

## PENDIMETHALIN: NEW ZEALAND EXPERIENCES WITH PLANT TOLERANCE ON CERTAIN VEGETABLE & FRUIT CROPS

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*Summary.* Pendimethalin is a versatile persistent herbicide with potential for use on a wide range of horticultural crops in New Zealand. Product efficacy was well-proven but questions about crop tolerance remained in the following fruit and vegetable crops.

Pendimethalin was surface applied pre weed emergence at rates of 660 g to 1980 g/ha immediately post sowing of onions, peas, and carrots, and pre transplant of lettuces. No significant crop yield reductions resulted provided timing of application, sowing depth and soil type recommendations were complied with. Young pome fruit in the year of planting were tolerant of 1980 g to 2970 g pendimethalin. Weed control was equivalent or superior to the standard herbicidal controls.

### INTRODUCTION

Pendimethalin is a selective dinitroaniline herbicide discovered and developed by American Cyanamid Company USA in the early 1970's. Pendimethalin inhibits cell division and cell elongation in shoot and root meristems of susceptible species. Weeds die shortly after germination or following emergence from the soil. Application techniques are flexible, pendimethalin being effective following pre plant incorporation, pre emergence or early post emergence applications.

Pendimethalin has been extensively tested throughout the world and is a significant herbicide in the major crops cotton, soya beans, cereals and maize, together with various uses in many other crops. Early New Zealand trials have shown pendimethalin to have potential for use in cereals, turf, grass seed crops, peas, evening primrose, maize, beans, carrots, onions and transplants of lettuce, brassicas, peppers and tomatoes.

In comparison with other dinitroaniline herbicides, pendimethalin exhibits low volatility (1), slow photodecomposition (2) and long soil persistence in various soils under different moisture regimes (3 and 4). Pendimethalin is essentially insoluble in water (0.3 ppm at 20°C) (5), therefore it has low potential for leaching and ground water contamination. The tolerance of pendimethalin by seeded crops may be physiological or positional. The low volatility and water solubility of pendimethalin allows positional tolerance of otherwise susceptible crop species by placement of seed below the herbicide layer.

This paper details crop tolerance and some efficacy results of pendimethalin in onions and other seeded and transplanted vegetable crops and young pome fruit in N.Z., and comments on crop safety from subsequent commercial experience.

### METHODS

All treatments were applied by precision plot sprayers delivering 210 to 400 litres/ha. Plot sizes were 1.2 to 1.5 metres by 5-10 metres with four or six replicates. All trials were randomised block designs. Onion, carrot and lettuce trials were conducted on Pukekohe Patumahoe clay loam soils (Organic Matter 3.5%), pome fruit on Hastings clay loam (O.M. 8.5%) and peas on a Canterbury soil - Waimakariri sandy silt loam (O.M. 4.2%).

All pendimethalin applications to the seeded crops were made within two days of sowing. Weeds were removed after counting from all handweeded plots in all trials whereas untreated plots were not disturbed. Pendimethalin 330 g a.i./litre as Yates STOMP® 330 EC was used for all trials. Statistical analysis was by Duncans multiple range test for the pea trial. Other trials were analysed by a standard means test.

## RESULTS AND DISCUSSION

*Onions.* Pendimethalin was applied to a firm seedbed one day following sowing. Sowing depth was a uniform 15 mm. All weeds were removed using 90 g a.i. ioxynil (Totril) and handweeding when percentage weed ground cover had reached 25% for each plot. Plots were maintained weed free until harvest with applications of 9 kg a.i. chlorthal dimethyl (Dacthal 75W), and handweeding. (Preeglone) 125 g/litre paraquat and 75 g/litre diquat was applied just pre emergence of the crop in the standard and handweeded treatments. (Alice) 200 g/kg chlorbufam and 200 g/kg chloridazon was applied as a split application at 3 kg plus Citowett 3 l/ha twice early post emergence as the standard. Yields were taken from 4.05 m<sup>2</sup> per plot.

Table 1.

