

Chemical Control of Annual Grasses in Sugar Beets in Montana, Wyoming, and Colorado

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Received for publication February 27, 1958

Real progress has been made in chemical weed control of annual grasses during the past eight years. Chemical weed control will continue to play a major role in the realization of a complete mechanization program for sugar beet production.

Previous Tests

Chemical weed control tests in previous years in Wyoming, Montana, and Colorado have shown that DCU¹ (Dichloral urea) at 7.3 pounds acid per acre, worked into the soil from two to four inches deep, gave promising results in controlling wild oats and grassy weeds. Dowpon, a sodium salt of Dalapon, at rates of five to eight pounds of acid per acre, applied after emergence gave satisfactory control of grassy weeds. Endothal at four pounds per acre pre-emergence, surface applied, appeared very promising with fair grass control and good broadleaf control. Indications of prolonged residual effect in the soil as a weed control was noted.

1957 Tests

The 1957 tests include the three treatments above mentioned plus EPTC (Ethel N,N-di-n-propylthiolcarbamate) at the Montana and Wyoming, locations. The Colorado tests included EPTC, Erbon (Erbon-2 (2,4,5-trichlorophenoxy) ethyl 2,2 dichloropropionate, Chloro IPC (Isopropyl-N-(3-chlorophenyl)-carbamate, and TCA (Sodium trichloroacetate).

Experimental Design and Methods

Tests were laid out in fields having a high population of grasses and broadleaf weeds. In some cases grass and broadleaf weed seeds were sown by hand during seed bed preparation or at time of planting the beets. Plot treatments followed a randomized block design with 7 to 10 replications being used.

At Sidney, Montana, and Sheridan, Wyoming, the knapsack hand sprayer was used for applying all treatments except the pre-plant series. At Swink, Colorado, a specially designed unit, mounted on a small tractor, was used. Preplant applications were made at Sidney with a Howry-Berg unit and at Sheridan and Swink a small roto-tiller was used to incorporate the materials into the soil.

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The tests were located on sandy loam soil at Sidney, clay loam at Sheridan, and heavy clay loam at Swink. Precipitation during the seven weeks following planting was unusually heavy for the season in areas of the test. At Sidney it amounted to 2.6 inches, Sheridan 7.8 inches, and Swink over 1 inch. Predominating grassy weeds at Sidney were *Setaria* spp.; at Sheridan *Setaria* spp. and wild oats (*Avena fatua*); at Swink *Setaria* spp. *Amaranthus retroflexus* was the most common broadleaf weed at all locations, although *Kochia* spp. was heavy at Swink.

A study of the data in the following tables seems to indicate that with good rainfall, well distributed, excellent weed control from several treatments was possible without injury to the sugar beet crop.

Harvest results for 1957 are given for the Sidney, Montana, test in Table 1. The soil in this field was a light, sandy loam type.

Table 1.—Effect of Chemical Weed Control Sprays on the Harvest Performance of Sugar Beets at Sidney, Montana, in 1957.

Treatment	Rate per Acre ¹	Tons per Acre	Percent Sugar	Gross Sugar per Acre	Percent Purity	Stand
Preplant						
DCU	7.3	12.64	19.26	4856	93.37	95
Mulch Check	—	13.75	19.23	5275	93.75	88
Pre-Emergence						
DCU	10.0	12.43	18.53	4602	94.25	97
DCU	14.6	13.06	18.27	4756	92.44	91
Endothal	4.0	14.45	18.57	5341	92.94	88
Endothal	6.0	14.51	18.68	5401	92.31	84
EPTC	5.0	14.37	18.50	5294	92.69	93
EPTC	10.0	12.19	18.77	4532	92.64	90
DCU plus Endothal	10.0 4.0	13.10	18.39	4807	92.81	98
Postemergence						
Dowpon	4.0	13.45	18.99	5082	93.61	113
Dowpon	6.0	9.78	19.27	3775	93.86	86
Endothal	5.0	12.40	19.23	4755	93.69	93
EPTC	6.0	15.64	18.74	5845	93.86	98
Dowpon plus Endothal	6.0 4.0	10.24	19.14	3908	93.35	85
Check	—	14.03	18.44	5174	93.40	91
LSD 5% pt.		1.97	.61	752	NS	—

¹ Pounds of acid equivalent on a broadcast basis. All applications were made in 6 inch bands, with approximately one-fourth of the above rates being used with 22 inch rows. Eight replications.

