PENDIMETHALIN FOR EARLY SEASON WEED CONTROL IN ONIONS IN PUKEKOHE

J.J.C. SCHEFFER and R.J. HUME

Horticultural Research Station, MAFTech, Pukekohe

SUMMARY

Trials were conducted at Pukekohe using pendimethalin as a pre-emergence herbicide on onions. Pendimethalin was shown to be a safe cheap alternative to current programmes if applied immediately after drilling at rates not exceeding 1.3 kg/ha on Patumahoe clay loam. Excellent control of wireweed (*Polygonum aviculare*), twincrest (*Coronopus didymus*), fumitory (*Fumaria spp.*) and scarlet pimpernel (*Anagallis arvensis*) was achieved.

INTRODUCTION

Onion crops grown in Franklin County receive up to 12 herbicide applications during their 9 months growing season. Current options for early season residual weed control (from crop emergence to the two true leaf stage) are limited and expensive. Following the application of a mixture of diquat/paraquat 7-18 days after drilling and a few days before onions emerge, growers most commonly use a chloridazon/chlorbufam mixture plus a non-ionic wetting agent applied at the onion flag stage (Wilson and Scheffer 1981).

Other successful but expensive herbicide programmes used locally are pre-emergence diquat/paraquat plus either chlorthal/dimethyl or propachlor followed by an application of a low rate of ioxynil at the first true leaf stage.

Promising results have been obtained with the relatively cheap herbicide pendimethalin for early season pre-emergence residual weed control in onions in England (P.A. Brown pers comm). A preliminary trial at Pukekohe in 1985/86 evaluated several concentrations of pendimethalin in a commercial onion planting (Scheffer 1986). The results indicated that although there was some crop risk, pendimethalin gave good control of a district problem, wireweed (*Polygonum aviculare*).

This paper reports the results of two trials to provide data on onion tolerance to, and weed control efficacy of, pendimethalin for Pesticides Board registration in New Zealand.

MATERIALS AND METHODS

In a 1986/87 trial on a grower's property, pendimethalin (Stomp 33% EC) was tested at 0.7, 1.3 and 2.0 kg/ha, applied either 2 or 19 days after drilling on 20.7.86. The second application time was 3 days before early crop emergence. The soil type was a Patumahoe clay loam. Treatments were replicated four times in a randomised block design. Plots were 5 m × 1.7 m with 6 rows of Pukekohe Longkeeper onions.

Onion plants in a 5 m² sample area of each plot were counted 9 weeks after drilling and again at final crop harvest. Weeds were identified and counted 3 months after drilling from three 45 × 45 cm quadrats in each plot.

A second trial in 1987/88 on Patumahoe clay loam at Pukekohe Horticultural Research Station compared 0.7, 1.0, 1.3 and 2.0 kg pendimethalin/ha applied 1 day after drilling onions (on 23.6.87) with the standard Pukekohe district treatment of diquat/paraquat (Preeglone 18% AC) at 0.5 kg/ha and chloridazon/chlorbufam (Alicep 40% WP) at 3 kg/ha. Diquat/paraquat was applied a few days before crop emergence and chloridazon/chlorbufam as a split application at 1.5 kg/ha at the onion flag stage and again at 1.5 kg/ha 3 weeks later. As a possible early season commercial programme the combination of pendimethalin 1.3 kg/ha (applied 1 day after drilling) followed by pendimethalin 1.3 kg/ha plus propachlor 5.8 kg/ha (applied 9 weeks after Proc. 41st N.Z. Weed and Pest Control Conf.

drilling at the onion 1½ true leaf stage) was also assessed. In a control treatment only diquat/paraquat at 0.5 kg/ha was applied a few days before crop emergence. Treatments were replicated 6 times in a randomised block design. Plots were 5 m × 1.5 m, each with 5 rows of Pukekohe Longkeeper onions.

Plant counts were carried out 7 and 12 weeks after drilling in a 4.05 m² sample area of each plot. Onion bulb numbers and yields were also recorded from the same sample areas.

The period from sowing to the occurrence of 25% weed cover in the weediest plot was recorded for each treatment. Weeds were then identified and counted from four 30 × 30 cm quadrats in each plot. Subsequently all plots were kept clean chemically with the use of ioxynil (Totril 25% EC) at 0.3 or 0.4 kg/ha and some handweeding when necessary until the most successful treatment had run its course. The whole trial was then oversprayed with chlorthal/dimethyl (Dacthal 75% WP) at 8 kg/ha and kept clean until harvest.

RESULTS AND DISCUSSION

In the 1986/87 grower's trial seed germination and plant establishment were erratic. Emerging seedlings in all treatment showed symptoms of phytotoxicity such as swelling and yellowing of the cotyledon leaves. These symptoms were most severe on plants from plots treated with the high rate of pendimethalin (2.0 kg/ha). The losses of onion plants between emergence and final harvest increased with both increasing concentrations of pendimethalin and delay in application time (Table 1).

TABLE 1: Effect of rate and timing of pendimethalin on onion plant mortality between early season counts and harvest in 1986/87 growers trials.

Rate (kg ai/ha)	Percent plant mortality	
	Application time (days after sowing)	
	2 days	19 days
0.7	10	23
1.3	18	55
2.0	38	70

SEM 3.8

The main weed species present in the control plots and their numbers/m² were: wireweed 89; white clover (*Trifolium repens*) 7, vetch (*Vicia* spp) 6, and fennel (*Foeniculum vulgare*) 3. Wireweed was completely controlled by all treatments except pendimethalin at 0.7 kg/ha where its population was only 2 plants/m² 3 months after treatment. There was no clear evidence that any treatments controlled any of the other weeds present.

