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THE ACTIVITY AND POST-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: AC 252214, DPX-T6376, AND CHLORAZIFOP

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

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NOTE

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THE ACTIVITY AND POST-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: AC 252214, , DPX-T6376 AND CHLORAZIFOP

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SUMMARY

Three herbicides were examined for post-emergence selectivity on 43 crop and weed species. The route of action of these herbicides was determined on six selected species in a separate test. The safener 1,8 naphthalic anhydride (NA) was used as a seed dressing on wheat, barley and maize to see if herbicide effects could be reduced.

AC 252214 was effective on a wide spectrum of weeds, especially pre- but also post-emergence. Soyabean showed outstanding tolerance, as did dwarf bean to a slightly lesser degree.

DPX-T6376, is one of the most phytotoxic chemicals yet tested, both pre- and post-emergence. Control of mainly broad-leaved weeds such as Veronica persica, Viola arvensis, composite, cruciferous and caryophyllaceous weeds was achieved post-emergence at rates which did not affect temperate cereals (wheat, barley, oat). Maize was protected to some extent by NA.

Chlorazifop was active pre- and post-emergence on certain annual and perennial grass weeds and selective in many broad-leaved crops, notably legumes. All broad-leaved weeds were resistant however while Poa annua was only moderately susceptible. The possibility of selective control of Avena fatua and Alopecurus myosuroides in wheat and barley however is of major interest.

INTRODUCTION

The pre- and post-emergence selectivities and effects of new herbicides are investigated at WRO on a large number of pot-grown crop and weed species. The limitations of these investigations are that only one crop variety or source of weed species is used and growth is in one particular soil type, at only one depth of sowing without interspecific competition. Consequently, as plant responses in pot experiments can be very different to those in the field the results should only be used as a guide for further work.

This report gives indications of the post-emergence selectivity of three new herbicides. Results of activity experiments are also included to provide information on levels of phytotoxicity, type and route of action.

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* Herbicide Performance Group

METHODS AND MATERIALS

(a) Activity experiments (AE 1 and 2)

These were carried out on six selected species as described previously (Richardson and Dean, 1974). Three annual species and perennial ryegrass were raised from seeds and two perennials from rhizome fragments. There were two replicates for each treatment. Herbicides were applied by four different methods:-

(i) post-emergence spray to the foliage only, avoiding contact with the soil,
(ii) post-emergence to the soil only, as a drench avoiding foliage contact,
(iii) pre-emergence spray to the soil surface,
(iv) pre-emergence with thorough incorporation, before planting.

Experimental details are summarised in Tables 1 and 2.

(b) Post-emergence selectivity experiment

The experimental details were as previously described (Richardson and Parker, 1977). Plants were raised in 9 or 10 cm diameter plastic pots in a soil/peat/sand medium (4:1:1 v/v) the soil being taken from a field near Begbroke Hill (Yarnton). Planting dates were staggered so that the majority of species would reach a pre-determined stage (2-4 leaves) by the time of spraying. However, as noted in Appendix I, several species were at a more advanced stage of growth. All species were raised in the open.

Table 1. Plant data for activity experiments

Species	Cultivar/ source	No. per pot at spraying		Depth of planting (cm)	Stage of growth at:		
		pre-	post-		Spraying post-em	Assessment pre-em	Assessment post-em
Dwarf bean (*Phaseolus vulgaris*	Masterpiece	3-4	2	2.0	2 uni-foliate leaves	1.5-2.5 tri-foliate leaves	2-3 tri-foliate leaves
Kale (*Brassica oleracea acephala*	Marrowstem	10	5	0.5	2-2.5 leaves	4-5 leaves	4-5 leaves
Polygonum amphibium	WRO Clone 1	6	4-5	1.0	4.5-5.5 leaves	6-8 leaves	9-10 leaves
Perennial ryegrass (*Lolium perenne*	S23	15	8-10	0.5	2-3 leaves	4-5 leaves, tillering	2-6 tillers
Avena fatua	WRO 1978 WRO 1980	10-12	5	1.0	2.5-3 leaves	3.5-4.5 leaves, 0-2 tillers	2 tillers
Elymus repens	WRO Clone 31	6	4-5	1.0	2.5-3 leaves	3.5-5 leaves, 0-3 tillers	1-2 tillers

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

Table 2. Soil and environmental conditions

Experiment number, type and herbicides included	AE 1 DPX-T6376	AE 2 AC 252214 Chlorazifop	Post-emergence selectivity test AC 252214, DPX-T6376 Chlorazifop
Date of spraying	13.10.82	20.5.83	7&12.7.83
Main assessment completed	16.11.82	21.6.83	5.8.83
Organic carbon (%)	2.2	2.2	1.3
Clay content (%)	15.0	15.0	16.0
pH (in water; 1:2 soil:water ratio)	7.5	7.5	7.5
Superphosphate (g/kg)	2.0	2.0	-
Vitax QS fertilizer (g/kg)	2.5	2.5	2.5
Hydrated Mg SO_4 $7H_2O$ (g/kg)	0.8	0.8	-
Temperature (^oC)	Glasshouse		Outdoors
Mean	19	19	19
Maximum	26	33	30
Minimum	12	11	9
Relative humidity (%)			
Mean	60	60	50
Maximum	85	90	86
Minimum	32	20	12

In some cases plant material was pre-treated to improve establishment:- seeds of Chenopodium album were soaked in 0.1 M potassium nitrate solution and kept in the light for two days prior to planting; seeds of Alopecurus myosuroides were soaked in distilled water and kept in the light for 24 hours; Rumex obtusifolius seeds were dehusked; Veronica persica and Agrostis stolonifera were sown in a tray of peat compost and seedlings (1-2 leaves) transplanted into the potting medium.

For protection from soil-borne pathogens all seeds except wheat, barley, oat, sugar beet, Avena fatua and those soaked in potassium nitrate solution were pre-treated with one of the following: thiram, Harvesan organomercury, thiram + benomyl (onion). Root fragments of Cirsium arvense were washed in a colloidal copper solution (2ml $litre^{-1}$) prior to planting. As dwarf bean, field bean and certain brassicas (kale, rape, cabbage, radish) are susceptible to "damping off" diseases, 6% gum arabic solution was included with the thiram fungicide seed dressing to improve adhesion.

