LINURON FOR SELECTIVE WEED CONTROL IN POTATOES

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Summary

Trials show that linuron at 1 to 2 lb per acre can be recommended for pre-emergent application to potato crops on mineral soils for the control of annual weeds. Soil types and duration of control required determine the rates that are necessary. Experimental plot and field crop evaluations of linuron treatments indicate increased crop yields by comparison with traditional cultural practices. Addition of surfactant enhances the spectrum of weed control.

INTRODUCTION

THE POTATO CROP is one of the largest and most important grown in this country. Studies in weed control by means of herbicides have not been very actively pursued, probably because acceptable standards of weed control have been attained by repeated cultivations; in fact, potatoes are generally regarded as a "cleaning crop", more especially in regard to annual weeds.

Research in potato culture has produced convincing evidence that traditional methods based on repeated cultivations and ridgings cause yield reductions due to crop damage. This has resulted overseas in a marked upsurge of interest in chemical weed control in this crop, and at the Seventh British Weed Control Conference, 1964, some twenty-one papers were presented on this subject alone.

It is not the intention of this paper to compare relative merits of cultivation versus chemicals, but rather to suggest linuron as an economic alternative to cultivation for weed control in potatoes.

While the objective of potato cultivation is to leave the crop growing in ridges, methods employed to bring this about vary in different districts. For example, in Pukekohe, the crop is ridged immediately after planting. When weeds appear, the ridges are saddle-harrowed, remoulded and left until a further crop of weeds has appeared. This pattern may be repeated as often as conditions require, but, once the crop has emerged completely, no further cultivation is carried out. In other districts, it is usual to throw a small ridge over the planted tubers. As weeds appear, a number of consecutive mouldings are carried out in order to smother weeds and to build the ridge into its final shape. This process often continues until after the crop is well advanced.

The main requirements of a suitable weedkiller for annuals in potatoes are a broad spectrum of weed control with both pre- and post-emergence activity on weeds, persistence without residual harmful effects on the following crops, reliable performance under varied rainfall and soil conditions, and crop tolerance.

Table 1 shows the weed control spectrum of linuron with and without the addition of surfactant.

TABLE 1: DEGREE OF WEED CONTROL WITH LINURON AT ¼ TO 2lb

DEFINITION OF CATEGORIES

S. Susceptible. Complete or nearly complete kill.
 MS. Moderately susceptible. Effective suppression with partial kill.
 MR. Moderately resistant. Temporary suppression, the duration depending on the environment.
 R. Resistant. No useful effect.
 SD. Seedling stage, cotyledon to the 2- to 3-leaf stage.
 YP. Young plant, 3- to 4-leaf stage to early flower bud stage.

Weed	Pre-emergence	SD	YP	With Surfactant SD	YP
Redroot (<i>Amaranthus hybridus</i>)		S	MS	S	S
Fathen (<i>Chenopodium album</i>)		S	MS	S	S
Nightshade (<i>Solanum nigrum</i>)		S	MS	S	S
Twincress (<i>Coronopus didymus</i>)		S	MS	S	S
Scarlet pimpernel (<i>Anagallis arvensis</i>)		S	MS	S	S
Shepherd's purse (<i>Capsella bursa-pastoris</i>)					
Mouse-eared chickweed (<i>Cerastium glomeratum</i>)	S	S	S	S	S
Wild turnip (<i>Brassica campestris</i>)	S	S	R	S	MR
Fumitory (<i>Fumaria</i> spp.)	S	R	M	S	S
Field pansy (<i>Viola arvensis</i>)	S	S	S	S	S
Spurrey (<i>Spergula arvensis</i>)	MR	M	R	MS	MR
Speedwell (<i>Veronica arvensis</i>)	S	S	S	S	S
Chickweed (<i>Stellaria media</i>)	S	S	S	S	S
Corbind (<i>Polygonum convolvulus</i>)	MS-MR	MS	R	S	MR
Wireweed (<i>Polygonum aviculare</i>)	S	S	MS	S	S
Redshank (<i>Polygonum persicaria</i>)	S	S	MS	S	S
Portulaca (<i>Portulaca oleracea</i>)	S	MS	R	S	MR
Groundsel (<i>Senecio vulgaris</i>)	S	S	MS	S	S
Sowthistle (<i>Sonchus oleraceus</i>)	S	S	MS	S	S
Nettles (<i>Urtica</i> spp.)	S	MR	R	MS	MR
Winter grass (<i>Poa annua</i>)	S	S	MS-MR	S	S
Barnyard grass (<i>Echinochloa crus-galli</i>)	S	S	MS-MR	S	S
Crabgrass (<i>Digitaria sanguinalis</i>)	S	S	MS-MR	S	S

EXPERIMENTAL

All rates of linuron are expressed as lb active ingredient per acre and surfactant concentration on a 100% basis. Plots were sprayed with a modified Oxford Precision Sprayer fitted with FS 4.5 nozzles applying 50 gal per acre at 30 lb/sq. in.