	Plant Establishment (m <sup>2</sup> @ 12 weeks)	Yield (t/ha)	Weed Control (Weeks to 25% ground cover)	Total Weeds (No/m <sup>2</sup> )
1. Pendimethalin 660 g	74	85.7	9	415
2. Pendimethalin 990g	74	87.4	11	273
3. Pendimethalin 1320 g	69	84.8	14	110
4. Pendimethalin 1980 g	64	79.3	15	56
5. Pendimethalin 1320 g + propachlor 5.76 kg	65	84.5	16	17
6. Preeglone 2.8 L + standard	74	83.4	11	266
7. Preeglone 2.8 L + hand- weeded	75	84.9	8	682
l.s.d. 5%		9.4	4.8	

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The principal weed was *Coronopus didymus*. All treatments except the lowest rate of pendimethalin gave commercially acceptable weed control. Small plot yields were considerably higher than commercial yields. The highest rate of pendimethalin caused some crop thinning and yield reduction. A total 97 mm of rain fell in the 3 weeks between application and crop emergence which gave conditions conducive to crop damage.

The crop safety of onions is based on positional tolerance, application timing and soil type. Seed must be sown into a firm seedbed to a uniform depth of at least 15 mm. Application of pendimethalin should be made immediately after sowing. Pendimethalin may cause damage after heavy rain on light or coarse soils where either (a) pendimethalin has not bound to organic matter, or (b) the coarse open nature of the soil allows physical migration of the herbicide down into the root zone.

## Peas

Table 2.

	Crop Emergence (m <sup>2</sup> )	Yield (kg/plot)	Weed Counts	
			<i>Polygonum aviculare</i> (m <sup>2</sup> )	<i>Veronica persica</i> (m <sup>2</sup> )
Untreated	53.0a	4.01a	134	67
Pendimethalin 990 g	51.8a	5.27b	1	0
Pendimethalin 1320 g	51.0a	5.19b	0	1
Pendimethalin 1320 g	54.0a	5.37b	0	0
Terbuthylazine 500 g	59.8a	5.28b	14	1
CV (%)	17.8	13.03		

Whole plots of dry peas were mechanically harvested at maturity. No crop damage was evident at any rate of pendimethalin and weed control was excellent. Over 200 mm of rain fell in the eight weeks following pendimethalin application.

## Carrots

Table 3.

	Yield (kg/plot)	<i>Amaranthus deflexus</i> (m <sup>2</sup> )
Untreated	5.70	31.0
Pendimethalin 1650 g	14.10	0.6
Pendimethalin 3200 g	18.52	1.0
l.s.d. 5%	5.24	14.9

No standard or handweeded control was included in this carrot trial, but the yield dose comparison and lack of phytotoxicity indicates good crop safety.

## Lettuce transplants

Table 4.

	Lettuce Phytotoxicity (0-5)	Yield (kg/plot)	<i>Coronopus didymus</i> (m <sup>2</sup> )
Handweed	0.00	22.85	42.0
Pendimethalin 1650 g	0.44	24.70	0.8
Pendimethalin 3200 g	1.63	21.45	0.8
l.s.d. 5%	0.56	3.38	23.0

Phytotoxicity: 0 - no effect; 5 - severely damaged.

Pendimethalin was applied to a rolled seedbed and lettuce cell transplants planted the same day. 23.9 mm of rain fell in the seven days following planting. The high rate of pendimethalin significantly checked the transplanted crop, phytotoxic symptoms were yellowing and growth suppression for 3-4 weeks post transplanting, however the final yield of lettuce was not affected.

*Fruit Crops – Young Pome Fruit*

Table 5.

	Nashi		Apple (G. Smith)		Weeds (Total m <sup>2</sup> )
	Increased trunk diam (cm)	Total new branch length (cm)	Increased trunk diam (cm)	Total new branch length (cm)	
Handweeded	11.6	782	8.8	617	103
Pendimethalin 1980 g	11.1	673	9.5	497	8
Pendimethalin 2970 g	12.0	863	8.0	554	7
Oryzalin 3750 g	12.9	771	8.3	476	7
Pendimethalin 1980 g + Simazine 1500 g	13.8	853	10.0	656	2
l.s.d. 5%	1.7	221	3.7	375	52

Plots consisted of two Nashi trees cv Housi, one Granny Smith apple and one Fuji apple. Treatments were applied to firm damp soil free from weeds 38 days after planting and irrigation (19 mm) was applied 10 days later. Principal weeds were *Solanum nigrum* and *Amaranthus* sp. Trunk diameter and total length of new branches were measured at the end of the summer 159 days after treatment. No tree growth suppression was recorded with any treatment.

Pendimethalin has good crop tolerance provided there is no contact with green bark, buds or leaves. Damage may occur on very light or coarse soils following heavy rain or where flooding occurs. Pendimethalin may be applied after bud movement without damage to emerging foliage flowers or fruit of young or established pome fruit.

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