

## A COMPARISON OF METHODS OF WEED CONTROL FOR SUGAR BEET GROWN IN TASMANIA

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*Summary.* Results from two trials in Northern Tasmania in the 1978/79 season involving inter-row cultivation and herbicide application are presented. Based on the results of a three year herbicide programme, the standard recommendation for weed control is two overall applications of phenmedipham at  $0.47 \text{ kg ha}^{-1}$  plus ethofumesate at  $0.6 \text{ kg ha}^{-1}$ . Costings are given for this recommendation and for two inter-row cultivations plus concurrent band sprays at the same rate per sprayed ha as the overall recommendation. The alternatives are assessed at  $\$233 \text{ ha}^{-1}$  and  $\$171 \text{ ha}^{-1}$  respectively, based on herbicide prices and contractor rates as at February 1981. Although this cost difference favours the choice of inter-row cultivation plus band spraying, lack of familiarity with the technique in the farming community, the relative ease of boom spraying and the large gross margin that is considered necessary to attract farmers to a sugar beet industry, favour overall herbicide application. Therefore, a forecast about the mode of weed control that would become generally adopted in a future industry cannot be made with confidence.

### INTRODUCTION

The main methods of weed control in sugar beet crops are the use of herbicides (overall or in bands), inter-row cultivation, hand weeding or combinations of these methods. Considering the likely manpower and cost structure of a sugar beet industry in Tasmania the only feasible alternatives are herbicide application, inter-row cultivation, or a combination of the two. These methods were evaluated as part of a research programme carried out by the Department of Agriculture that investigated important cultural factors affecting the production of sugar beet in Northern Tasmania from 1977/78 to 1979/80.

This paper reports the results of the relevant treatments in two trials conducted in 1978/79 involving inter-row cultivation and herbicide application. A costing is presented based on the standard recommendations and its implication is discussed in relation to other considerations impinging on the decision to adopt one of the alternative methods of weed control.

### MATERIALS AND METHODS

*Weed control treatments.* The seven treatments shown in Table 1 were part of two trials conducted in 1978/79 each involving 24 treatments and four replicates in a randomised block design. One trial was at Forthside Vegetable Research Station on a krasnozom soil containing 16% organic matter, and the other was at Cressy Research Station Outstation on a Cressy Association soil type (clay loam) containing 9% organic matter. The trial area was sown on September 15 1978 at Forthside and on October 6 1978 at Cressy. The plot size was 18 m by 2.5 m (4 rows at 0.5 m spacing) with a harvest area of 10 m by 1 m (2 rows). The inter-

row cultivation was carried out with a Webb six row front mounted steerage hoe. Band spraying was carried out simultaneously using equipment made up at the Forthside VRS workshops, with an output of 240 L ha<sup>-1</sup> at 210 kPa using TeeJet 8001E nozzles. The overall spraying was carried out using a self propelled off-set-boom sprayer built up from a Honda rotary hoe. Output was 310 L ha<sup>-1</sup> at 210 kPa with TeeJet 8003 nozzles. The trials were hand harvested.

*Costing.* Costs are based on February 1981 herbicide prices and contract rates. The contract rate for boom spraying can be given with confidence but that for inter-row cultivation plus band spraying has to be estimated as this operation is usually carried out only by farmers that specialise in vegetable growing. Considering the speed of the inter-row cultivation operation, the cost of a cultivator and band spray equipment and the time penalty involved in herbicide mixing and spray tank refilling, the rate required is considered to be similar to that for precision drilling of seed. The contract rates are those quoted in a Tasmanian Department of Agriculture report (Anon. 1979) adjusted for inflation at 12% p.a. calculated on a monthly basis and rounded to the nearest whole number.

## RESULTS

The average weed density on the untreated plots at post-emergence herbicide application was 373 m<sup>-2</sup> at Forthside and 422 m<sup>-2</sup> at Cressy. The average beet density at harvest was 89 370 ha<sup>-1</sup> at Forthside and 60 880 ha<sup>-1</sup> at Cressy; there was no significant difference in beet density between treatments.

Table 1. The effect of method of weed control on the root production of sugar beet at Forthside and Cressy.

Treatment	Root wt. (t ha <sup>-1</sup> )	
	Forthside	Cressy
Untreated control	22.7	12.8
Handweeded control	90.7	60.1
One inter-row cultivation post-emergence	34.2	37.7
One inter-row cultivation plus band spray <sup>1</sup> post-emergence	50.4	40.2
Overall spray <sup>2</sup> pre-emergence; one inter-row cultivation post emergence	67.5	51.7
Overall spray <sup>2</sup> pre-emergence; one inter-row cultivation plus band-spray <sup>1</sup> post-emergence	80.5	52.8
Overall spray <sup>2</sup> pre-emergence; one overall spray <sup>1</sup> post-emergence	86.6	55.7
F ratio	**	**
LSD P = 0.05	11.4	10.6
LSD P = 0.01	15.1	14.0

<sup>1</sup> Phenmedipham at 0.79 kg ha<sup>-1</sup> (trade name Betanal) plus ethofumesate at 1.0 kg ha<sup>-1</sup> (trade name Trammat). The band spray rate is per sprayed ha.

<sup>2</sup> Ethofumesate at 1.5 kg ha<sup>-1</sup> plus lenacil at 0.64 kg ha<sup>-1</sup> (trade name Venzar).