A series of treatments was included to investigate possible uses for the safener NA (1,8-naphthalic anhydride). Maize, wheat and barley were treated with NA at 0.5% a.i. w/w of seeds. Before spraying, each species was thinned to constant number per pot.

Herbicides were applied using a laboratory sprayer operating at a pressure of 207 kPa (30 lb/in^2) with a Spraying Systems 8002 TeeJet spray nozzle moving at 0.5 m sec^{-1}, 45 cm above the stationary plants and delivering a volume of 370 l/ha. There were two replicates for each treatment. Stages of growth at spraying and assessment are summarised in Appendix I. After spraying, the plants were protected from rainfall for 24 hours and then watered overhead to wash any residues off the foliage, using a rose at the end of a trigger hose attached to the mains water supply. The pots were then returned to their original position in the open. Watering throughout the experiment was from overhead. Additional fertilizer in solution was applied to all species at one week intervals after spraying (5 ml $litre^{-1}$ Vitafeed 301). Insecticide and fungicide solutions were applied to individual species as required.

(c) Assessments and processing of results

Results were assessed and processed as before (Richardson and Dean, 1974). Survivors were counted and scored for vigour on a 0-7 scale as previously, where 0 = dead and 7 = as untreated control. Histograms are presented for the results of each treatment, the upper of each pair represents mean plant survival and the lower, mean vigour score,both calculated as percentages of untreated controls. Actual percentage figures are displayed to the left of each row of x's (in selectivity test only). The same information is displayed in the histograms, each 'x' representing a 5% increment, but in the activity experiment each 'x' represents a 7% increment. A '+' indicates a value in excess of 100%. A value of 100 = as untreated control and 0 = a complete kill. 'R' indicates results based on one replicate only.

A table of observed selectivities, using the criteria specified, is presented below for each compound along with comments to highlight salient points. Radish (Raphanus raphanistrum) which was included because it is easy to propagate), may be regarded as a crop or a weed.

Several species, notably the perennials, were kept for extra periods to observe later effects, or the degree of recovery from injury. Results for Cirsium arvense were not included in the histograms because plant growth was variable, but some observations were possible and are referred to in the text where relevant.

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

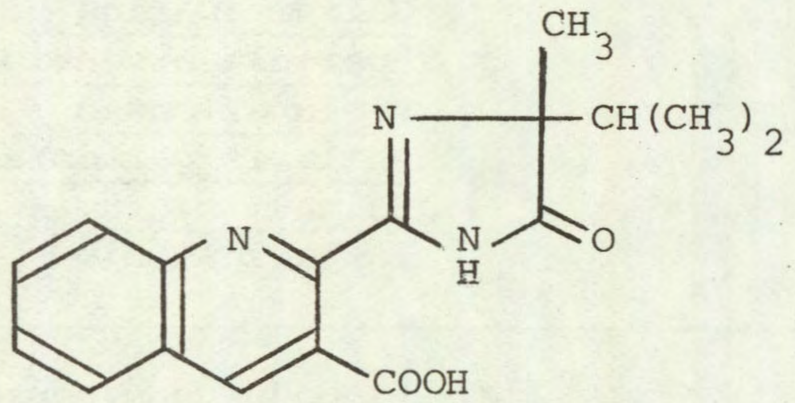
AC 252214

Code number AC 252214 Trade name -

Common name Imazaquin (BSI proposed)

Chemical name
2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-3-quinolinecarboxylic acid.

Structure



Source Cyanamid International Limited
Fareham Road
Gosport
Hants PO13 OAS; UK.

Information available and suggested uses
Broad spectrum weed control in soyabean pre-plant incorporated, pre- and post-emergence; beans and cowpeas pre-emergence; lucerne, clover, tobacco post-emergence. Addition of a non ionic surfactant for post-emergence applications at 0.1 to 0.5% v/v final concentration is recommended.

Formulation used 70% w/w a.i. water dispersible granules + 0.1% v/v Agral 90 surfactant.

Spray volume 370 l/ha for both experiments.

RESULTS

Full results are given in the histograms on pages 9-13 and potential selectivities are summarised in the following table.

RATE (kg/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.8	soyabean	Bromus sterilis Avena fatua Poa annua Matricaria perforata Galium aparine Spergula arvensis Viola arvensis Phalaris paradoxa Solanum nigrum + species below
0.2	species above + dwarf bean	Alopecurus myosuroides Chrysanthemum segetum Phalaris minor Elymus repens * + species below
0.05	species above + oat field bean	Beta vulgaris Festuca rubra Poa trivialis Sinapis arvensis Raphanus raphanistrum Stellaria media

* controlled at late assessment

Comments on results

Activity experiment

Activity was generally greater in the soil applied treatments, especially pre-emergence. Effects of the foliar spray were apparent on all species however even at the lower doses. The perennials, Polygonum amphibium and Elymus repens were the most sensitive species while dwarf bean showed some degree of tolerance. The soil drench treatments did not affect dwarf bean but all other species were highly susceptible. There was little difference between surface and incorporated pre-emergence applications.

Symptoms on susceptible species

Symptoms took several days to develop with post-emergence treatments being more prominent on newly developing leaves. These were usually small, stunted and chlorotic, necrosis of tissues developing later. The new leaves of certain species were also sometimes distorted. A patchy chlorosis developed later on older, sprayed leaves of some broad-leaved species. Plants often failed to

emerge at higher doses in the pre-emergence treatments. Those which succeeded were inhibited severely at an early growth stage, grasses dying back from the one to two leaf stage while broad-leaved species sometimes failed to develop beyond the cotyledon leaf stage. Necrosis and death was usually preceded by a pronounced chlorosis.

Post-emergence selectivity

Six annual weeds were controlled at the lowest dose of 0.05 kg/ha including two grasses (Poa trivialis and Festuca rubra), both crucifers (Sinapis arvensis and Raphanus raphanistrum), Beta vulgaris and Stellaria media. At higher doses a further 13 weeds were controlled including several grasses (Poa annua, Alopecurus myosuroides, Avena fatua, Bromus sterilis, Phalaris spp., E. repens) and several broad-leaved species (Chrysanthemum segetum, Matricaria perforata, Galium aparine, Viola arvensis, Solanum nigrum, Spergula arvensis). Chenopodium album was quite resistant but this was probably due to its rather advanced growth stage (14 leaves) when sprayed. The other perennials, although not adequately controlled, were severely suppressed at higher doses.

