WEED CONTROL IN POTATO PRODUCTION

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This is a report on the current status of research on the use of certain chemicals that require registration under the Federal Insecticide, Fungicide, and Rodenticide Act. It does not set forth recommendations for the use of such chemicals, nor does it imply that the uses discussed have been registered. All uses of these chemicals must be registered by the appropriate State and Federal agencies before they can be recommended.

Weed control is an integral part of all farming operations. In the past, we have relied primarily on cultivation and hand labor for weed control. At present, rising wage scales are prohibiting the use of hand labor for weed control in many crops, including potatoes. More-over, we are finding that excessive cultivation may reduce yields. Frequent cultivation tends to pack some soils and alter their physical structures. In turn, poor root aeration, puddling during wet periods, and development of clods during harvest may result. Cultivation may also sever many roots in the most fertile soil area. In addition, the spread of certain virus diseases is promoted by the passage of cultivating machinery through the field. Finally, in several potato growing areas of Washington, cultivation which tends to pulverize the soil and cause loss of moisture, results in the erosion of soil by wind.

However, we are faced with the problem that weed competition reduces potato yields. Weeds compete with potatoes for nutrients and water. One investigator has found that potato yields could be increased 10 percent if weed competition were eliminated. Weeds present at harvest time result in a greater number of tubers left in the ground, in an increase in mechanical damage, and in a slow down in harvesting operations. In addition, weeds harbor disease and insect pests that attack potatoes.

To reduce the costs of hand labor and the amount of cultivation needed to control weeds, more and more farmers are using herbicides. However, herbicides are not a complete solution of weed problems; they must be used in conjunction with good management practices. To be acceptable and practical, the herbicides must be inexpensive, effective, and non-toxic to the plants and to the consumers of the potatoes.

Herbicides are applied at one or more of the following stages of potato production: preplanting, preemergence, or postemergence. Probably the most common practice is to apply herbicides preemergence, that is, after planting the potatoes, but before they emerge. EPTC (S-ethyl dipropylthiocarbamate) and trifluralin (a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) are herbicides most commonly used in potatoes in eastern Washington. They can be applied separately or in combination as preemergence treatments.

In the past three to four years, a large number of herbicides with weed control potential in potatoes have been developed. However, very few of these herbicides have been investigated for weed control on potatoes grown in the irrigated

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regions of Washington.

We began our weed control research in potatoes in the spring of 1970. A number of different herbicides and herbicide combinations have been evaluated for annual weed control and crop toxicity in rill and sprinkler irrigated potates during the past two years.

In 1970, we had test plots at Prosser, Othello, and Pasco, Washington. The most promising treatments in these tests were selected for further evaluation during 1971 at Prosser and Othello. Also, several new treatments were added in 1971. The following is a discussion of our results for 1971.

Prosser

Russet Burbank potatoes were planted at Prosser, Washington, on April 27, 1971, in a very fine sandy loam that contained 0.9 percent organic matter. The field was divided into two areas. One area was rill irrigated, and the other was sprinkler irrigated. The plots were four rows wide and 20 feet long. Herbicides were applied as preemergence treatments on May 14-17, 1971, and as postemergence treatments on June 24, 1971. Each treatment was replicated three times. Rolling cultivators were used to incorporate certain herbicides with the soil. Barnyardgrass and redroot pigweed were the predominant weed species at this location.

TABLE 1. --Weed control in rill irrigated potatoes at Prosser, Washington.

Most promising treatments	Rate lbs/A	Percent Control 1/ Barnyardgrass	Pigweed	Potato Injury 2/
trifluralin + EPTC	1/2 + 3	100	100	10.0
Bay-94337	3/4	84	97	9.3
alachlor + linuron	2 + 1	98	100	10.0
alachlor + DNBP	2 1/2 + 3	91	100	9.0
chlorbromuron + DCPA.	1 1/2 + 6	99	100	10.0
Bay-94337 (Post)	3/4	98	100	10.0

1/ Treatments evaluated for weed control on August 27, 1971.

2/ Potato injury ratings taken on June 15, 1971. Rating scale: 0=dead; 10=normal, vigorous, no injury symptoms.

Fourteen different treatments were evaluated under rill irrigation. A list of the most promising treatments is given in Table 1. The combination of trifluralin + EPTC provided excellent weed control with no visible injury to the potatoes. This treatment is currently being used by a number of growers.

Alachlor (2-chloro-2', 6'-diethyl-N-(methoxymethyl)acetanilide) + linuron (3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea), alachlor + DNBP (alkanolamine salt of 4,6-dinitro-o-sec-butylphenol), chlorbromuron (3-[4-bromo-3-chlorophenyl]-1-methoxy-1-methylurea + DCPA (dimethyl tetrachloroterephthalate), and Bay-94337 (4-amino-6-t-butyl-3-(methylthio)-1,2,4-triazin-5(4H)-one) are not registered for commercial useage, but these herbicides provided good to excellent weed control and will be investigated further.

Eight of the 26 treatments applied to potatoes grown under sprinkler irrigation provided good to excellent weed control without appreciable injury to the potatoes. (Table 2). Data from the less effective treatments are not included in this report.

TABLE 2.--Weed control in sprinkler irrigated potatoes at Prosser, Washington.

