DPX-PE350, A NEW POST-EMERGENCE HERBICIDE FOR COTTON

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Summary. The experimental herbicide DPX-PE350 was evaluated over 3 years (1990-92) for crop safety and post-emergence control of important broad-leaved weeds of cotton in Australia. DPX-PE350 was tested at rates between 25-200 g ai/ha and was found to be effective against Thornapple, *Datura* spp. at 25 g ai/ha, Sesbania pea, *Sesbania cannabinda*, Anoda weed, *Anoda cristata* and Boggabri weed, *Amaranthus mitchellii*, at 50 g ai/ha, Polymeria, *Polymeria pussilla* , Yellow vine and *Tribulus micrococcus*, at 75 g ai/ha, and Annual ground cherry, *Physalis angulata*, and Cowvine, *Ipomoea lonchophylla* at 100 g ai/ha and gave useful suppression of Noogoora burr, *Xanthium pungens* and Bathurst burr, *Xanthium spinosum* at 100 g ai/ha when applied as an early post-emergence treatment. A number of other weeds were also controlled or suppressed. The effect of DPX-PE350 on cotton was rate related and temporary, most pronounced at 100-200 g ai/ha and expressed as interveinal yellowing and biomass reduction.

INTRODUCTION

Post-emergent control of weeds in cotton is important as they reduce lint yield and quality and can interfere with harvesting. At present the number of post-emergence herbicides available for weed control in cotton is limited and their crop safety is marginal. Current weed control practices are ineffective against weeds such as Sesbania pea, Anoda weed and Thornapple. Weeds escaping control by pre-emergence herbicides, e.g. Burrs, Cowvine, Bellvine, *Ipomoea plebea* or weeds emerging later in the season continue to pose a problem for Australian cotton growers. Often, the only available method of weed control is by mechanical cultivation and hand chipping. The average cost of chipping over the last 3 years was close to $85.00/ha. Typically, the cotton industry spends approximately $50 million per annum on weed control and nearly 40% of this amount is spent on chipping weeds.

DPX-PE350 (pyrithiobac) is a new experimental herbicide first evaluated in Australia in 1990 as a selective herbicide for early post-emergence control of weeds in cotton. It represents a new family of chemistry which inhibits the enzyme acetolactate synthase, a key enzyme in the biosynthesis of branched chain amino acids (1). The herbicide is rapidly absorbed through foliage and to some extent by roots, blocking cell division and inhibiting growth in susceptible plants. Overseas data indicates both pre- and post-emergence activity for the control of broad-leaved and grass weeds (1). This paper reports on the results from 57 field trials conducted in Australia with the herbicide DPX-PE350 to determine its efficacy spectrum and crop safety when applied as a post-emergence treatment in cotton.

METHODS

Field trials were conducted in the major cotton producing regions of Australia in 1990, 1991 and 1992. Experimental sites were established in the Macquarie, Namoi, Gwydir and McIntyre Valleys of New South Wales and the Darling Downs, Lockyer Valley, St George and the Central Highlands areas of Queensland. While the trials were targeted against the economically important weeds of cotton such as Sesbania pea, Thornapple, Bathurst and Noogoora burr, Cowvine, Anoda weed, Caltrop, *Tribulus terrestris*, Yellow vine and Annual ground cherry, other species occurring in the trials were evaluated for their susceptibility. Most of the trials