Soyabean showed outstanding tolerance, being unaffected at the highest dose of 0.8 kg/ha. Tolerance was found in other legume crops, notably dwarf bean which was reduced in vigour by only 21% at 0.8 kg/ha while field bean withstood 0.05 kg/ha.

The potential control or suppression of nearly all broad-leaved and grass weeds in soyabean was impressive. The unexpected tolerance of dwarf bean, found in both experiments was also of considerable interest and worth further investigation.

ACTIVITY EXPERIMENT

AC 252214

		0.0625 kg/ha	0.25 kg/ha	1.0 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxx
	P	xxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxx xxxxx
	I	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxx xxxxxx
KALE	F	xxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxx xxxxxx
	S	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxxx+ xxxx	xxxxxxxxxxxxxx+ xxxx	xxxxxxxxxxxxxx+ xxxx
	I	xxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx+ xxxx	xxxxxxxxxxx xx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxxxx
	S	xxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxx
	P	o o	o o	o o
	I	xxxxxxxx xxx	o o	o o
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxx xxxxxx
	S	xxxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxx xxxxx	xx xx	xx x
	I	xxxxxxxxxxxxxx+ xxxxxx	xxxxxxxxxx xxx	xxxxxx xx
AVENA FATUA	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxx
	S	xxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxxx+ xxxxx	xxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx+ xxxx
	I	xxxxxxxxx xxxxx	xxxxxxxxxx xxxx	xxxxxxxxxxxxxx xx
ELYMUS REPENS	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxx
	P	x x	o o	o o
	I	o o	o o	o o

KEY: F = post-emergence, foliar application
S = post-emergence, soil drench
P = pre-emergence, surface film
I = pre-planting, incorporated

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

Species	AC 252214 0.05 kg/ha		AC 252214 0.2 kg/ha		AC 252214 0.8 kg/ha	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx
(1)	57	xxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
WHEAT+S	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(2)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	36	xxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(3)	50	xxxxxxxxxx	36	xxxxxxx	21	xxxx
BARLEY+S	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(4)	43	xxxxxxxxx	29	xxxxxx	14	xxx
OAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx
(5)	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	14	xxx
PER RYGR	81	xxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	56	xxxxxxxxxxx
(6)	57	xxxxxxxxxxx	29	xxxxxx	21	xxxx
ONION	92	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	8	xx
(8)	57	xxxxxxxxxxx	50	xxxxxxxxxx	21	xxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
FLD BEAN	107	xxxxxxxxxxxxxxxxxxxx+	80	xxxxxxxxxxxxxxx	53	xxxxxxxxxxx
(10)	86	xxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	36	xxxxxxx
PEA	83	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(11)	57	xxxxxxxxxxx	50	xxxxxxxxxx	43	xxxxxxxxx
W CLOVER	100	xxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(12)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
RAPE	75	xxxxxxxxxxxxxxx	50	xxxxxxxxxx	25	xxxxx
(14)	21	xxxx	14	xxx	7	x

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

	AC 252214				
Species	0.05 kg/ha		0.2 kg/ha		0.8 kg/ha	
KALE	100	xxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(15)	43	xxxxxxxxx	29	xxxxxx	29	xxxxxx
CABBAGE	100	xxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(16)	36	xxxxxxx	29	xxxxxx	29	xxxxxx
CARROT	114	xxxxxxxxxxxxxxxxxxxx+	105	xxxxxxxxxxxxxxxxxxx+	48	xxxxxxxxxx
(18)	36	xxxxxxx	43	xxxxxxxxx	36	xxxxxxx
PARSNIP	83	xxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(19)	43	xxxxxxxxx	43	xxxxxxxxx	43	xxxxxxxxx
LETTUCE	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(20)	57	xxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
FENUGREK	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	58	xxxxxxxxxxx
(21)	57	xxxxxxxxxxx	50	xxxxxxxxxx	36	xxxxxxx
SUG BEET	92	xxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(22)	29	xxxxxx	29	xxxxxx	21	xxxx
BETA VUL	67	xxxxxxxxxxxxx	67	xxxxxxxxxxxxx	58	xxxxxxxxxxx
(23)	21	xxxx	14	xxx	14	xxx
BROM STE	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	30	xxxxxx
(24)	71	xxxxxxxxxxxxxx	36	xxxxxxx	14	xxx
FEST RUB	87	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	37	xxxxxxx
(25)	29	xxxxxx	14	xxx	7	x
AVE FATU	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(26)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

Species		AC 252214 0.05 kg/ha		AC 252214 0.2 kg/ha		AC 252214 0.8 kg/ha
ALO MYOS	90	xxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx	50	xxxxxxxxxx
(27)	57	xxxxxxxxxxx	21	xxxx	14	xxx
POA ANN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	81	xxxxxxxxxxxxxxxx
(28)	79	xxxxxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
POA TRIV	40	xxxxxxxx	30	xxxxxx	40	xxxxxxxx
(29)	21	xxxx	7	x	14	xxx
SIN ARV	82	xxxxxxxxxxxxxxxx	91	xxxxxxxxxxxxxxxxxx	73	xxxxxxxxxxxxxxx
(30)	29	xxxxxx	21	xxxx	29	xxxxxx
RAPH RAP	30	xxxxxx	10	xx	0	
(31)	29	xxxxxx	14	xxx	0	
CHRY SEG	90	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx
(32)	43	xxxxxxxxx	29	xxxxxx	14	xxx
MAT PERF	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	62	xxxxxxxxxxxx
(33)	71	xxxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(38)	64	xxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
CHEN ALB	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(39)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
STEL MED	94	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(40)	29	xxxxxx	29	xxxxxx	14	xxx
SPER ARV	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
(41)	64	xxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