Postemergence treatments of (a) Dowpon at 6 pounds acid per acre and (b) a combination of Dowpon at 6 pounds plus Endothal at 4 pounds reduced yields significantly in both tons per acre and gross sugar per acre in the Sidney tests. Air temperatures around 85° F. at time of application probably increased their burning effect on the leaves of seedling beets. Beet roots from these two treatments as well as from Endothal at the 5-pound rate as a postemergence treatment also had significantly higher sugar content. No significant differences in purity were noted between treatments. Postemergence treatment of Endothal reduced yields of roots and gross sugar somewhat.

Table 2.—Effect of Chemical Weed Control Sprays on Harvest Performance of Sugar Beets at Sheridan, Wyoming, in 1957.

Treatment	Rate per Acre ¹	Tons per Acre	Percent Sugar	Gross Sugar per Acre	Stand
Preplant					
DCU	7.3	14.20	16.71	4744	110
Dowpon	1.0	13.76	16.63	4574	109
Endothal	4.0	14.90	16.21	4806	113
Mulch Check	—	13.58	16.55	4489	107
Pre-Emergence					
DCU	10.0	13.78	16.80	4597	112
DCU	14.6	14.86	16.29	4830	113
Endothal	4.0	15.10	16.16	4877	111
Endothal	6.0	14.10	16.58	4664	114
EPTC	5.0	13.62	16.34	4439	111
EPTC	10.0	15.04	15.88	4773	110
DCU plus	10.0				
Endothal	4.0	14.12	16.50	4644	116
EPTC plus	5.0				
Endothal	4.0	14.85	16.29	4847	113
Postemergence					
Dowpon	4.0	14.03	16.56	4632	111
Dowpon	6.0	13.57	16.28	4414	110
Endothal	4.0	12.96	16.63	4318	106
EPTC	6.0	13.66	16.67	4542	109
Dowpon plus	6.0				
Endothal	4.0	12.51	16.27	4051	110
Dowpon plus	6.0				
Endothal and	4.0				
EPTC	5.0	13.96	16.18	4517	106
Check	—	12.92	16.48	4225	103
LSD 5% pt.		NS	NS	NS	—

¹ Pounds of acid equivalent on a broadcast basis. All applications were made in 6 inch bands, with approximately one-fourth of the above rates being used with 22 inch rows. Eight replications.

Table 2 shows the harvest results of a similar test conducted at Sheridan, Wyoming. No significant difference for yield, percent sugar, and gross sugar per acre was noted between treatments.

The relative weed control ratings² as computed for the Sidney test are shown in Table 3.

Table 3.—Chemical Weed Control Ratings at Sidney, Montana, 1957.

Treatment	Rate per Acre ¹	Percent Grass Control	Percent Broadleaf Control	General Weed Control	Percent Stand ²
Preplant					
DCU	7.3	83	48	77	95
Mulch Check	—	0	0	0	88
Pre-Emergence					
DCU	10.0	93	64	87	97
DCU	14.6	97	78	94	91
Endothal	4.0	89	68	86	88
Endothal	6.0	94	79	91	84
EPTC	5.0	98	81	95	93
EPTC	10.0	98	81	95	90
DCU plus Endothal	10.0	95	73	91	98
Postemergence					
Dowpon	4.0	80	47	78	113
Dowpon	6.0	81	47	77	86
Endothal	5.0	93	38	82	93
EPTC	6.0	25	30	27	98
Dowpon plus Endothal	6.0	94	58	89	85
Check	—	0	0	0	91
LSD 1% pt.		23	10	12	—

¹ Pounds of acid equivalent on a broadcast basis. All applications were made in 6 inch bands, with approximately one-fourth of the above rates being used with 22 inch rows. Eight replications. Predominating grassy weed was pigeon grass.