were conducted in irrigated cotton, however some were established under dryland conditions. DPX-PE350 was tested at rates between 25-200 g ai/ha. Where appropriate, standard treatments were included in the trials but they were too numerous and varied for the results to be presented in this paper. Often the standard treatment was hand chipping. Herbicide treatments were applied as early as practical, usually at cotyledon-4 leaf stage although in some trials weeds were more advanced. Crop stage was between 1 true leaf and early flowering. Trials were installed on the common commercial varieties DP90, Siokra L22, Siokra 5324, Siokra 1-4, Sicala 33, Sicala V1 and CS-189. The herbicide treatments were applied as a blanket spray using a 3 m hand-held boom, with Teejet 11001 and 11002 flat fan spray tips, at 250 Kpa pressure in 100-150 L/ha water. A non-ionic surfactant [Alcohol Alkoxylate] was added to all herbicide treatments at 0.25% v/v. Plots (3 or 4 rows x 15 m) were arranged in randomised complete blocks, replicated 3 or 4 times. Weed control was visually evaluated by using a linear rating system where 0 = no control and 100 = 100 % biomass reduction, at 1, 2-3 and 5-6 weeks post application. Crop phytotoxicity was assessed at the same times using a linear rating system where 0 = no injury and 100 = severe effect, 80-100% mortality. Individual trials were analysed using a two way analysis of variance, and the results presented in this paper are the mean of all available data.

RESULTS AND DISCUSSION

Weed control. Weed control expressed as % biomass reduction taken at the final assessment is given in Table 1.

DPX-PE350 at 25 g ai/ha gave excellent control of volunteer sunflower and thornapple, one of the most troublesome weeds in cotton. At this rate plants with up to 9 leaves or 30 cm high were controlled within 10 days of application. At 50 g ai/ha DPX-PE350 gave at least 95% biomass reduction of Boggabri weed and Sesbania pea up to 20 cm high and Anoda weed with up to 5 leaves. These weeds were controlled in 14-21 days. 75 g ai/ha was required to achieve good control of Polymeria and Yellow vine up to 15 cm in diameter. On 1-4 leaf Annual ground cherry and Cowvine and Sesbania pea up to 60 cm high 100 g ai/ha gave over 90% control. This rate also gave useful supression of up to 4 leaf Noogoora burr and Bathurst burr. Other species were less sensitive and at the highest test rate only supression was achieved. Two important weeds of cotton, Bladder ketmia and Nutgrass were not controlled. Application timing was more critical for some species (Burrs, Cowvine and Annual ground cherry) than others (Thornapple, Volunteer sunflower). While larger plants were initially suppressed, regrowth occurred and control dropped markedly when plants with more than 4 leaves were treated. Trial results indicate that for optimum weed control good soil moisture is essential, under dry conditions weeds were slower to respond and weed control was generally less satisfactory. Herbicide symptoms on susceptible species appeared within 5 to 10 days post treatment and varied between species. Most typical symptoms were chlorosis or browning of leaves and necrosis of growing points and stem followed by plant death. Inhibition of root development (root pruning) was observed on many species. Plants died within 7 to 28 days of application, depending on sensitivity and size. Early leaf drop was reported on sesbania pea and stem brittleness was observed in a number of species

Crop effect. The effect of DPX-PE350 on cotton was transient, rate related and influenced by crop stage. Crop phytotoxicity was commonly observed as biomass reduction and interveinal yellowing. Crop phytotoxicity recorded as % biomass reduction at the 1 week assessment is presented in Table 2.

Table 1. Weed control (% biomass reduction) by DPX-PE350 when applied as a post-emergence treatment

