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CHEMICAL CONTROL OF WEEDS IN POTATOES IN SOUTHCENTRAL AND INTERIOR ALASKA

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INTRODUCTION

Weeds cause serious problems for commercial potato growers in Southcentral and Interior Alaska. Reductions in potato yields of 20 to 70 percent due to weeds have been observed in previous studies (Carling, unpublished data). Competition by weeds generally is so intense that profitable yields cannot be produced unless weed growth is controlled. Mechanical methods alone, including cultivation and hilling, have not provided acceptable levels of control.

For many years, commercial potato growers relied on the chemical herbicide Premerge® (dinoseb) to control weeds. Premerge killed weeds by contact and was very effective in controlling the most troublesome broad leaf weeds when applied just prior to emergence of the potato plants. In addition, Premerge left no chemical residues in the soil to damage vegetable or other crops grown in succeeding years. Unfortunately, several years ago Premerge was found to be a hazard to human health and now may not be used as an herbicide.

Commercial growers have been trying other chemicals as they search for alternatives to Premerge. Several of these chemicals are promising but, unlike Premerge, all leave chemical residues in the soil that could be toxic to crops that potato growers plant in rotation.

In 1988, a field study was initiated to evaluate the efficacy and carryover of several herbicides. Five chemicals including: Treflan® (trifluralin), Enide® (diphenamide), Eptam® (ETPC), Sencor® (metribuzin) and Lorox® (linuron) were evaluated at Fairbanks and Palmer. Eptam, Sencor and Lorox controlled weeds most effectively of the five and were selected for reevaluation in 1989. Summarized in this report are data on potato yields and weed control from the study in 1989. Information on phytotoxic residues associated with some of these chemicals will be presented in later publications.

MATERIALS AND METHODS

Field plots were tilled in the spring with a chisel plow at the Agricultural and Forestry Experiment Station (AFES) Matanuska Farm near Palmer and with a disk at the AFES farm in Fairbanks. Additional fine tilling and packing was done with a roterra

Table 1. Weed control treatments, formulations, rates and times of application.

Common name	Trade name	Formulation	Time of application	Rate of application
EPTC	Eptam®	7 E	pre-plant	3.5 pts/a
Metribuzin	Sencor®	75 DF	post-plant	1.0 lb/a
Metribuzin	Sencor®	75 DF	pre-emerge	1.0 lb/a
Linuron	Lorox®	DF	post-plant	3.0 lbs/a
Linuron	Lorox®	DF	pre-emerge	3.0 lbs/a
-	Hand weeding	-	-	-
-	No weeding	-	-	-

prior to application of the herbicides and planting.

Seven weed control treatments were evaluated and are presented in Table 1 along with formulations, times and rates of application. Rates of application indicate the amount of material applied, not the amount of active ingredient applied.

Eptam was tilled into the top 2 to 4 inches of soil immediately after application on May 16 at Palmer and May 25 at Fairbanks. The remaining chemical treatments were applied to the surface of the soil immediately after planting (post-plant) on May 16 at Palmer and May 25 at Fairbanks or just prior to emergence (pre-emergence). Pre-emergent treatments were applied June 13 at Palmer and on June 19 at Fairbanks. All herbicides were applied with a CO_2 backpack sprayer calibrated to deliver 40 gal per acre at 30 psi.

Each weed control treatment was tested on four varieties of potato including Bake-King, Green Mountain, Shepody and Superior. Each treatment x variety combination was replicated four times in a randomized complete block design. Twenty-two potato seed pieces were planted approximately 11 inches apart in rows spaced three feet apart with a single row assist-feed planter. Potatoes were planted May 16 at Palmer and on May 25 at Fairbanks. Granular fertilizer was applied at the time of planting in bands beside and below the seed at the rate of 96 lbs N per acre, 384 lbs P_2O_5 per acre and 192 lbs K_2O per acre. Hilling was done in mid-July. Water was applied through overhead sprinklers at Palmer and Fairbanks. Potatoes were lifted with a mechanical digger, then picked by hand and placed in cold storage. Harvest occurred on September 8 at Palmer and on September 5 at Fairbanks. Potatoes were washed and graded approximately six weeks after harvesting.