TRIAL 1

This trial was sited in Pukekohe on a basaltic red brown loam soil type; the variety was Ilam Hardy planted May 24, 1965, and all treatments were sprayed on June 17. The cultivated control was hoed down on June 14 and remoulded June 28, while a further moulding was carried out on July 29 to smother late emerging weeds. The trial was replicated five times; plot size was 20 × 10 ft containing 4 rows; only the two centre rows were harvested. The first significant rain, 40 points, fell on June 20 and a total of 20.23 in. fell during the trial. The trial was harvested on November 4. The following weeds were present in order of predominance—twincress, speedwell, fumitory and chickweed.

Although the crop was slow to emerge and was subject to six mild frosts, at the 1 and 2 lb rates no visual damage was evident at inspection. However, early in October, some veinal yellowing was evident at the 4 lb plots. These plots lost their foliage quickly and died down. From the yield figures set out in Table 2, linuron at 4 lb significantly decreased the yield of first-grade potatoes.

TRIAL 2

This trial was carried out in Rata on a medium silt loam soil. The variety was Sebago and was sown on October 2. All treatments were sprayed October 30. The trial was replicated four times and the plot sizes were 35 ft by 15 ft containing 6 rows, only the two middle rows being harvested. No rainfall figures are available from this trial. The following weeds were present in order of predominance — fathen, spurrey, nightshade, twincress, docks, shepherd's purse, chickweed and redroot.

There was no visual damage to the crop at any stage of growth. Linuron at 3 lb was not detrimental to crop yield and this indicated that soil type is important in determining what rates to use.

Further observational plots were conducted on five other sites over New Zealand. These were designed to test linuron on various soil types and different varieties of potatoes. Varieties tested were Jersey Bennes, Glen Ilam, Rua and Dakota. At rates of 0.5 to 2 lb no damage was noted on soils ranging from clay loam through silts to sandy loam. These trials also confirmed the effectiveness of linuron plus surfactant in controlling fumitory as well as other annual weeds.

DISCUSSION

The results of two yield trials carried out indicate that, by comparison with standard cultivation methods, the use of linuron tends to give adequate weed control and also increased yield. From a summary of results overseas, it appears to be accepted that on light and medium soils increased yields are often obtained when chemicals are used to replace cultivation. However, heavy clay soils, on the other hand, need cultural practices. Repeated cultivation damages developing shoots or shallow roots and compaction occurs when tyres are repeatedly run over the same area.

TABLE 2: ASSESSMENT OF WEED CONTROL AND YIELD, TRIAL 1

Treatment (lb)	Weed Control*			1st Grade	Yield (tons/acre)	
	Jul. 2	Jul. 27	Sep. 2		Total	Yield
Linuron 1.0/0.25% surfactant	9.9	9.7	9.6	5.28 aA	6.94 aA	
Linuron 2.0/0.25% surfactant	10.0	9.9	9.8	4.94 aA	6.18 aA	
Linuron 1	9.5	9.5	8.0	4.83 aA	5.98 aA	
Linuron 2	9.8	9.7	8.5	4.42 abAB	5.74 aA	
Cultivated control	9.0	6.5	7.0	4.12 abAB	5.27 aAB	
Linuron 4	10.0	9.9	9.9	3.17 bcAB	5.00 aAB	
Untreated control	6.0	2.5	0	2.04 cB	2.94 bB	
CV				1.1%	0.82%	

*0 = No control, 10 = Complete control.

TABLE 3: ASSESSMENT OF WEED CONTROL AND YIELD, TRIAL 2

Treatment (lb)	Weed Control*		Yield (tons/acre)	
	Nov. 22	Jan. 12	1st Grade	Total
Linuron 3.0	10.0	9.8	14.74 a	18.87 a
Linuron 1.6/0.25% surfactant	9.5	9.5	13.88 a	17.90 ab
Linuron 2.0	9.8	9.5	13.41 ab	17.74 ab
Linuron 0.5	8.8	6.0	13.19 ab	17.16 ab
Linuron 1.0	9.5	8.0	13.13 ab	16.89 ab
Cultivated control				
(Growers' practice)				
Linuron 0.8/0.25% surfactant	8.0	8.0	13.09 ab	16.81 ab
Untreated control	8.0	9.5	13.00 ab	16.58 ab
CV	4.0	4.0	12.53 b	16.15 b
			3.3%	2.8%

*0 = No control, 10 = Complete control.

Soil heat losses are greater on ridged than on uncultivated areas, while repeated cultivation may bring about losses of soil moisture which could be important in the case of main crop varieties grown under dry conditions. There is obviously a saving in labour and equipment.

CONCLUSION

Linuron adequately meets the requirements of a candidate weed-killer for potato crops. It has a broad spectrum of annual weed control, excellent contact action on existing weed seedlings, and sufficient residual effect to control further germinating seedlings. There has been no reported incidence of persistence in the soil beyond 16 weeks, even at rates as high as 5.5 lb. Chemical performance is satisfactory on most soil types and under varying rainfall conditions. Trials have shown good crop tolerance so long as the treatment is not delayed until after emergence of the crop.

It appears that the use of linuron could replace the traditional methods of weed control by cultivation in potato crops by a more efficient chemical method.

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