Sugar beet root production was increased by the addition of both a band spray and an overall pre-emergence spray to the inter-row cultivation at Forth-

side. These benefits were additive. At Cressy there was an increase from the use of a pre-emergence overall spray, but not a band spray. The results reflect the difference in activity of the pre-emergence herbicide at the two sites, not in the weed spectrum; clover (*Trifolium repens* and *T. subterraneum* cv. Mt. Barker) was present at both sites and was much more effectively controlled at Cressy than at Forthside. The difference is attributed to moister topsoil for a longer period and lower organic matter in the soil at Cressy compared to Forthside. The inter-row cultivation plus band spray, preceded by the overall pre-emergence herbicide, and the comparable boom spraying treatment were not significantly different from the handweeded control at either site.

At both Forthside and Cressy the weed control between the rows from one inter-row cultivation was unsatisfactory especially in the treatments that did not involve a pre-emergence herbicide. Weeds at the time of the operation were larger and more numerous and many re-grew despite severe disturbance. The results suggest that more than one inter-row cultivation is necessary for effective control of weeds and this is supported by practice in the UK where two cultivations are usual with the type of equipment used in these experiments (J. Armstrong, pers. comm., 1980). Two cultivations are necessary for adequate control of weeds with the tyne equipment currently used in the vegetable industry. In addition, the results clearly show that inter-row cultivation will only be satisfactory if herbicides are also used in bands over the rows. The technique of using equipment to move soil laterally into the rows to smother weed seedlings is unsatisfactory because direct drilled sugar beet seedlings remain relatively small and weak for some time after emergence.

Based on the results of three seasons experiments, the likely standard recommendation for weed control in sugar beet in Tasmania is two applications of phenmedipham at  $0.47 \text{ kg ha}^{-1}$  plus ethofumesate at  $0.6 \text{ kg ha}^{-1}$  applied within 5 to 10 days, the first application at the two leaf stage of the crop. This co-incides with the need to use two inter-row cultivations so that band spraying would be used concurrently with both cultivations.

The figures given in Table 2 show the comparison of two overall herbicide sprays and two inter-row cultivations plus concurrent band sprays, at the herbicide rates quoted above. It is assumed that the bands represent 40% of the total area.

Table 2. A cost comparison of two methods of weed control.

Weed control method	Rate of product ( $\text{L ha}^{-1}$ )	Cost of product ( $\text{L}^{-1}$ )	Total cost ( $\text{ha}^{-1}$ )
<i>Boom spray operations:</i>			
Phenmedipham $0.94 \text{ kg ha}^{-1}$	6	\$16.91	\$101.46
Ethofumesate $1.2 \text{ kg ha}^{-1}$	6	\$16.85	\$101.10
Two boom sprays, contract rate			\$ 30.00
			<u>\$232.56</u>
<i>Inter-row cultivation plus band spraying operations:</i>			
Phenmedipham $0.38 \text{ kg ha}^{-1}$	2.4	\$16.91	\$ 40.58
Ethofumesate $0.48 \text{ kg ha}^{-1}$	2.4	\$16.85	\$ 40.44
Two inter-row cultivations plus band sprays, contract rate			\$ 90.00
			<u>\$171.02</u>

## DISCUSSION

The costing shows a margin of \$61.54 ha<sup>-1</sup> in favour of the inter-row cultivation plus band spraying operation, and on the basis of cost alone this would persuade farmers to opt for the cheaper form of weed control.

The established techniques of inter-row cultivation may need some modification for sugar beet growing in Tasmania. Debris accumulation over the blades of the steerage hoe has occurred regularly on krasnozems but it is expected that this can be overcome by narrowing the width of the blades. The equipment currently in use in the vegetable industry may need modification or re-setting because it moves soil laterally. Cultivation close to the rows is unsuitable in sugar beet because the seedlings are relatively small and weak. Nevertheless, there is little doubt that a workable system of inter-row cultivation would be developed if there was a demand for it.

In January 1979 a Department of Agriculture report (Anon. 1979) quoted a gross margin of at least \$700 ha<sup>-1</sup> as necessary to attract farmers to a sugar beet growing industry in Northern Tasmania, taking into account the gross margins of alternative crops. At an inflation rate of 12% this currently represents approximately \$900 ha<sup>-1</sup>. Therefore, \$60 ha<sup>-1</sup> is relatively small in relation to this margin and is a factor which would dilute the attractiveness of the cost saving of inter-row cultivation plus band spraying if non-cost factors favour boom spraying.

Boom spraying is a relatively fast operation whereas inter-row cultivation is demanding, tedious and slow in sugar beet crops. Also, boom spraying is a technique which is well known in the cropping area of Northern Tasmania and contract spraying is a well developed service enterprise. On the other hand, inter-row cultivation is a technique that would be unfamiliar to most farmers entering a sugar beet industry; generally it is used only in bean and vegetable brassica growing at present.

Resistance to inter-row cultivation was encountered when the poppy (*Papaver somniferum*) industry was being established in Tasmania and poppy growing did not expand beyond the high value vegetable growing areas until chemical weed control methods were developed (J. Thorp, pers. comm. 1981).

Considering these factors, a forecast about the mode of weed control that would be generally adopted in a future industry cannot be made with confidence.

## LITERATURE CITED

- Anon. 1979. Investigations into the production of sugar beet 1977-78. Department of Agriculture, Tasmania.