	AC 252214				
Species	0.05 kg/ha		0.2 kg/ha		0.8 kg/ha
VER PERS	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	80 xxxxxxxxxxxxxxx
(42)	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	36 xxxxxxx
VI ARVE	120	xxxxxxxxxxxxxxxxxxx+	100	xxxxxxxxxxxxxxxxxxx	80 xxxxxxxxxxxxxxx
(43)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	29 xxxxxx
RUM OBTU	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
(44)	57	xxxxxxxxxx	43	xxxxxxxx	43 xxxxxxxx
EL REPEN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
(47)	57	xxxxxxxxxx	36	xxxxxxx	43 xxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
(48)	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxx	36 xxxxxxx
PHAL PAR	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	80 xxxxxxxxxxxxxxx
(54)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	29 xxxxxx
MAIZE+S	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	83 xxxxxxxxxxxxxxxx
(56)	43	xxxxxxxx	29	xxxxxx	14 xxx
MAIZE	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
(57)	36	xxxxxxx	29	xxxxxx	29 xxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
(65)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
SOL NIG	100	xxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	75 xxxxxxxxxxxxxx
(81)	64	xxxxxxxxxxxx	43	xxxxxxxx	29 xxxxxx
PHAL MIN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxx
(84)	57	xxxxxxxxxx	29	xxxxxx	14 xxx

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

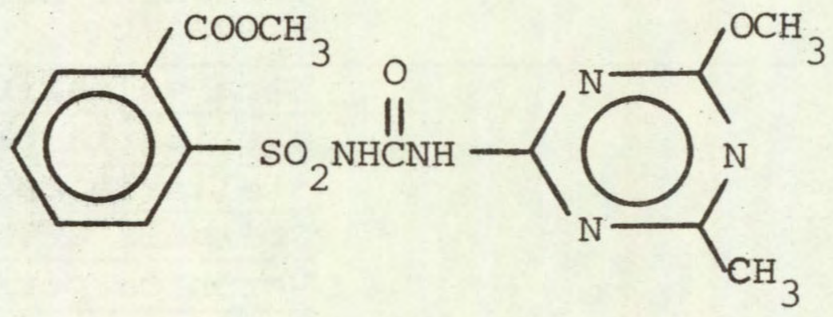
DPX-T6376

Code number DPX-T6376 **Trade name** -

Common name Metsulfuron-methyl (BSI proposed)

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

Structure



Source

Du Pont (UK) Ltd
Wedgwood Way
Stevenage SG1 4QN
Herts.

Information available and suggested uses

Control of broad-leaved weeds in cereals.

Formulation used 70% w/w a.i. dry flowable dispersible granules + 0.1% v/v Agral 90 surfactant.

Spray volume 370 l/ha for both experiments.

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

RESULTS

Full results are given in the histograms on pages 17-21 and potential selectivities are summarized in the following table.

RATE (kg/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.008	wheat±safener (NA) barley±safener (NA) maize+safener (NA) oat	Poa trivialis Chenopodium album Solanum nigrum + species below
0.002	as above	Beta vulgaris Matricaria perforata Stellaria media Spergula arvensis Veronica persica Viola arvensis + species below
0.0005	species above + maize	Sinapis arvensis Raphanus raphanistrum Chrysanthemum segetum

Comments on results

Activity experiment

DPX-T6376 is one of the most active herbicides yet tested. It was two to three times more active than chlorsulfuron (Richardson et al., 1980 and 1981) to which it is chemically related. Though pre-emergence activity and selectivity was apparent, as indicated by the manufacturers, its activity as a foliar spray on dwarf bean and Polygonum amphibium was considerable and the tolerance of grasses and kale suggested selectivity post-emergence. Activity pre-emergence was greater as a surface spray rather than incorporated into the soil.

Symptoms

Wilting and collapse of the unifoliate leaves of dwarf bean resulted within 24 hours of spraying. Scorch and necrosis of leaves usually developed on other broad-leaved species within a few days of treatment, accompanied by severe chlorosis, retardation or cessation of growth. With pre-emergence treatments broad-leaved plants usually died back soon after emergence, the growth of the main bud being virtually stopped. At high doses P. amphibium was killed just before or after emergence. At lower doses a pronounced yellowing of this species was evident with all four application methods. Rumex obtusifolius however showed an intense reddening of leaves. All three grasses treated pre-emergence assumed a dart-like appearance, with needle shaped leaves, a symptom common with root-inhibiting herbicides. Later examination showed that roots were severely retarded being much shortened and often swollen. These symptoms were very similar to those reported earlier for the chemically related chlorsulfuron (Richardson, et al., 1980).

Post-emergence selectivity

Even at a dose as low as 0.0005 kg/ha (0.5 g/ha) many annual broad-leaved weeds were severely affected while crucifers (Sinapis arvensis, Raphanus raphanistrum) and Chrysanthemum segetum were controlled. Six more weeds were susceptible at 0.002 kg/ha (2 g/ha) including Veronica persica, Viola arvensis, Matricaria perforata, Beta vulgaris and the caryophyllaceae (Stellaria media, Spergula arvensis). Galium aparine was resistant however as were all grass weeds, except Poa trivialis which was controlled at the high dose.

All temperate cereals (wheat, barley, oat) were highly tolerant. Maize was the only other tolerant crop but only to the lowest dose. NA produced an outstanding safening effect on this species such that it was able to tolerate the highest dose of 0.008 kg/ha. Perennial ryegrass and all broad-leaved species were very sensitive.

The potential selective control of weeds as important as Veronica spp., Viola spp. and composites, in wheat and barley was interesting. However, in view of the resistance of Galium and grass weeds, consideration should be given to mixing with other herbicides. Post-emergence activity was higher than had been indicated by the manufacturer and appears to extend to established broad-leaved, perennial weeds as well (West and Richardson, unpublished data). The safening of maize with NA needs verification, especially as untreated and NA treated plants were sprayed at different growth stages and on different days. Even so, this safening effect is not altogether surprising as it also occurs with chlorsulfuron (Parker et al., 1980).