The 1987/88 crop tolerance studies showed that all treatments were relatively safe on Patumahoe clay loam except the double (2 × 1.3 kg/ha) treatment of pendimethalin and the high rate of this herbicide both of which caused significant crop thinning (Table 2). Although there was no significant reduction in the plant population with a single application of 1.3 kg/ha pendimethalin, plant mortality was nearly as high as in the double treatment of pendimethalin.

Compared with the control plots, onion bulb yields were significantly reduced by only the high rate of pendimethalin.

All treatments were successful in delaying weed ingress after drilling with the exception of the lowest rate of pendimethalin where control was not commercially acceptable (Table 3). With 1.0 kg/ha pendimethalin control was adequate and similar to the level achieved with the standard chloridazon/chlorbufam treatment. Control of seedling twincrest and scarlet pimpernel with chloridazon/chlorbufam was considered inadequate. Although initially checked by the herbicide treatment, weeds recovered after a short period.

Pendimethalin at 1.3 kg/ha provided excellent long-lasting (3½ months) weed control. Some weeds emerged in this treatment but remained small and stunted. A

follow up treatment of pendimethalin plus propachlor (1.3 + 5.8 kg/ha) applied 9 weeks after drilling provided effective control of these weeds.

Fumitory, which was thought to be resistant to pendimethalin, emerged normally but remained in a very stunted seedling state even at low rates of the herbicide.

TABLE 2: Effect of herbicide treatment on plant establishment and mortality in Patumahoe clay loam in 1987/88 trial.

Treatment	Rate kg ai/ha	Application time (days) from drilling	Onion plants/m ² at			Percent onion plant mortality from 7 weeks to harvest
			7 weeks	12 weeks	harvest	
pendimethalin	0.7	1	75	74	72	4
pendimethalin	1.0	1	75	74	72	4
pendimethalin	1.3	1	74	69	67	9.5
pendimethalin	2.0	1	70	64	61	12.9
pendimethalin + pendimethalin + propachlor	1.3 1.3 + 5.8	1 66	70	65	62	11.4
diquat/ paraquat + *chloridazon/ chlorbufam + *chloridazon/ chlorbufam	0.5 1.5 1.5	17 41 62				
diquat/paraquat	0.5	17				
CV%			2.5	2.9	1.1	
SED			4.3	4.7	4.5	

* A non-ionic wetter was added at 3 litres/ha

CONCLUSIONS

The results of these trials have shown that pendimethalin could be a useful, and cheaper alternative residual herbicide for early season weed control in onions in the Pukekohe area. The standard treatment used by growers in the Pukekohe area of pre-emergence diquat/paraquat plus two early post-emergence applications of chloridazon/chlorbufam involves critical timing in relation to both crop and weed development, and is expensive. The application of pendimethalin immediately following drilling is obviously a far more practical method for the average grower.

The 1986/87 growers's trial indicates that pendimethalin should be applied soon after crop drilling as delay reduced crop safety.

The 1987/88 trial results indicate that 1.3 kg/ha pendimethalin is the maximum relatively "safe" rate for Patumahoe clay loam. Although crop thinning in this treatment was 4.4% higher than the natural plant mortality in the control plots, there was no evidence of a detrimental effect on final bulb yields. Allowances for crop thinning can be made by drilling extra seed to get as close as possible to the optimum plant density for onions of 50 plants/m² as recommended by Hutton (1985). However, it is suggested that on light silt soils around Pukekohe pendimethalin should not be applied at above a 1 kg/ha rate.

TABLE 3: Effect of herbicide treatments on weed control in Patumahoe clay loam in 1987/88 trial. Application time of treatments as for Table 2.

Treatment +	Rate kg ai/ha	Time (wks) to 25% weed cover	Main weed species and numbers/m ² at 25% weed cover				totals
			twincress	fumitory	scarlet pimpernel	others	
pendimethalin	0.7	9	374	6***	19	16	415
pendimethalin	1.0	11	215	11***	12	35	273
pendimethalin	1.3	14	94	4***	0	12	110
pendimethalin	2.0	15	54	0	0	2	56
pendimethalin + pendimethalin + propachlor	1.3 1.3 + 5.8 1.3 + 5.8	>16**	17	0	0	0	17
diquat/paraquat + *chloridazon/ chlorbufam + *chlordiazon/ chlorbufam	0.5 1.5 1.5	11	144	9	89***	24	266
diquat/paraquat	0.5	8	391	10	243	37	681

* A non-ionic wetter was added at 3 litres/ha

** Recordings discontinued

*** weeds severely checked by treatment

ACKNOWLEDGEMENTS

We thank John Flynn for providing the onion trial site, Yates New Zealand Ltd for the partial funding of this project, and Dr Ray Littler for the statistical analyses of results.

REFERENCES

- Wilson, G.J. and Scheffer, J.J.C., 1981. Pre- and early post-emergence weed control in onions. *Proc. 6th Aust. Weed Control Conf. 1*: 221-226.
- Scheffer, J.J.C., 1986. Initial tests with Stomp for onions suggests caution is needed. *New Zealand Commercial Grower. 41(8)*: 23-27.
- Hutton, R.C., 1985. Trial work on onion spacing at Pukekohe. *New Zealand Commercial Grower. 40(8)*: 22-23.