An Investigation of the Effects of Various Methods of Herbicide Application on Weed Control in Sugar Beets

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At the present time, there is considerable controversy about the value of incorporating herbicides with the soil. Although many herbicides may not need to be incorporated, soil incorporation can reduce loss as vapors, lessen risk of crop injury, and improve weed control (5)[2]. Poor weed control has been associated with wet soil conditions at the time of pre-emergence application of EPTC (ethyl N, N-di-n-propylthiolcarbamate) (1). However, investigations have indicated that this chemical gives reliable weed control when incorporated with the soil. The effects of both incorporation and irrigation on the activity of EPTC, CDEC and CIPC have been investigated by Havis ET AL. (4). Endothal (3,6-endoxohexahydrophthallic acid) also has been reported as being more effective when incorporated (3).

The tests reported below were designed to evaluate the effect of two chemicals; endothal and EPTC, on weeds and sugar beets, under different methods of application.

EPTC at 2,4 and 6 and endothal at 4,6 and 8 pounds of active material per acre were applied in a split-plot design consisting of rates of chemicals and methods of applications on 9 x 20 foot plots replicated six times. Chemicals were applied in 30 gallons of water per acre by an Oxford Precision sprayer to a freshly worked, packed and moist soil surface. There were four methods of applications: (1) pre-emergence (after beets planted) surface application, (2) incorporation (before beets planted) with a spike-tooth harrow, (3) incorporation with a spring-tooth cultivator, (4) incorporation with a double disk. All plots were then harrowed and packed. All incorporation plots were sprayed early May 9 and incorporated immediately. Monogerm sugar beets[3] were planted May 11, 1959 and the pre-emergence plots treated the same day.

Effects on beets and weeds were estimated and counts were made on June 8 and 9, 1959. Weeds present were mainly redroot pigweed, (*Amaranthus retroflexus* L.), lamb's quarters

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[2] Numbers in parentheses refer to literature cited.

[3] Monogerm seed was a blend of U158-K114 and SL227MSxSP5114-0 and SL117MSx-SP5481-0.

Table 1.—Effects of Chemicals and Methods of Application on Weeds and Beets.

Treatment	Pre-Emergence Surface					Spike-Tooth Harrow				
	Weed Count		Herbicidal Rating		Beet Injury	Weed Count		Herbicidal Rating		Beet Injury
	Grass	BLW[2]	Grass	BLW	% of Check	Grass	BLW	Grass	BLW	% of Check
EPTC 2 lb./A.[1]	5.8	19	221	92	0	1.8	10	896	517	6
EPTC 4 lb./A.	7.8	19	238	127	0	1.7	7	936	849	26
EPTC 6 lb./A.	5.7	14	288	240	0	1.0	4	957	939	36
EPTC Mean	6.4	17	249	153		1.5	7	930	768	
Endothal 4 lb./A.	5.4	16	286	116	0	4.8	12	512	382	0
Endothal 6 lb./A.	5.7	15	214	285	0	4.0	10	612	438	0
Endothal 8 lb./A.	4.2	16	251	270	0	2.4	11	622	378	0
Endothal Mean	5.1	16	250	224		3.7	11	582	400	
Check	6.9	18	0	0	0	10.7	19	0	0	0

Treatment	Spring-Tooth Cultivator					Double Disk					Mean			
	Weed Count		Herbicidal Rating		Beet Injury	Weed Count		Herbicidal Rating		Beet Injury	Weed Count		Herbicidal Rating	
	Grass	BLW	Grass	BLW	% of Check	Grass	BLW	Grass	BLW	% of Check	Grass	BLW	Grass	BLW
EPTC 2 lb./A.	1.5	7	755	828	12	.2	4	925	861	6	2.3	10	699	574
EPTC 4 lb./A.	0.	4	972	933	26	.5	3	929	975	26	2.3	8	769	721
EPTC 6 lb./A.	.2	3	973	985	34	.2	2	978	982	56	1.8	6	799	787
EPTC Mean	.5	4	900	915		.3	3	944	939		2.2	8	756	694
Endothal 4 lb./A.	3.3	14	312	158	0	1.0	11	566	365	0	3.6	13	419	255
Endothal 6 lb./A.	6.7	14	439	254	0	2.4	15	399	266	0	4.7	14	416	311
Endothal 8 lb./A.	5.7	14	289	202	0	3.0	11	245	438	0	3.8	13	351	322
Endothal Mean	5.2	14	347	204		2.1	12	403	356		4.8	13	396	296
Check	2.6	14	0	0	0	2.8	27	0	0	0	5.8	20	0	0

[1] All rates are in terms of active material per acre.

[2] BLW = broadleaf weeds.

[3] Herbicidal rating = $1000 - \left[\frac{\text{Weed count (\% of check)} \times \text{Weed injury (\% of check)}}{10}\right]$

(*Chenopodium album* L.) and barnyard grass (*Echinochloa crusgalli* L. Beauv.). An analysis of variance was performed on grass count, broadleaf weed count and herbicidal ratings in which the main effects and interaction were broken down into components, each having one degree of freedom. Results are presented in Table 1.

The data in Table 1 show that the grass control obtained with endothal tended to be increased where this chemical was incorporated into the soil with a spike-tooth harrow. However, this method of incorporation was not significantly better than the other methods of application when compared by the analysis of variance technique. Furthermore, the data show that there was no organized trend of effectiveness in either broadleaf weed or grass control when endothal levels were increased.

There was no difference in grass control between different levels of EPTC but broadleaf weed control was significantly increased as the level of EPTC was increased. These trends were observed under all methods of application.

The weed control effectiveness of EPTC on both grasses and broadleaf weeds increased markedly when it was incorporated with the soil rather than applied to the soil surface. However, incorporation by the use of a double disc or a spring-tooth cultivator gave more effective broadleaf weed control than incorporation by means of a spike-tooth harrow. No such difference was noted with respect to grasses.

The treatment that gave the best general weed control with the least beet injury appeared to be EPTC at two pounds per acre, incorporated either by double disking or spring-tooth cultivation immediately after application.

Summary

EPTC at 2, 4 and 6 and endothal at 4, 6 and 8 pounds active material per acre were applied in a split-plot design consisting of rates of chemicals and methods of application on 9 x 20 foot plots replicated six times. Methods consisted of: (1) surface application, (2) incorporation with a spike-tooth harrow, (3) incorporation with a spring-tooth cultivator and (4) incorporation with a double disk. At the time of application, the soil was moist.

Endothal gave unsatisfactory reduction of weeds and grasses under all methods of application and at all rates. Endothal when incorporated with a spike-tooth harrow gave greater grass reduction. All other methods of application of endothal gave similar results with both broadleaf weeds and grasses.

EPTC gave no weed reduction and no beet injury when applied pre-emergence to the soil surface but was considerably better when incorporated. Incorporation with the double disk and the spring-tooth cultivator was significantly better than with the spike-tooth harrow in the control of broadleaf weeds but not in the control of grasses. As the rate of EPTC increased broadleaf weed control increased but beet stunting was severe at the highest rate. The treatment giving the best general weed control with least beet injury appeared to be EPTC at two pounds per acre, incorporated either by double disking or spring-tooth cultivation immediately after application.

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