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

ACTIVITY EXPERIMENT

DPX-T6376

		0.0005 kg/ha	0.002 kg/ha	0.008 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxx	o o
	S	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxxxx xxxxx
	P	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxx xxxxxx
	I	xxxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxx
KALE	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxx
	P	xxxxxxxxxx xxxx	xxxxxxxxxx xxxx	xxxxxxxxxxxxx xxxx
	I	xxxxxxxxxxxxxxx+ xxxxxxxxxxx	xxxxxxxxxxxxxxx+ xxxxxx	xxxxxxxxxxxxxxx+ xxxx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xx x
	S	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxxx xxxxxx
	P	xxxxxxxxxxxxxxx xxxxxx	xxxxxxxxxx xxxx	o o
	I	xxxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxx	xxxxxxxx xxxx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx	xxxxxxxx xxxx
	P	xxxxxxxxxxxxxx xxxxxxx	xxxx xxx	x xxx
	I	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xxxxxxx xxxxxx
AVENA FATUA	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxx
	P	xxxxxxxxxxxxxxx+ xxxxxxxxxxxxx	xxxxxxxxxx xxxxxxxxxx	xxxxxxxxxx xxxxxx
	I	xxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxxx x	xxxxxxxxxxxxxxx xxxxxxxxx
ELYMUS REPENS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxx
	P	xxxxxxxxxxxxxxx+ xxxxxxxxxxxx	xxxxxxxxxxxxxxx+ xxxxxx	xxxxxxx xxxx
	I	xxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxx xxxxxx

KEY: F = post-emergence, foliar application
S = post-emergence, soil drench
P = pre-emergence, surface film
I = pre-planting, incorporated

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

DPX-T6376

Species	0.0005 kg/ha		0.002 kg/ha		0.008 kg/ha	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(1)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
WHEAT+S	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(2)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
BARLEY+S	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(4)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
OAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(5)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
PER RYGR	56	xxxxxxxxxx	50	xxxxxxxxx	69	xxxxxxxxxxxxx
(6)	43	xxxxxxxxx	43	xxxxxxxxx	36	xxxxxxx
ONION	92	xxxxxxxxxxxxxxxxxx	8	xx	8	xx
(8)	50	xxxxxxxxxx	14	xxx	7	x
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	79	xxxxxxxxxxxxxxx	29	xxxxxx	29	xxxxxx
FLD BEAN	93	xxxxxxxxxxxxxxxxxx	13	xxx	0	
(10)	36	xxxxxx	7	x	0	
PEA	100	xxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx	67	xxxxxxxxxxxx
(11)	29	xxxxxx	14	xxx	14	xxx
W CLOVER	0		0		0	
(12)	0		0		0	
RAPE	50	xxxxxxxxx	25	xxxxx	0	
(14)	29	xxxxxx	14	xxx	0	

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

DPX-T6376

Species	0.0005 kg/ha		0.002 kg/ha		0.008 kg/ha	
KALE	100	xxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(15)	36	xxxxxxx	36	xxxxxxx	29	xxxxxx
CABBAGE	100	xxxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(16)	29	xxxxxx	29	xxxxxx	29	xxxxxx
CARROT	67	xxxxxxxxxxxxx	76	xxxxxxxxxxxxxxx	10	xx
(18)	57	xxxxxxxxxxx	43	xxxxxxxxx	7	x
PARSNIP	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxx
(19)	64	xxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
LETTUCE	92	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(20)	36	xxxxxxx	29	xxxxxx	29	xxxxxx
FENUGREK	83	xxxxxxxxxxxxxxxxx	17	xxx	0	
(21)	36	xxxxxxx	7	x	0	
SUG BEET	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	67	xxxxxxxxxxxxx
(22)	43	xxxxxxxxx	21	xxxx	21	xxxx
BETA VUL	75	xxxxxxxxxxxxxxx	58	xxxxxxxxxxxx	42	xxxxxxxx
(23)	36	xxxxxxx	29	xxxxxx	14	xxx
BROM STE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(24)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
FEST RUB	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(25)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	36	xxxxxxx
AVE FATU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(26)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
ALO MYOS	90	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxx
(27)	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxx

POST-EMERGENCE SELECTIVITY TEST

NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

DPX-T6376

Species	0.0005 kg/ha		0.002 kg/ha		0.008 kg/ha	
POA ANN	94	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(28)	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx	43	xxxxxxxxx
POA TRIV	100	xxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxx	10	xx
(29)	86	xxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	21	xxxx
SIN ARV	73	xxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxx
(30)	29	xxxxxx	21	xxxx	21	xxxx
RAPH RAP	30	xxxxxx	0		0	
(31)	43	xxxxxxxxx	0		0	
CHRY SEG	90	xxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(32)	29	xxxxxx	29	xxxxxx	14	xxx
MAT PERF	81	xxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(33)	43	xxxxxxxxx	29	xxxxxx	29	xxxxxx
GAL APAR	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	57	xxxxxxxxxx
CHEN ALB	100	xxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx
(39)	79	xxxxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
STEL MED	94	xxxxxxxxxxxxxxxxxx	81	xxxxxxxxxxxxxxx	62	xxxxxxxxxxx
(40)	43	xxxxxxxxx	29	xxxxxx	14	xxx
SPER ARV	71	xxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
(41)	43	xxxxxxxxx	29	xxxxxx	21	xxxx
VER PERS	50	xxxxxxxxxx	30	xxxxxx	50	xxxxxxxxxx
(42)	36	xxxxxxx	21	xxxx	14	xxx
VI ARVE	100	xxxxxxxxxxxxxxxxxx	20	xxxx	0	
(43)	71	xxxxxxxxxxxxxx	21	xxxx	0	

DPX-T6376

Species	0.0005 kg/ha		0.002 kg/ha		0.008 kg/ha	
RUM OBTU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(44)	50	xxxxxxxxxx	43	xxxxxxxxx	43	xxxxxxxxx
EL REPEN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(48)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
PHAL PAR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(54)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
MAIZE+S	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(56)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
MAIZE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(57)	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	36	xxxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(65)	29	xxxxxx	29	xxxxxx	29	xxxxxx
SOL NIG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxx
(81)	57	xxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
PHAL MIN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(84)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxx

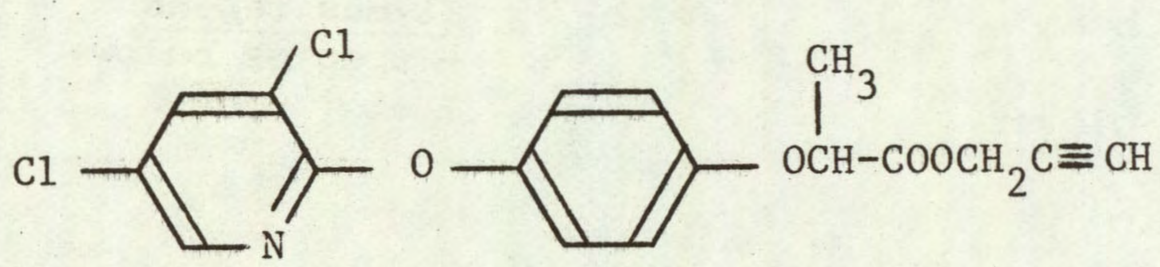
NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

CHLORAZIFOP

Code number CGA 82725 **Trade name** -

Chemical name 2-[4-(3,5-dichloro-2-pyridyloxy)-phenoxy]-propionic acid,-2-propynylester

Structure



Source

Ciba-Geigy (UK) Ltd
Agrochemical Division
Whittlesford
Cambridge
CB2 4QT

Information available and suggested uses

Post-emergence control of grasses in broad-leaved crops at 0.5 to 1.5 kg a.i./ha.