Weed control was rated at Palmer on July 5 and August 23 and at Fairbanks on July 8. To assess control, a one m^2 quadrat was placed at five spots in a diagonal line through each plot. The percentage ground cover of weeds in each quadrat was then estimated.

Table 2. Effect of various herbicide treatments on US #1 and total yields of potatoes at Palmer in 1989.

Treatment	US #1 Yield[1]	Total Yield
Hand weeding	13.82 a[2]	14.93 a
Lorox (pre-emerge)	13.74 a	15.02 a
Lorox (post-plant)	13.23 a	14.34 a
Sencor (pre-emerge)	13.12 a	14.90 a
Sencor (post-plant)	11.24 b	12.71 b
Eptam	4.06 c	5.08 c
No weeding	2.30 d	3.20 d

[1] Average yields of four varieties in tons per acre.
[2] Numbers in columns followed by the same letter are not different at the five percent level of significance using Duncan's multiple range test.

Table 3. Effect of various herbicide treatments on US #1 and total yield of potatoes at Fairbanks in 1989.

Treatment	US #1 Yield[1]	Total Yield
Sencor (pre-emerge)	14.31 a[2]	15.39 a
Eptam	13.88 a	14.80 a
No weeding	13.78 a	14.69 a
Sencor (post-plant)	13.43 a	14.51 a
Lorox (post-plant)	3.01 a	13.93 a
Lorox (pre-emerge)	12.92 a	13.92 a
Hand weeding	12.90 a	13.76 a

[1] Average yields of four varieties in tons per acre.
[2] Numbers in columns followed by the same letter are not different at the five percent level of significance using Duncan's multiple range test.

RESULTS AND DISCUSSION

Total and US #1 yields are presented by treatment for the Palmer (Table 2) and Fairbanks (Table 3) trials. Since there was no significant interaction between variety and herbicide treatment, yields for the four varieties are averaged and presented for each treatment at each location. At Palmer (Table 2), US #1 yields ranged from 13.82 tons per acre in the hand weeded plots to 2.30 tons per acre in plots where no weeding was done. Yields from plots treated with Lorox (either pre-emergent or at planting), or Sencor (pre-emergent) were statistically the same as yields from the hand weeded plots. Plants in plots treated with Sencor post-plant yielded slightly but significantly less than the top group, while yields in the Eptam and non-weeded control plots were severely reduced. Total yields for the various treatments fell into the same statistical groups as did US #1 yields.

Yields of US #1 tubers from Fairbanks (Table 3) ranged 14.31 to 12.90 tons per acre, but there was no significant difference among treatments. Also, there was no significant difference in total yield among treatments at Fairbanks.

Competition from weeds was intense at Palmer and by early July more than 77 percent of the soil surface in non-weeded plots was covered by weeds (Table 4). Chickweed covered more than 50 percent of the soil surface in non-weeded control plots; while common lambsquarters, shepherd's-purse, corn spurry, pineappleweed and several other weeds were present in lesser amounts. Plots treated with Eptam were nearly as heavily populated with weeds as the non-weeded control plots. More than 60 percent of the

Table 4. Percent cover by various weeds in potato plots receiving different weed control treatments at Palmer on July 5, 1989.

	WEEDS						
Treatments	Chick-weed	Common lambsquarters	Shepherd's-purse	Corn spurry	Pineapple weed	Other[1]	Total
Not weeded	53.4	8.2	5.0	6.7	2.3	1.5	77.1
Eptam	36.6	6.6	9.6	4.6	2.3	0.7	60.5
Sencor (post-plant)	8.5	0.5	0.0	0.0	0.0	0.2	9.2
Sencor (pre-emerge)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lorox (post-plant)	5.6	0.0	0.2	0.0	0.1	0.1	6.0
Lorox (pre-emerge)	0.1	0.0	0.0	0.0	2.3	1.7	4.1

[1] Includes prostrate knotweed, quackgrass, rapeseed and dandelion.

Table 5. Percent cover by various weeds in potato plots receiving different weed control treatments at Palmer August 23, 1989.

