DPX-T6376 — A NEW HERBICIDE FOR BROADLEAF WEED CONTROL IN CEREALS

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SUMMARY

DPX-T6376 at rates of 5 to 10 g ai/ha controlled a wide spectrum of broadleaf weeds. Compared with chlorsulfuron it showed greater activity on field pansy (*Viola arvensis*), *Polygonum* spp and scrambling speedwell (*Veronica persica*), but was weaker on fathen (*Chenopodium album*). Applied post-emergence it showed good crop selectivity, with barley being more tolerant than wheat. Combinations of DPX-T6376 and chlorsulfuron provided good weed control while maintaining a high level of crop safety.

INTRODUCTION

The attributes of chlorsulfuron use in cereal growing systems are well documented (Cornwell and Christie 1981; Palm and Ailison 1980). Since then Du Pont has continued to develop sulfonylurea materials with a complementary weed spectrum to chlorsulfuron and more flexibility in sensitive crop rotations.

After encouraging results from three exploratory trials conducted late in the 1982 season, a more extensive programme was set up in 1983. Trials were carried out to establish likely use rates, weed species controlled and cereal crop tolerance. This paper presents results from these trials.

CHEMICAL AND PHYSICAL PROPERTIES

Chemical name

Methyl 2-[3-(4-methoxy-6-methyl-1,3,5-triazin-2-yl)ureidosulphonyl]benzoate.

Chemical structure

Toxicology

DPX-T6376 has a low level of acute mammalian toxicity - the oral LD₅₀ to male rats is >5000 mg/kg for technical product. The dermal LD₅₀ for rabbits is >2000 mg/kg. The product is a mild but reversible eye irritant. It is non-mutagenic in the Ames test. Sub-acute oral studies have shown no mortality or histopathological effects. The compound also shows very low toxicity to fish and wildlife.

Mode of action

The mode of action of DPX-T6376 is similar to that of chlorsulfuron (Cornwell and Christie 1981). The product is absorbed both through the roots and foliage. Translocation within the plant is fairly rapid, and both acropetal and basipetal translocation can occur. Within hours of uptake by the plant there is rapid inhibition of the growing tips of the roots and shoots, followed by visible die-back in the growing tips, (usually between 3-14 days after application), a general yellowing, tissue necrosis and death. Plants which do not die are often severely stunted and are much less competitive to the cereal crop. DPX-T6376 is non-volatile.

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Selectivity

Cereal selectivity is due to the rapid metabolism of the molecule by the cereal plant. The parent material cannot be detected in the plant within a few days of application at normal use rates.

Behaviour in soil

Degradation in the soil of DPX-T6376 occurs through both chemical hydrolysis and microbial degradation. Overseas data suggest a half life of between 1 week and 1 month. Increasing levels of soil moisture and warmer temperatures accelerate the rate of disappearance.

METHODS

DPX-T6376 was evaluated alone or in combination with chlorsulfuron (GLEAN™ 75 DF) in major cereal growing areas of New Zealand. A standard proprietary formulation of bromoxynil/ioxynil/mecoprop (Axall) was included in all trials at the recommended rate of application.

Treatments were applied by a modified Oxford precision sprayer fitted with 730308 fan nozzles, delivering 300 litres/ha at 200 kPa. Plots measured 2 m x 10 m or 2 m x 15 m, replicated four times and arranged in a completely randomised block design.

Treatments were applied when the crop was at the 2-4 tiller stage and weeds were seedlings. Weed control and crop tolerance assessments were carried out at 2 week intervals for 2 months after application and again at harvest. Weed control assessments were based on biomass reduction compared to untreated plots. A small self cleaning combine harvester was used to harvest plots.

In addition to weed control trials, three varietal tolerance trials were carried out in Canterbury and Manawatu, under low weed populations.

RESULTS

Weed control

DPX-T6376 at 5 g ai/ha and above either alone or in combination with chlorsulfuron consistently gave good control of a range of common weed species. As with chlorsulfuron control of susceptible weed species was better when applied to seedling weeds growing under moist conditions.

In all trials weed collapse was more gradual and slower than the standard treatment.

The moist growing season resulted in field pansy becoming a dominant weed species in many of the Canterbury trial sites, and DPX-T6376 at rates 4 g ai/ha and above provided excellent control even at more advanced growth stages.

DPX-T6376 provided good control of the following weed species:- combind (*Polygonum convolvulus*), wireweed (*Polygonum aviculare*), and scrambling speedwell. However DPX-T6376 at 5 g ai/ha appeared weaker than chlorsulfuron on fathen. The combination of DPX-T6376 and chlorsulfuron gave good control of all major weed species encountered in these trials. Black nightshade (*Solanum nigrum*) was tolerant to both chlorsulfuron and DPX-T6376 at all rates.