² Number of beets in 100 feet of row.

All treatments except the EPTC postemergence gave very good grass control.

The weed control rating results of the Holly Experiment Station, Sheridan, Wyoming, test appear in Table 4. The weed control obtained at Sheridan was somewhat less than at Sidney. This may have been due to soil difference and to heavy rainfall during May and June.

At Sheridan the most effective pre-emergence treatment for grass control was a combination surface spray composed of EPTC

³ A weed control rating system was used as calculated by Mr. Herb Day of Stauffer Chemical Company.

Table 4.—Chemical Weed Control Ratings at Sheridan, Wyoming, 1957.

Treatment	Rate per Acre ¹	Percent Grass Control	Percent Broadleaf Control	General Weed Control	Percent Stand ²
Preplant					
DCU	7.3	54	42	50	110
Dowpon	1.0	23	16	19	109
Endothal	4.0	50	42	48	113
Mulch Check		0	0	0	107
Pre-Emergence					
DCU	10.0	59	11	42	112
DGU	14.6	60	17	44	113
Endothal	4.0	39	47	41	111
Endothal	6.0	36	51	42	114
EPTC	5.0	58	17	42	111
EPTC	10.0	60	15	42	110
DCU plus Endothal	10.0 4.0		44	57	116
EPTC plus Endothal	5.0 4.0	78	26	60	113
Postemergence					
Dowpon	4.0	63	12	43	111
Dowpon	6.0	72	27	56	110
Endothal	4.0	59	43	54	106
EPTC	6.0	59	6	39	109
Dowpon plus Endothal	6.0 4.0		43	65	110
Dowpon plus EPTC plus Endothal	6.0 5.0 4.0	99	69	89	106
Check	---	0	0	0	103
LSD 1% pt.		17	15	12	

¹ Pounds of acid equivalent on a broadcast basis. All applications were made in 6 inch bands, with approximately one-fourth of the above rates being used with 22 inch rows. Eight replications. Predominating grassy weed was wild oats.

² Number of beets in 100 feet of row.

5 pounds and Endothal 4 pounds. The best postemergence treatment was a combination of Dowpon at 6 pounds, EPTC at 5 pounds, and Endothal at 4 pounds. In this test the Endothal and EPTC treatments alone were not as effective as at Sidney. At Sheridan, Endothal as a postemergence spray for grasses appears to be more effective than the pre-emergence treatment, whereas there is little difference at Sidney. This is probably a soil moisture effect. EPTC as a postemergence treatment shows fair grass control at Sheridan but at Sidney showed practically no control. At Swink, Colorado, EPTC at 5 and 10 pound rates applied as a pre-emergence spray gave good grass control and appears to be a very promising material.

The sugar beet germination stand as shown in Table 5 illustrates the stand reduction exhibited by the EPTC and Endothal pre-emergence treatments in Montana.

Table 5.—Influence of Chemical Weed Controls on Vigor of Beets and Grass Seedlings, Sidney, Montana, 1957.