Most promising treatments	Rate lbs/A	Percent Control 1/ Barnyardgrass	Pigweed	Potato Injury 2/
trifluralin + EPTC	1/2 + 3	88	98	10.0
Bay-94337	3/4	98	100	9.0
oryzalin + linuron	1 + 3/4	89	100	9.7
oryzalin + linuron	1 1/2 + 1	93	100	9.7
alachlor + linuron	2 + 1	100	100	8.7
alachlor + DNBP	2 1/2 + 3	98	100	9.7
Bay-94337 (Post)	1/2	93	99	10.0
Bay-94337 (Post)	3/4	95	100	10.0

1/ Treatments evaluated for weed control on August 27, 1971.

2/ Potato injury ratings taken on June 15, 1971. Rating scale: 0=dead; 10=normal, vigorous, no injury sumptoms.

The combination of trifluralin + EPTC was less effective under sprinkler irrigation than under rill irrigation. On the other hand, Bay-94337 was more effective under sprinkler irrigation, but caused some early season chlorosis when applied preemergence. Oryzalin (3,5-dinitro-N^4,N^4-dipropylsulfanilamide), a slightly water soluble analog of trifluralin, provided good to excellent weed control when combined with linuron. Alachlor used in combination with linuron or DNBP gave excellent weed control. Some early season chlorosis was noted after the linuron combination treatments.

Yields were taken from the center two rows in each plot. Only the postemergence applications of Bay-94337 under rill irrigation reduced yields significantly.

Othello

At Othello, Washington, Russet Burbank potatoes were planted on April 28, 1971, on a silt loam containing 0.6 percent organic matter. Preemergence treatments were applied on May 18 to 20, and postemergence treatments were applied on June 30. Rolling cultivators were used to incorporate certain herbicides with the soil. Each treatment was replicated three times on plots four rows wide and 20 feet long. Treatments were evaluated under both rill and sprinkler irrigation. Barnyardgrass and redroot pigweed were the dominant weed species.

Four of the 20 treatments evaluated under rill irrigation gave good to excellent weed control with minimal injury to the potaotes (Table 3). The combination of trifluralin + EPTC gave good early-season weed control, but was relatively ineffective from mid to late-season. This was the first time in two years of testing that this treatment failed to give good, season-long weed control. Thirty to 45 minutes elapsed between spraying and incorporation of the herbicides with the soil. Volatization of the herbicide during this period may account for the reduced effectiveness.

TABLE 3.--Weed control in rill irrigated potatoes at Othello, Washington.

Most promising treatments	Rate lbs/A	Percent Control 1/ Barnyardgrass	Pigweed	Potato Injury 2/
Bay-94337	3/4	77	97	9.0
alachlor + linuron	2 + 1	91	100	10.0
Bay-94337 (Post)	1/2	82	95	10.0
Bay-94337 (Post)	3/4	83	97	10.0
trifluralin + EPTC	1/2 + 3	46	82	9.0

1/ Treatments evaluated for weed control on September 14, 1971.

2/ Potato injury ratings taken on June 8, 1971. Rating scale: 0=dead; 10=normal, vigorous, no injury symptoms.

The combination of alachlor + linuron at 2 + 1 lbs/A provided the best weed control without injury to potatoes. Some early season chlorosis was observed when Bay-94337 was applied before emergence. When the herbicide was applied after emergence, it controlled barnyardgrass slightly better and did not visibly injure potatoes.

As in previous experiments, yields were taken from the center two rows in each plot. Although the data were highly variable, post-emergence applications of Bay-94337 under rill irrigation were found to reduce yields significantly. However, Bay-94337 did not reduce yields under sprinkler irrigation. Similar results were recorded at Prosser.

TABLE 4.--Weed control in sprinkler irrigated potatoes at Othello, Washington.

Most promising treatments	Rate lbs/A	Percent Control 1/ Barnyardgrass	Pigweed	Potato Injury 2/
trifluralin + EPTC	1/2 + 3	86	90	10.0
U-27,267	3	79	100	9.7
chlorbromuron + DCPA	1 1/2 + 6	95	82	10.0
oryzalin + linuron	1 + 3/4	85	90	9.3
oryzalin + linuron	1 1/2 + 1	79	90	9.7
alachlor + linuron	2 + 1	82	85	9.7
alachlor + DNBP	2 1/2 + 3	85	93	8.3
Bay-94337 (Post)	3/4	85	100	10.0

1/ Treatments evaluated for weed control on September 15, 1971.

2/ Potato injury ratings taken on June 9, 1971. Rating scale: 0=dead; 10=normal, vigorous, no injury symptoms.

The most promising of the 34 treatments evaluated under sprinkler irrigation at Othello are presented in Table 4. A severe infection of early blight killed 95 percent of the potato vines by September 1 and interfered somewhat with the evaluation of the treatments. Weed growth increased rapidly as the crop canopy disappeared and weed control ratings were generally lowered.

The combination of trifluralin + EPTC provided good, season-long weed control without injury to the crop. Nightshade was the most prevalent weed in these plots at the end of the season.

U-27,267 (3,4,5-tribromo-N,N,a-trimethylpyrazole-1-acetamide) was less effective on barnyardgrass than on pigweed. However, overall control was still satisfactory. Combinations of oryzalin and alachlor with linuron gave good weed control. Linuron in the combinations caused some early-season chlorosis in one or more replicates, particularly when used at one pound or more per acre. Potatoes were very close to emergence at the time the preemergence treatments were applied. This may explain why the combination of alachlor + DNBP injured potato vines slightly. The postemergence application of Bay-94337 gave satisfactory weed control in this experiment, whereas the preemergence applications were largely ineffective, particularly on barnyardgrass.