Crop tolerance

Phytotoxicity was noted in autumn and winter sown wheat from DPX-T6376 rates of 10 g ai/ha and above. Symptoms observed 14 days after application were general loss of colour, stunting, and at the highest rate, abortion of the leading tiller of some plants. These symptoms were especially evident in the wheat varietal tolerance trial. Recovery was gradual over a 4 week period with height reduction from 40 g ai/ha still being evident at harvest. It is suggested that the 27 mm of rainfall that fell subsequent to application, at the above trial site contributed significantly to the level of crop phytotoxicity observed.

On wheat cultivars the above symptoms were noted, with Kopara and Advantage being more tolerant, whilst Arawa and Konini, which were used as buffers, were unaffected. Yields however were not affected with no significant difference between treatments (Table 3). In five other trials where rates of DPX-T6376 at 20 g ai/ha and above were used no significant reductions in yield occurred.

There were no symptoms of effect on either foliage or yield on the barley cultivars evaluated (Table 3) and Zephyr and Mata showed excellent tolerance in weed efficacy trials.

TABLE 1: Percent weed control - 6 weeks after application.

Treatment g ai/ha	field pansy	wireweed	cornbind	fathen
DPX-T6376 2.5	50 (2)*	80 (2)	77 (3)	83 (2)
DPX-T6376 5.0	93 (3)	88 (4)	89 (4)	83 (2)
DPX-T6376 10.0	96 (4)	93 (4)	94 (4)	95 (3)
DPX-T6376 2.0 + chlorsulfuron 10	46 (2)	-	-	95 (2)
DPX-T6376 5.0 + chlorsulfuron 10	95 (3)	97 (2)	-	96 (2)
DPX-T6376 10.0 + chlorsulfuron 10	95 (2)	97 (2)	-	100 (2)
chlorsulfuron 15	58 (6)	74 (6)	80 (5)	94 (3)
bromoxynil/ioxynil/mecoprop 150 + 150 + 750	66 (2)	88 (3)	91 (4)	100 (3)
CV %	16.8	17.8	18.6	2.3
LSD 5%	22.1	24.9	24.3	4.8

* No. of trials

TABLE 2: Percent control of broadleaf weeds.

Weed species	Number of Trials	DPX-T6376 g ai/ha 5	chlorsulfuron g ai/ha 15	DPX-T6376 + chlorsulfuron g ai/ha 5 + 10
black nightshade	2	4	2	-
chickweed (<i>Stellaria media</i>)	4	98	94	100
cornbind	4	89	80	-
fathen	4	83	94	96
field pansy	6	93	58	96
scarlet pimpernel (<i>Anagallis arvensis</i>)	2	97	96	98
shepherd's purse (<i>Capsella bursa-pastoris</i>)	4	97	97	96
speedwell	3	91	72	85
spurrey (<i>Spergula arvensis</i>)	2	100	100	100
stinking mayweed (<i>Anthemis cotula</i>)	1	100	100	100
wild turnip (<i>Brassica campestris</i>)	1	100	100	-
willow weed (<i>Polygonum persicaria</i>)	2	84	85	-
wireweed	6	88	74	97
white clover (<i>Trifolium repens</i>)	3	86	68	-
yarrow (<i>Achillea millefolium</i>)	1	92	92	-

TABLE 3: Weed free crop tolerance trial : yield tonne/ha.

Treatment	g ai/ha	Advantage	Wheat varieties			
			Rongotea	Oroua	Kopara	
DPX-T6376	10	3.50	3.68	3.40	3.52	
DPX-T6376	20	3.88	3.01	3.33	3.30	
DPX-T6376	40	3.94	3.15	3.06	3.38	
untreated	--	3.66	3.87	3.37	3.67	
CV% 9.4	LSD 5%	0.455				

			Barley Varieties				
			Triumph	Gwylan	Kym	Goldmarker	Koru*
DPX-T6376	5	6.62	6.87	6.92	6.96	8.01	
DPX-T6376	10	6.44	7.06	7.38	6.94	8.26	
DPX-T6376	20	5.83	7.00	7.06	7.18	7.93	
untreated	--	6.70	6.74	7.44	6.45	8.30	
CV% 6.4	LSD 5%	0.63					

* Manawatu Results

DISCUSSION

New Zealand results with DPX-T6376 are consistent with overseas experience (Doig *et al* 1983). Of particular note was the control of field pansy, a species becoming more important in Canterbury and one which has been inconsistently controlled by cereal herbicides in the past. DPX-T6376 in combination with chlorsulfuron was particularly impressive in controlling a wide spectrum of broadleaf weeds at very low rates in wheat and barley. However black nightshade remains resistant.

Yield results in low weed pressure sites showed no significant difference between treatments. Varietal trials demonstrated that the wheat cultivars Kopara and Advantage had a higher level of tolerance than Rongotea and Oroua. Good selectivity at up to 20 g ai/ha DPX-T6376 has been shown on a wide range of barley cultivars.

Attributes of broad spectrum weed activity, the convenience of very low use rates of a dry flowable formulation and its non-volatility suggest that DPX-T6376 will be a valuable addition to the weed control programmes of cereal growers.

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