Treatment	Rate per Acre ¹	Number of Beets in 50 Feet of Row	Sugar Beet Vigor ²	Grass Seedling Vigor ²
Preplant				
DCU	7.3	116	7.2	2.5
Mulch Check		135	8.5	10.0
Pre-Emergence				
DCU	10.0	124	6.5	2.0
DCU	14.6	100	5.2	1.5
Endothal	4.0	81	6.8	2.2
Endothal	6.0	73	6.5	1.8
EPTC	5.0	73	5.0	1.5
EPTC	10.0	89	4.8	1.1
DCU plus Endothal	10.0			
	4.0	110	5.5	1.8
Postemergence				
Dowpon	4.0	147	5.2	3.1
Dowpon	6.0	123	3.0	3.0
Endothal	5.0	118	5.2	2.0
EPTC	6.0	149	8.0	6.6
Dowpon plus Endothal	6.0			
	4.0	92	2.8	1.5
Check		142	9.0	10.0
LSD 1% pt.		32	1.1	2.8

¹ Pounds of acid equivalent on a broadcast basis. All applications were made in 6 inch bands, with approximately one-fourth of the above rates being used with 22 inch rows. Eight replications. Predominating grassy weed was pigeon grass.

² Numerical plant vigor rating of a low of 1 to a high of 10.

The postemergence treatments of Dowpon at 6 pounds and the combination treatment of Dowpon at 6 pounds plus Endothal at 4 pounds reduced the sugar beet plant vigor considerably. DCU at 7.3 pounds preplant and EPTC at 6 pounds postemergence retarded the beets the least of any treatments.

Comparing the sugar beet vigor and the grass seedling vigor of Table 5 from Sidney, Montana, with Table 6 from Sheridan, Wyoming, reveals that similar treatments showed more effective weed control and also more setback to the beets at Sidney than at Sheridan.

In general, more effective grass control was obtained under the drier conditions at Sidney than under exceptionally good moisture conditions at Sheridan.

Erbon at all rates drastically reduced the stand of beets at Swink, Colorado, indicating that the rates used were probably too high. EPTC, both liquid and granular, was very promising.

Table 6.—Influence of Chemical Weed Controls on Vigor of Beets and Grass Seedlings, Sheridan, Wyoming, 1957.

Treatment	Rate per Acre ¹	Number of Beets in 100 Inches	Sugar Beet Vigor ²	Grass Seedling Vigor ²
Preplant				
DCU	7.3	73	8.1	6.0
Dowpon	1.0	74	9.9	8.1
Endothal	4.0	71	8.2	4.1
Mulch Check	—	75	10.0	10.0
Pre-Emergence				
DCU	10.0	71	10.0	5.9
DCU	14.6	70	9.9	9.2
Endothal	4.0	71	9.4	7.6
Endothal	6.0	70	9.2	8.0
EPTC	5.0	70	9.9	8.1
EPTC	10.0	71	10.0	8.1
DCU plus	10.0			
Endothal	4.0	67	8.8	7.5
DCU plus	10.0			
Endothal plus	4.0			
EPTC	5.0	69	8.9	4.0
Postemergence				
Dowpon	4.0	74	9.0	5.2
Dowpon	6.0	64	8.1	2.8
Endothal	4.0	62	7.6	7.5
EPTC	6.0	66	10.0	7.6
Dowpon plus	6.0			
Endothal	4.0	52	6.5	2.4
Dowpon plus	6.0			
Endothal plus	4.0			
EPTC	5.0	42	4.1	0
Check	—	78	10.0	10.0
LSD 1% pt.		13	.8	1.2

¹ Pounds of acid equivalent on a broadcast basis. All applications were made in 6 inch bands, with approximately one-fourth of the above rates used with 22 inch rows. Eight replications. Predominating grassy weed was wild oats.

² Numerical plant vigor rating with a low of 1 to a high of 10.

Table 7.—Beet Count, Weed Counts, and Vigor of Beets, Miscellaneous Herbicides, Swink, Colorado, 1957.