This herbicide has now been withdrawn by the manufacturers.

Formulation used 20% w/v a.i. emulsifiable concentrate + 0.1% v/v Agral 90 surfactant.

Spray volume 370 l/ha for both experiments.

RESULTS

Full results are given in the histograms on pages 25-29 and potential selectivities are summarized in the following table.

RATE (kg/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
1.6	dwarf bean field bean pea white clover carrot parsnip lettuce fenugreek sugar beet	Poa annua Elymus repens + species below
0.4	species above + wheat+safener (NA) barley±safener (NA) onion kale soyabean	species above
0.1	species above + wheat cabbage radish	Avena fatua Alopecurus myosuroides Poa trivialis Agrostis stolonifera Phalaris paradoxa Phalaris minor

Comments on results

Activity experiment

Grasses were very susceptible while broad-leaved species showed a high degree of tolerance. The post-emergence foliar spray was more active than the soil drenches on the two annual grasses, Avena fatua in fact being most susceptible to the foliar spray. Perennial ryegrass however was most susceptible to the pre-emergence surface treatments with 42% of plants being killed at 0.05 kg/ha and complete kill at higher doses. On grasses, the surface pre-emergence treatment was generally more effective than when incorporated into the soil. This difference was greatest with the smaller seeded ryegrass.

Symptoms on susceptible species

The main symptoms on grasses were a stunting of growth followed by a general necrosis of tissues. Chlorosis of new leaves was observed in several species this being interveinal with Elymus repens while older leaves often became darker green. At higher doses pre-emergence, plants often failed to emerge or died back from the one-leaf stage. Roots of Avena fatua were weakened at low doses pre-emergence. Tillers of grasses were often inhibited partially or completely.

Effects on broad-leaved species were only seen at the higher doses and consisted of a general lack of vigour, as well as stunting and necrosis. This was severe on some of the brassicas, resulting in death of some plants. Some formative effects were seen on kale, rape, soyabean and sugar beet and in the latter species appeared as inrolling of leaves from their margins.

Post-emergence selectivity

Only certain grass weeds were controlled, all broad-leaved species being resistant. Six grasses, Avena fatua, Alopecurus myosuroides, Poa trivialis, Agrostis stolonifera and both Phalaris species were controlled at the lowest dose of 0.1 kg/ha. Poa annua and Elymus repens were controlled at 0.4 kg/ha and above. Festuca rubra and in particular, Bromus sterilis, were resistant.

Most broad-leaved crops were tolerant. All leguminous crops tested and carrot, parsnip, lettuce and sugar beet tolerated the highest dose of 1.6 kg/ha. Brassica crops were not quite so tolerant however, rape showing symptoms even at the lowest dose while radish and cabbage tolerated only 0.1 kg/ha and kale 0.4 kg/ha. Onion was reduced in vigour by only 21% at 1.6 kg/ha. Surprisingly barley was tolerant to 0.4 kg/ha while wheat was reduced in vigour by only 21%. Perennial ryegrass and in particular, oat and maize were very sensitive.

Important grass weeds are apparently more susceptible than many broad-leaved crops as with the other new graminicides, such as fluazifop-butyl, fenthiaprop-ethyl, haloxyfop and sethoxydim. Similarly, Poa annua is relatively resistant necessitating mixture studies. Control of volunteer barley and wheat may not be as good with chlorazifop as with the other graminicides. Of more interest however was the tolerance of these two species to doses which killed or controlled Avena fatua and Alopecurus myosuroides, for which there is no post-emergence cereal herbicide. The resistance of Bromus sterilis was a disadvantage in these two cereals however.

ACTIVITY EXPERIMENT

CHLORAZIFOP

		0.05 kg/ha	0.25 kg/ha	1.25 kg/ha
DWARF BEAN	F	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX
	P	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXX
	I	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXX
KALE	F	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX
	P	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX
	I	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX
POLYGONUM AMPHIBIUM	F	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX
	P	XXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXX XXXXXXXXXXXXXX
	I	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXXX
PERENNIAL RYEGRASS	F	XXXXXXXXXXXXXX XXXXXXXXX	XXXXXXXXXXXXXX XXXX	XXXXXXXXXXXXXX XX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXX	XXXXXXXXXXXXXX XXX
	P	XXXXXXXX XXXXXXXXX	O O	O O
	I	XXXXXXXXXXXXXX+ XXXXXXXXXXX	XXXXXXXXXXX XXXXXXX	X XXXX
AVENA FATUA	F	XXXXXXXXXXXXXX XXXXXXXXXXX	XXXXXXXXXXXXXX XXXX	XXXXXXXXXXXXXX XX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX	XXXXXXXXXXXXXX XX
	P	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXX XXXXXXXXX	XXXXXXXXXX XX
	I	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXXXXX XXXXXXXXXX	XXXXXXXXXXXXX XXXXXX
ELYMUS REPENS	F	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXX	XXXXXXXXXXXXXX XXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXX
	P	XXXXXXXXXXXXXX+ XXXXXXXXXXXXXX	XXXXXXXXXX XXXXXXXXXX	XXXX XX
	I	XXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXXXX XXXXXXXXXX	XXXXXXXXXX XXXX

KEY: F = post-emergence, foliar application
S = post-emergence, soil drench
P = pre-emergence, surface film
I = pre-planting, incorporated

CHLORAZIFOP

Species	0.1 kg/ha		0.4 kg/ha		1.6 kg/ha	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	62	xxxxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	36	xxxxxxx
WHEAT+S	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(2)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	37	xxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
BARLEY+S	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx
(4)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
OAT	0		0		0	
(5)	0		0		0	
PER RYGR	50	xxxxxxxxxx	0		0	
(6)	36	xxxxxxx	0		0	
ONION	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(8)	93	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
FLD BEAN	107	xxxxxxxxxxxxxxxxxxxx+	107	xxxxxxxxxxxxxxxxxxxx+	107	xxxxxxxxxxxxxxxxxxxx+
(10)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
PEA	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
W CLOVER	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(12)	93	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
RAPE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	58	xxxxxxxxxxx
(14)	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx	29	xxxxxx