	WEEDS						
Treatments	Chick-weed	Common lambsquarters	Shepherd's-purse	Corn spurry	Pineapple weed	Other[1]	Total
Not weeded	50.0	25.0	8.3	1.5	1.0	3.1	88.9
Eptam	23.8	20.0	22.5	2.3	2.8	4.0	75.4
Sencor (post-plant)	33.8	5.0	1.0	3.8	0.5	3.9	48.0
Sencor (pre-emerge)	11.5	0.8	0.0	1.8	0.0	1.0	15.1
Lorox (post-plant)	21.3	3.5	1.8	1.8	0.0	2.1	0.5
Lorox (pre-emerge)	13.8	0.0	0.0	2.3	0.8	4.9	21.8

[1] Includes prostrate knotweed, quackgrass, rapeseed and dandelion.

soil surface of Eptam plots was covered with weeds, and chickweed was the dominant weed species. Plots treated with Sencor or Lorox, either with a post plant or pre-emergent application, had few weeds in early July.

By late August, weed cover in all plots at Palmer had increased (Table 5). Total cover in the non-weeded plots was nearly 90 percent, with chickweed accounting for the majority of cover. The percentage of cover by common lambsquarters had increased four-fold since the early July reading, while the percentage of cover by other weeds remained low. The total percentage of cover in plots treated with Eptam had increased by late August, although the population of chickweed had declined. Cover by common lambs-quarters and shepherd's-purse had increased to more than 20 percent, but populations of other weed species remained low.

Weed populations also had increased in plots treated with Sencor or Lorox (Table 4) by late August, although increases were greater where the herbicide had been applied post-plant. Total weed cover where Sencor had been applied post-plant approached 50 percent while total cover where Lorox was applied post-plant was 30.5 percent. Chickweed was the dominant weed species in each Sencor and Lorox plot.

Although total weed cover at Palmer ranged from 15.1 to 30.5 percent in the two Lorox treatments and the pre-emergent Sencor treatment, yields were not different from the hand weeded control (Table 2). This illustrates that reduction, rather than elimination, of weeds is adequate to achieve maximum yields of potatoes. If it is possible to delay the development of weeds until the potato plants have become established, then hilling in combination with shading by the potato plants canopy may eliminate weed induced yield reductions. When considered in this way, Sencor applied pre-emergent, and Lorox applied post-plant

Table 6. Percent cover by various weeds in potato plots receiving different weed control treatments at Fairbanks July 8, 1989.

Treatments	WEEDS						
	Chick-weed	Common lambsquarters	Shepherd's-purse	Volunteer barley	Wild oats	Other[1]	Total
Not weeded	0.6	0.7	0.5	0.5	0.5	1.8	4.6
Eptam	0.1	0.2	1.2	0.4	0.2	1.7	3.8
Sencor (post-plant)	0.0	0.0	0.0	1.6	0.5	0.0	2.1
Sencor (pre-emerge)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lorox (post-plant)	0.0	0.2	0.0	1.8	0.4	1.5	3.9
Lorox (pre-emerge)	0.0	0.0	0.1	1.1	0.9	0.1	2.2

[1] Includes common knotweed and volunteer rapeseed.

or pre-emergent effectively controlled weeds.

At Fairbanks, weed populations were very low in all treatments (Table 6). The low populations of weeds were due in part to the very dry conditions in the early spring, and possibly to low populations of weed seeds in the soil. Total weed cover was less than 5 percent in all treatments. Increases in weed cover were minimal throughout the season, therefore late season weed cover readings were omitted.

Although weed cover was very low at Fairbanks and differences in yield due to weeds were not observed, the Fairbanks plots did illustrate that none of the five chemical treatments had a negative effect on yields of potatoes.

SUMMARY

1. Weed growth at Fairbanks in 1989 was below the level required to reduce potato yields.
2. Weed growth at Palmer in 1989 was intense and, where not controlled, weeds reduced potato yields 83 percent.
3. Post-plant and pre-emergent applications of Lorox and a pre-emergent application of Sencor reduced weed populations sufficiently to maximize potato yields at Palmer.
4. A post-plant application of Sencor permitted reinvasion by chickweed and other weeds late in the season which resulted in potato yield reductions.
5. Eptam was not effective in controlling weeds at Palmer.

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