Treatments ¹	No. Beets per 72" Row	No. Grassy ² Weeds	No. Broadleaved Weeds	Vigor of Beets ³
Check	31.8	14.1	10.7	1.2
Erbon 6	11.8	3.7	3.8	4.2
Erbon 9	4.3	2.5	1.5	5.0
Erbon 12	3.9	2.7	1.2	5.0
EPTC 5 L	29.6	8.1	6.7	1.6
EPTC 10 L	26.0	1.0	2.6	2.4
EPTC 5 G	34.0	1.8	2.3	2.5
EPTC 7.5 G	18.9	0.7	1.8	3.5
CIPC 4	21.6	7.1	3.0	3.0
CIPC 6	16.7	2.4	3.5	3.6
LSD 5% pt.	6.82	7.48	3.06	0.61
LSD 1% pt.	9.06	9.93	4.06	0.81

¹ L. = Liquid; G = Granular.

² Per 3 square feet — 6" wide by 72" long.

³ June 18, 1957: 1 = Most vigorous on scale of 1 to 5.

Table 8.—Thinning and Harvest Data, Miscellaneous Herbicides, Swink, Colorado, 1957.

Treatment	Stand ¹	Percent Sucrose	Tons per Acre	Gross Sugar Lbs./Acre
Check	115.7	12.58	22.52	5695
Erbon 6	50.0	11.92	15.43	3713
Erbon 9	26.5	11.22	8.62	1962
Erbon 12	15.1	10.72	4.51	942
EPTC 5 L	112.8	13.04	22.48	5856
EPTC 10 L	116.3	12.72	23.36	5948
EPTC 5 G	121.5	12.49	22.90	5721
EPTC 7.5 G	105.8	12.11	22.46	5428
CIPC 4	94.1	12.67	21.55	5461
CIPC 6	77.7	12.37	20.15	4970
LSD 5% pt.	11.70	0.52	2.166	563
LSD 1% pt.	15.54	0.69	2.877	717

¹ Beets per 100 feet of row.

Summary

1. In the tests reported more effective grass control was obtained under the drier moisture conditions of the sandy loam soil at Sidney, Montana, than on the heavier soil at Sheridan

with an excessively high rainfall. This is somewhat contrary to general experience. Possibly loss of the chemicals by leaching can partially explain this for Sheridan.

2. Preplant treatments of DCU at 7.3 pounds per acre and Endothal at 4 pounds per acre, both gave satisfactory control of grassy weeds without reducing beet yields.

3. The following pre-emergence treatments gave satisfactory control of grassy weeds without reducing beet yields: (a) Endothal at 4 to 6 pounds per acre; (b) EPTC at 5 pounds per acre.

(4) Postemergence treatments exhibiting satisfactory grassy weed control at both locations were Dowpon at 4- to 6 pounds per acre and Endothal at 5 pounds per acre at Sheridan.

5. Air temperatures near 85° F. caused the postemergence treatments of Dowpon and Endothal to severely burn the sugar beets in the Montana tests.

6. Percent purity was not affected by any treatment.

7. The germination stand of beets was reduced in Montana by the pre-emergence treatments: (a) Endothal at 4 to 6 pounds per acre and (b) EPTC at 5 to 10 pounds per acre, but such was not the case in Wyoming. The Erbon treatments drastically reduced germination stands of beets at Swink, probably because the rates of application were so heavy.

8. In Wyoming the stand was significantly reduced by the following postemergence treatments: (a) Dowpon at 6 pounds, (b) Endothal at 4 pounds, and (c) the combinations of these treatments.

9. Endothal has given somewhat more effective grassy weed control in Montana than in Wyoming when applied pre-emergence, which may be due to kind of weed present.

10. A 5 pound per acre or lower rate of EPTC applied pre-emergence seems to be indicated for Sidney but heavier rates can be used in the Sheridan and Swink areas.

11. Postemergence applications of Dowpon at 6 pounds per acre was a very effective grassy weed control at Sidney. Sugar beet plants were slightly burned and yields reduced by this treatment in the Sidney tests but such was not the case at Sheridan.

12. The reasons for the great variation in effectiveness of grass control between locations by certain of these chemical treatments is not fully known. The factors of climatic variation (temperature and moisture relations), soil type and difference in nature of the predominating grassy weeds undoubtedly played an important role.