CHLORAZIFOP

Species	0.1 kg/ha		0.4 kg/ha		1.6 kg/ha	
KALE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(15)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
CABBAGE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(16)	93	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
CARROT	114	xxxxxxxxxxxxxxxxxxxx+	114	xxxxxxxxxxxxxxxxxxxx+	114	xxxxxxxxxxxxxxxxxxxx+
(18)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
PARSNIP	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(19)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
LETTUCE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(20)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
FENUGREK	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(21)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
SUG BEET	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(22)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
BETA VULG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(23)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
BROM STE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(24)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
FEST RUB	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(25)	86	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx
AVE FATU	30	xxxxxx	0		0	
(26)	14	xxx	0		0	
ALO MYOS	50	xxxxxxxxx	0		0	
(27)	14	xxx	0		0	

CHLORAZIFOP

Species	0.1 kg/ha		0.4 kg/ha		1.6 kg/ha	
POA ANN	94	xxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	12	xx
(28)	100	xxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	7	x
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	91	xxxxxxxxxxxxxxxxxx	91	xxxxxxxxxxxxxxxxxx	91	xxxxxxxxxxxxxxxxxx
(30)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
RAPH RAP	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(31)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
CHRY SEG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(32)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
MAT PERF	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(33)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
CHEN ALB	100	xxxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(39)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
STEL MED	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(40)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
SPER ARV	86	xxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(41)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
VER PERS	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(42)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
VI ARVE	100	xxxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(43)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx

CHLORAZIFOP

Species	0.1 kg/ha		0.4 kg/ha		1.6 kg/ha	
RUM OBTU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(44)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
EL REPEN	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx
AG STOLO	70	xxxxxxxxxxxxxx	60	xxxxxxxxxxxx	10	xx
(48)	29	xxxxxx	14	xxx	7	x
PHAL PAR	40	xxxxxxxx	10	xx	0	
(54)	29	xxxxxx	7	x	0	
MAIZE+S	33	xxxxxxx	0		0	
(56)	57	xxxxxxxxxxx	0		0	
MAIZE	0		0		0	
(57)	0		0		0	
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(65)	93	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
SOL NIG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(81)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
PHAL MIN	70	xxxxxxxxxxxxxx	0		0	
(84)	29	xxxxxx	0		0	

ACKNOWLEDGEMENTS

We are most grateful to the joint Letcombe/WRO Statistics Section for processing the experimental data; Messrs R H Webster, R M Porteous and S L Burbank for technical and practical assistance; to Mrs L Gawne and Mrs J Wallsworth for the preparation and typing of this report; to Mrs S Cox and her staff for its duplication and to the commercial firms who provided the chemicals and relevant data.

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Appendix 1. Species, abbreviations, varieties and stages of growth at spraying and assessment for post-emergence selectivity test

Species	Designation and computer serial number	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls, leaf numbers exclusive of cotyledons)
Wheat (Triticum aestivum)	WHEAT (1)	Timmo	3.5–4.5 leaves, 1 tiller	3–5 tillers
Wheat + safener	WHEAT + S (2)	Timmo	3 leaves	4 tillers
Barley (Hordeum vulgare)	BARLEY (3)	Triumph	3–5 leaves, 1 tiller	4–5 tillers
Barley + safener	BARLEY + S (4)	Triumph	2–2.5 leaves	4–5 tillers
Oat (Avena sativa)	OAT (5)	Pennal	2.5–3 leaves	4–6 tillers
Perennial ryegrass (Lolium perenne)	PER RYGR (6)	S 23	1 tiller	7–9 tillers
Onion (Allium cepa)	ONION (8)	Robusta	2–2.5 leaves	4.5 leaves
Dwarf bean (Phaseolus vulgaris)	DWF BEAN (9)	Masterpiece	2 unifoliate leaves	5 trifoliate leaves, flowering
Field bean (Vicia faba)	FLD BEAN (10)	Maris Bead	3 leaves	10–12 leaves, flowering
Pea (Pisum sativum)	PEA (11)	Dark Skinned Perfection	3.5 leaves	Up to 10 leaves
White Clover (Trifolium repens)	W CLOVER (12)	S 100	4 trifoliate leaves	Numerous trifoliate leaves
Rape (Brassica napus oleifera)	RAPE (14)	Jet Neuf	2.5–3.5 leaves	7–7.5 leaves
Kale (Brassica oleracea acephala)	KALE (15)	Marrowstem	2–2.5 leaves	3.5–4.5 leaves
Cabbage (Brassica oleracea capitata)	CABBAGE (16)	Derby Day	2–2.5 leaves	8–8.5 leaves

Species	Designation and computer serial number	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls, leaf numbers exclusive of cotyledons)
Carrot (Daucus carota)	CARROT (18)	Chantenay Red Core	3-3.5 leaves	7-8 leaves
Parsnip (Pastinaca sativa)	PARSNIP (19)	Evesham	2.5 leaves	4.5-5 leaves
Lettuce (Lactuca sativa)	LETTUCE (20)	Reskia	3.5 leaves	6-10 leaves
Fenugreek (Trigonella foenumgraecum)	FENUGREK (21)	Paul	3-4 trifoliate leaves	7.5-8.5 trifoliate leaves
Sugar beet (Beta vulgaris)	SUG BEET (22)	Nomo	4-5 leaves	10 leaves
Beta vulgaris	BETA VUL (23)	WRO 1981 ex Attleborough	3-4 leaves	14 leaves
Bromus sterilis	BROM STE (24)	WRO 1982	2-3 tillers	Up to 10 tillers
Festuca rubra	FEST RUB (25)	Boreal	3-3.5 leaves	7-20 tillers
Avena fatua	AVE FATU (26)	WRO 1980	2-3 tillers	3-4 tillers
Alopecurus myosuroides	ALO MYOS (27)	WRO 1982	1-2 tillers	Up to 14 tillers
Poa annua	POA ANN (28)	B & S Supplies,1978	2-3 tillers	8-10 tillers
Poa trivialis	POA TRIV (29)	B & S Supplies,1981	1-3 tillers	8-10 tillers
Sinapis arvensis	SIN ARV (30)	WRO 1981	5 leaves	Numerous leaves, podded
Raphanus raphanistrum	RAPH RAP (31)	Long Black Spanish	2.5-4 leaves	4.5-6 leaves
Chrysanthemum segetum	CHRY SEG (32)	WRO 1982	8 leaves	Up to 11 leaves
Matricaria perforata	MAT PERF (33)	WRO 1981	7-9 leaves	Numerous leaves, flowering
Galium aparine	GAL APAR (38)	WRO 1981	3-3.5 whorls	Numerous whorls

