VOLUNTEER POTATO CONTROL IN ONIONS

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Summary. Fluroxypyr (methyl hepyl ester) applied sequentially, (300 g + 300 g and 225 g + 225 g a.i./ha, each 21 days apart), to potato plants in conjunction with other commercial onion herbicides significantly (P=0.01) reduced viable tuber number when applied at either tuber initiation or flowering, but not earlier than tuber initiation. Daughter tuber numbers from potato plants originating from mother tubers 50 g to 100 g were significantly (P=0.01) reduced by fluroxypyr. Fluroxypyr applied to autumn sown onions at the above rates significantly (P=0.05) decreased onion yield when applied at the five leaf stage of crop growth. Fluroxypyr did not significantly reduce total yield of spring-sown onions at any growth stage.

INTRODUCTION

Volunteer potatoes at a density of four plants/m^2 crops depresses onion yields, decreases bulb quality, and increases operating costs (2). A further problem is the production of viable daughter tubers that sustain volunteer potatoes for several seasons. This interferes with clean crop rotations as the carry-over volunteers are a source of pest and disease for future potato crops (1, 4, 6). Current chemical control measures use repeated applications of contact herbicides. In some cases, volunteer potatoes are hand pulled.

Overseas work (7) and previous research conducted by the Department of Primary Industry and Fisheries, Tasmania (8) has shown fluroxypyr (methyl hepyl ester) to control volunteer potatoes. In the studies reported here, the efficacy of fluroxypyr is further evaluated on volunteer potatoes. The tolerance of onion crops to fluroxypyr is also examined.

METHODS

Three experiments were conducted at Forthside Vegetable Research Station (FVRS) on red krasnozem soils in Northern Tasmania.

Effect of growth stage of potato plant on efficacy of fluroxypyr. Russett Burbank potato sets (50 g whole) were planted by hand in autumn at a density of four plants/m^2. A randomised complete block trial design examined the two sequential fluroxypyr treatments (Table 1) applied initially at three growth stages (pre-tuber initiation, tuber initiation, and flowering) of the potato plants, and replicated four times.

Table 1. Split fluroxypyr treatments used in experiments 1 to 3.

Treatment	Rate (g a.i./ha)	Timing of application (days apart)
1	300 + 300	21
2	225 + 225	21

Effect of mother tuber set size on the efficacy of fluroxypyr. Russett Burbank potato sets (25, 50, 75, 100 g whole) were planted by hand in autumn at a density of four plants/m^2. A randomised complete block trial design examined two sequential fluroxypyr treatments (Table 1) applied initially at tuber initiation, and replicated four times.

In both potato experiments, the same commercial herbicides used on the onion crops in the third experiment (see below) were also used on the potatoes to simulate an infestation of volunteer potatoes in an onion crop. The potatoes were harvested at the same time as the autumn sown onions. Number of potato daughter tubers from each treatment was recorded along with tuber quality. The daughter tubers were left to sprout in trays under glasshouse conditions (temperature range 16 to 25°C) to test for viability.

Onion crop susceptibility. Early Creamgold onions were planted in autumn 1992, and Regular Creamgold onions were planted in the spring of that year. A randomised complete block trial design examined two sequential fluroxypyr treatments (Table 1) applied at four growth stages (1, 3, 5, and 7 leaf) of the onion crop, and replicated four times. The use of other herbicides (propachlor, oxyfluorfen, methazole, ioxynil, ethofumesate) during onion crop growth was based on commercial decisions made by the FVRS manager. The physical appearance of the onion plants following application of each fluroxypyr treatment up until crop maturity was recorded. At harvest, onion bulbs were sorted into seven grades (<35, 35-40, 40-50, 50-60, 60-70, 70-80, and >80 mm) and the yield of each grade was recorded. A visual assessment was made for any bulb distortion or quality variations. Onion samples were sent for fluroxypyr residue analysis.

RESULTS AND DISCUSSION

Effect of growth stage of potato plant on efficacy of fluroxypyr. Application of both rates of fluroxypyr at tuber initiation and flowering resulted in significant (P=0.01) reduction in viable daughter tuber production (Fig. 1). There was no significant difference between the rates of fluroxypyr applied at these growth stages. The data indicated higher potato yields from plots treated at pre-tuber initiation with fluroxypyr compared with the nil application plots. This apparent anomaly indicated the other commercial herbicides used assisted in volunteer potato control; application of fluroxypyr at pre-tuber intiation resulted in insufficient healthy foliage to absorb the other herbicides applied shortly after fluroxypyr application.

