Amaranthus retroflexus*) and purslane (*Portulaca oleracea*).

In addition to control of annual weeds, yellow nutgrass continued to be controlled in all cases with the recommended rate of 4 lbs per acre. It was observed in a limited number of fields that Bermuda grass and Johnson grass from rhizomes were controlled by the 4-lb. rate of Tillam wherever the rhizomes were thoroughly chopped up prior to, or during the application.

F. *Length of Weed Control*: Most applications resulted in weed control well beyond thinning time and where solid treatments were made on flat planted beets, weed control extended to harvest time in a number of fields. The length of control in a given field was dependent upon numerous factors such as band or solid treatment, rainfall and irrigation, weeds involved, and type and frequency of cultivation.

### Summary and Conclusions

Two years of extensive field testing and one year of commercial use have proven Tillam to be a selective preplant soil-incorporated herbicide effective in controlling many of the major annual grassy and broadleaved weeds and some of the perennial weeds which occur in sugar beets. Weeds controlled include watergrass, wild oats, red-root pigweed, lambsquarters, purslane

and nutgrass. Rates of 4 lbs per over-all acre have been effective on all mineral soils and organic soils containing up to 20% organic matter. On soils containing above 20% organic matter, rates of 6 to 8 lbs per acre over-all are required depending upon the organic matter content. Under most conditions rates at least double those required for weed control caused no appreciable injury to sugar beets.

Results have been highly uniform over a wide range of soil and climatic conditions where incorporation of the Tillam into the soil has been done immediately and properly. Under commercial conditions the most satisfactory method of application has been to spray and incorporate (with a power-driven rotary tiller) on the front tool bar of the tractor and to seed with the same tractor by having the seeders mounted on the rear tool bar.

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