Species	Designation and computer serial number	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls, leaf numbers exclusive of cotyledons)
Chenopodium album	CHEN ALB (39)	WRO 1979	Up to 14 leaves	Numerous leaves, flowering
Stellaria media	STEL MED (40)	B & S Supplies,1982	Up to 18 leaves	Numerous leaves, flowering
Spergula arvensis	SPER ARV (41)	WRO, 1981	3-4 whorls	Numerous whorls, flowering
Veronica persica	VER PERS (42)	WRO, 1980	9-11 leaves	Numerous leaves, flowering
Viola arvensis	VI ARVE (43)	B & S Supplies,1982	3-7 leaves	Numerous leaves, flowering
Rumex obtusifolius	RUM OBTU (44)	WRO, 1981	3-4.5 leaves	5.5 leaves
Elymus repens	EL REPEN (47)	WRO Clone 31*	2.5-3 leaves	4-5 tillers
Agrostis stolonifera	AG STOLO (48)	B & S Supplies,1981	4-6 stolons	18-25 stolons
Cirsium arvense	CIRS ARV (50)	WRO Clone 1**	10-10.5 leaves	Numerous leaves
Phalaris paradoxa	PHAL PAR (54)	Ethiopia, 1979	Up to 2 tillers	5-7 tillers, flowering
Maize + safener (Zea mays)	MAIZE + S (56)	LG 11	4.5 leaves	6-6.5 leaves
Maize (Zea mays)	MAIZE (57)	LG 11	3.5 leaves	5.5-6.5 leaves
Soybean (Glycine max)	SOYABEAN (65)	Anoko	2 unifoliates	3.5 trifoliate leaves
Solanum nigrum	SOL NIG (81)	WRO, 1980	3.5-4 leaves	5-6 leaves, flowering
Phalaris minor	PHAL MIN (84)	WRO, 1979	2 tillers	5 tillers

* one node rhizome pieces ** root fragments

ABBREVIATIONS

ångstrom	Å	freezing point	f.p.
Abstract	Abs.	from summary	F.s.
acid equivalent*	a.e.	gallon	gal
acre	ac	gallons per hour	gal/h
active ingredient*	a.i.	gallons per acre	gal/ac
approximately equal to*	≃	gas liquid chromatography	GLC
aqueous concentrate	a.c.	gramme	g
bibliography	bibl.	hectare	ha
boiling point	b.p.	hectokilogram	hkg
bushel	bu	high volume	HV
centigrade	C	horse power	hp
centimetre*	cm	hour	h
concentrated	concd	hundredweight*	cwt
concentration	concn	hydrogen ion concentration*	pH
concentration x time product	ct	inch	in.
concentration required to kill 50% test animals	LC50	infra red	i.r.
cubic centimetre*	cm^3	kilogramme	kg
cubic foot*	ft^3	kilo ($x10^3$)	k
cubic inch*	in^3	less than	<
cubic metre*	m^3	litre	l.
cubic yard*	yd^3	low volume	LV
cultivar(s)	cv.	maximum	max.
curie*	Ci	median lethal dose	LD50
degree Celsius*	^oC	medium volume	MV
degree centigrade	^oC	melting point	m.p.
degree Fahrenheit*	^oF	metre	m
diameter	diam.	micro ($x10^{-6}$)	μ
diameter at breast height	d.b.h.	microgramme*	μg
divided by*	÷ or /	micrometre (micron)*	μm (or μ)
dry matter	d.m.	micron (micrometre)*†	μm (or μ)
emulsifiable concentrate	e.c.	miles per hour*	mile/h
equal to*	=	milli ($x10^{-3}$)	m
fluid	fl.	milliequivalent*	m.equiv.
foot	ft	milligramme	mg
		millilitre	ml

† The name micrometre is preferred to micron and μm is preferred to μ.

millimetre*	mm
millimicro* (nano: $x10^{-9}$)	n or mμ
minimum	min.
minus	-
minute	min
molar concentration*	M (small cap)
molecule, molecular	mol.
more than	>
multiplied by*	x
normal concentration*	N (small cap)
not dated	n.d.
oil miscible concentrate	o.m.c. (tables only)
organic matter	o.m.
ounce	oz
ounces per gallon	oz/gal
page	p.
pages	pp.
parts per million	ppm
parts per million by volume	ppmv
parts per million by weight	ppmw
percent(age)	%
pico (micromicro: $x10^{-12}$)	p or μμ
pint	pint
pints per acre	pints/ac
plus or minus*	±
post-emergence	post-em
pound	lb
pound per acre*	lb/ac
pounds per minute	lb/min
pound per square inch*	lb/in^2
powder for dry application	p. (tables only)
power take off	p.t.o.
precipitate (noun)	ppt.
pre-emergence	pre-em.
quart	quart
relative humidity	r.h.
revolution per minute*	rev/min
second	s
soluble concentrate	s.c.
soluble powder	s.p.
solution	soln
species (singular)	sp.
species (plural)	spp.
specific gravity	sp. gr.
square foot*	ft^2
square inch	in^2
square metre*	m^2
square root of*	$\sqrt{}$
sub-species*	ssp.
summary	s.
temperature	temp.
ton	ton
tonne	t
ultra-low volume	ULV
ultra violet	u.v.
vapour density	v.d.
vapour pressure	v.p.
varietas	var.
volt	V
volume	vol.
volume per volume	v/v
water soluble powder	w.s.p. (tables only)
watt	W
weight	wt
weight per volume*	w/v
weight per weight*	w/w
wettable powder	w.p.
yard	yd
yards per minute	yd/min

* Those marked * should normally be used in the text as well as in tables etc.

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NB: AC 252214 is imazaquin, DPX-T6376 is metsulfuron-methyl

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