Effect of mother tuber set size on the efficacy of fluroxypyr. Application of both fluroxypyr treatments significantly (P=0.01) reduced viable daughter tuber number from volunteer potato plants grown from the set sizes 50 g, 75 g, and 100 g (Fig. 2). Fluroxypyr treatment of plants grown from 25 g mother sets resulted in the least reduction of viable daughter tubers. Commercial onion herbicides and/or environment had the major effect on tuber production from mother tubers of 25 g or less. The larger the mother sets the more significant the effect of fluroxypyr. There were no significant differences between the two rates used.

In each of the nil treatments, potato plants grown from 25 g and 50 g sets produced significantly fewer tubers than plants grown from 75 g, and 100 g sets. Only the mother sets of 25 g produced fewer than 4 daughter tubers/m^2. Tuber numbers produced from 100 g mother set plants were reduced from more than 16 viable tubers/m^2 to just over 4 viable tubers/m^2 with these tubers now being less than 50 g. Although this would still result in onion crop yield reductions, volunteer potato infestation for the following season would be reduced. Fluroxypyr application to plants grown from each of the smaller set sizes showed viable daughter tuber reductions less than 1 viable tuber/m^2 (plants from 25 g mother sets).

The results of both potato experiments indicated that maximum volunteer potato control in onion crops was achieved using either of the sequential fluroxypyr treatments applied at tuber initiation or potato plant flowering. Minimum viable daughter tuber production was achieved applying either fluroxypyr treatment to potato plants grown from 25 g mother sets. This finding indicates the importance of the use of narrow pitch digging webs on potato harvesters to reduce the size of tubers falling through the digging web (5).

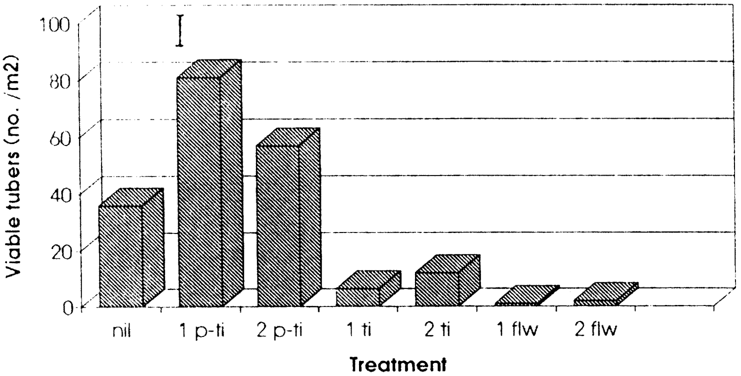

Figure 1. Efficacy of fluroxypyr treatments 1 and 2 applied to the potato plants at three different growth stages (p-ti = pre-tuber initiation, ti = tuber initiation, flw = flowering) on the viable number of daughter tubers produced compared with no fluroxpyr application (nil). Bar represents Fischers protected l.s.d. (P=0.01) for viable tuber number.

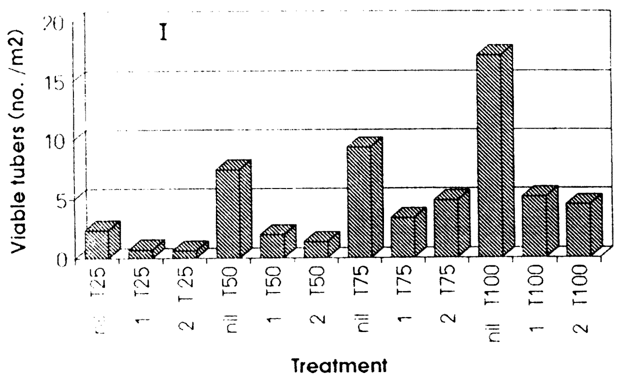

Figure 2. Efficacy of fluroxypyr treatments 1 and 2 applied to the potato crop originating from four different mother set sizes (T25 = 25 g, T50 = 50 g, T75 = 75 g, T100 = 100 g) on the number of daughter tubers produced compared with no fluroxypyr application for each set size (nil T25, nil T50, nil T75, and nil T100). Bar represents Fischers protected l.s.d (P=0.01) for viable tuber number.

Onion crop susceptibility. Fluroxypyr application resulted in mild to severe epinasty in the onion crops regardless of fluroxypyr application timing. Yield was significantly (P=0.01) decreased in the autumn sown onion crop with either rate of fluroxypyr applied at the 5 true leaf stage of the onion plants. No significant reductions in total onion yield were found on the spring sown crops, however there was a significant (P=0.01) reduction of onions larger than 80 g. Considering total yield was not affected by any of the treatments, this indicates a smaller bulb size in the marketable (30 to 80 g) size range. No significant reductions were found in plots treated at the 7 true leaf stage. This was probably because the onion plant had already reached its maximum yield by this late stage. Preliminary visual observations of the onions found no bulb distortions or quality variations. Chemical analysis of the treated bulbs found no detectable residues of fluroxypyr for any of the treatments.

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