Species[a,b]		Treatments (g ai/ha)					
		25	50	75	100	150	200
Boggabri weed	[6]	85	95	96	99	100	100
Anoda weed	[3]		97	100	100	100	100
Wild melon	[1]		65	75	80	85	95
Nutgrass	[4]	0	6	8	21	32	37
Thornapple	[9]	99	100	100	100	100	100
Sunflower (volunteer)	[1]	100	100	100	100	100	100
Bladder ketmia	[3]		13	18	27	34	38
Barley (volunteer)	[1]	15	37	62	72	92	92
Yellowflower devil's claw	[1]		33	53	62	85	92
Cowvine	[5]			78	91	90	93
Bellvine	[3]		60	65	76	79	88
Sensitive plant	[1]	22	37	49	56		64
Annual ground cherry	[3]		87	88	92	92	96
Polymeria	[2]	77	84	96	98	99	100
Pigweed	[1]		26	36	41		60
Rhyncosia	[5]		28	40	43	41	57
Mintweed	[1]		64	71	71	75	76
Sesbania pea[c]	[8]	82	98	99	100	100	100
Sesbania pea[d]	[4]		82	84	95	94	95
Sida	[1]	68	70	100	100	100	83
Common sowthistle	[1]		43	60	83	92	83
Columbus grass	[2]		57	65	58	74	84
Black pigweed	[3]			47	58	61	69
Yellow vine	[5]	65	80	92	96	98	98
Caltrop	[2]		36	54	68	70	78
Maloga bean	[3]			44	50	45	62
Noogoora burr	[6]			74	81	83	85
Bathurst burr	[3]			59	76	85	88

[] Indicates the number of trials

[a] See Appendix for scientific names not given previously

[b] Application timing was cotyledon-4 leaf or up to 15 cm in diameter or in height for most species

[c] Up to 20 cm high

[d] 20-60 cm in high

As shown in Table 2 crop effect was most pronounced when young crops (cotyledon to 3 leaf) were treated. The level of biomass reduction observed on more advanced crops was less, particularly at the 25 to 100 g ai/ha rates. Biomass reduction however, was not observed in every trial. In the 25 to 100 g ai/ha rate range there was no crop effect reported in 23% of all trials and a further 35% of all trials had no more than 10% biomass reduction. The highest level of biomass reduction was 35%, recorded in one trial when DPX-PE350 was applied to a 2 leaf crop. Crop effects were temporary and crops fully recovered within 4 to 6 weeks, often sooner. Varietal differences did not appear to influence the level of phytotoxicity, this was confirmed by a specific tolerance screen (Agrisearch Pty Ltd, pers. comm., 1992). Other forms of crop phytotoxicity were also observed and described as interveinal yellowing, however bronzing and

leaf burn were reported in 5 trials conducted on the Central Highlands. Interveinal yellowing was commonly evident in trials where biomass reduction was observed and it was usually the first symptom to appear, but was not reported in every trial. Symptoms lasted no more than 14 to 21 days and were not always rate related. It was most apparent on the top part of the plant where leaves were most exposed to the herbicide. Emerging new leaves were unaffected. Biomass reduction did not effect subsequent plant development and did not appear to delay maturity. Yield data and boll counts from 10 trials and from one tolerance screen (Agrisearch Pty Ltd, pers. comm., 1992) indicate no negative effect on yield at the highest test rate of 200 g ai/ha.

Table 2. Effect of DPX-PE350 on cotton when applied at various crop stages

Crop stages	% Biomass reduction DPX-PE350 g ai/ha					
	25	50	75	100	150	200
Cotyledon - 3 leaf	6.7 [7]	9.7 [18[	10.0 [19]	11.7 [24]	13.2 [16]	15.2 [23]
3-5 leaf	2.7 [4]	4.5 [15]	6.7 [15]	9.0 [17]	10.2 [15]	10.9 [14]
5 leaf - flowering	0 [2]	1.6 [5]	3.0 [10]	4.4 [11]	10.0 [7]	10.4 [9]

[] Indicated the number of trials.

APPENDIX

List of scientific names not given previously.

Wild melon, *Citrullus lannatus*
Barley (volunteer), *Hordeum vulgare*
Yellowflower devil's claw, *Ibicella lutea*
Sensitive plant, *Mimosa* spp.
Pigweed, *Portulaca oleracea*
Rhyncosia, *Rhyncosia minima*
Mintweed, *Salvia reflexa*
Sida, *Sida retusa*
Common sowthistle, *Sonchus oleraceus*
Columbus grass, *Sorghum x almum*
Black pigweed, *Trianthema portulacastrum*
Maloga bean, *Vigna lanceolata*

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