WEED RESEARCH ORGANIZATION

TECHNICAL REPORT No.40

THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: RP 20810, OXADIAZON, CHLORNITROFEN, NITROFEN, FLAMPROP-ISOPROPYL

RP 20810 is confidential (Rhone Poulenc)

W G Richardson, M L Dean and C Parker

August 1976

Price - £2.75

Agricultural Research Council Weed Research Organization, Begbroke Hill, Yarnton, Oxford, OX5 1PF

ISBN 0 7084 0041 8

CONTENTS

NOTE

RICHARDSON, W.G., DEAN, M.L. and PARKER, C. The activity and pre-emergence selectivity of some recently developed herbicides: RP 20810, oxadiazon, chlornitrofen, nitrofen and flamprop-isopropyl. Technical Report Agricultural Research Council Weed Research Organization, 1976, 40, pp 52.

THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: RP 20810, OXADIAZON, CHLORNITROFEN, NITROFEN AND FLAMPROP-ISOPROPYL

W.G. Richardson*, M.L. Dean** and C. Parker**

Agricultural Research Council Weed Research Organization
Begbroke Hill, Yarnton, Oxford OX5 1PF

SUMMARY

The pre-emergence selectivity of five herbicides was examined on a range of 35 temperate and 21 tropical crop and weed species. Herbicides were applied to the soil surface and persistence in the soil was monitored. The foliar and soil activity of two herbicides was also investigated on six selected species.

The weed control and crop tolerance of oxadiazon and RP 20810, two closely related compounds, was very similar. Oxadiazon was marginally superior against annual grasses, except R. exaltata, while RP 20810 achieved slightly better broad-leaved weed control and was notably more active against Stellaria media. Convolvulus arvensis was susceptible to both herbicides, particularly oxadiazon. Potential selectivities were noted with both herbicides mainly in broad-leaved crops such as brassicas, carrot and large seeded legumes. Groundnut and soyabean tolerance of RP 20810 was outstanding. Potential selective annual grass weed control was found in rice using oxadiazon. Soil persistence of RP 20810 is much shorter than that of oxadiazon.

The pattern of weed control and crop tolerance with nitrofen and chlornitrofen was similar to that with oxadiazon and RP 20810. Good potential selective control of mainly annual grasses, certain broad-leaved weeds and C. arvensis was noted. S. media was resistant to both herbicides. Good tolerance of a range of crops was noted including large seeded legumes, brassicas, carrots and certain tropical cereals. Nitrofen was somewhat more active against both crops and weeds than chlornitrofen. The latter showed good potential selective control of certain tropical annual grasses in rice. Both compounds showed a prolonged persistence in the soil.

Flamprop-isopropyl was found to have some potential for pre-emergence control of annual grass weeds, including A. fatua in cereals, especially barley, and certain other crops. Control of broad-leaved and perennial weeds was negligible, A. retroflexus being the only susceptible species. A long period of soil persistence was found.

INTRODUCTION

The pre-emergence selectivities of new herbicides are investigated on a large number of pot-grown crop and weed species at WRO. The

---

* Herbicide Group
** ODM Tropical Weeds Group

objectives are to discover selectivities, crop and weed susceptibilities and to obtain experience of the type of effects produced by each compound. Soil persistence is also monitored and these data, in conjunction with crop susceptibilities, are useful in considering subsequent cropping of treated land. Attention is drawn to the limitations of these investigations; i.e. use of only one crop variety or source of weed species and growth in one particular soil type at only one depth of sowing without intraspecific competition. Consequently the results should only be used as a guide for further work, as plant responses in pot experiments can be very different to those in the field.

The present report gives pre-emergence selectivity data on five herbicides. Nitrofen and oxadiazon were included as standards for comparison to related compounds. Results of activity experiments are included for RP 20810 and flamprop-isopropyl to provide information on levels of phytotoxicity, type and route of action. These data for chlornitrofen and oxadiazon have already been published (Richardson and Dean, 1973b, 1974).

METHODS AND MATERIALS

The activity experiment was carried out on six selected species as described previously (Richardson and Dean, 1973a). Four annual species were raised from seeds and two perennials from rhizome fragments. Herbicides were applied by four different methods: (i) post-emergence 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 to the soil surface, (iv) pre-emergence with thorough incorporation before planting. Species data are summarised in Table 1 and soil and environmental conditions in Table 2.

Table 1. Plant data for activity experiments

Species	Cultivar /source	No. per pot at spraying		Depth of planting (cm)	Post-emergence stage of growth at spraying	Stage of growth at assessment	
		pre-	post-			pre-	post-
Dwarf bean (*Phaseolus vulgaris*)	The Prince	2-3	2	1.8	2 unifoliate leaves	1½ trifoliate leaves	1½-2½ trifoliate leaves
Kale (*Brassica oleracea acephala*)	Marrow-stem	10-15	6-8	0.6	1½ leaves	2½-3½ leaves	3½-4½ leaves
Polygonum amphibium	WRO Clone 1	6	4	1.2	5½ leaves	7-8 leaves	7½-9 leaves
Perennial ryegrass (*Lolium perenne*)	S 23	15-20	10	0.6	1½-2½ leaves	3-6 leaves, tillering	5 leaves, tillering

(Table continued overleaf)

Species	Cultivar /source	No. per pot at spraying		Depth of planting (cm)	Post-emergence stage of growth at spraying	Stage of growth at assessment	
		pre-	post-			pre-	post-
Avena fatua	Hensington 1969	10	5	1.2	2-2½ leaves	3-5 leaves, tillering	7 leaves, tillering
Agropyron repens	WRO Clone 31	6	3-4	1.2	2-3½ leaves	3-5 leaves, tillering	4½-7 leaves, tillering

Table 2. Soil and environment conditions

Experiment number, type and herbicide(s) included	AE 1 Flamprop-isopropyl	AE 2 RP 20810	Pre-emergence selectivity test RP 20810 Oxadiazon Chlornitrofen / Nitrofen Flamprop-isopropyl	
Date of spraying	21.6.73	6.12.73	30.1.74	
Main assessment completed	20.7.73	24.1.74	5.3.74	
Soil moisture at spraying (%)	13.5	12.0	13.5	
Organic matter (%)	2.8	2.8	2.8	
Clay content (%)	16.0	16.0	16.0	
pH	7.7	7.7	7.7	
John Innes Base fertiliser (g/kg)	4.0	5.0	2.5	
DDT (5% dust) (g/kg)	0.5	0.5	0.5	
Fritted trace elements (g/kg)	0.25	0.25	-	
Epsom salts (g/kg)	-	1.0	1.0	
Temperature (°C)			Temperate	Tropical
Mean	18	19	18	22
Maximum	27	29	30	30
Minimum	8	9	5	9
Relative humidity (%)				
Mean	60	60	60	60
Maximum	90	88	87	86
Minimum	25	30	30	34

Techniques for the selectivity experiment differed from the usual practice in that all herbicides were applied to the soil surface following planting, instead of being mixed into the soil before planting. Otherwise procedure was as previously described (Richardson and Dean 1973a). Species were sown as detailed in Appendix I, each being replicated twice for every treatment. Herbicides were applied to the soil surface using a laboratory sprayer operating at a pressure of 2.11 bars (30 lb/in^2) and moving at constant speed, 30 cm above the soil. Subsequent watering was from overhead. Soil and environmental conditions are summarised in Table 2. During the experiment, normal daylight was supplemented with a 14 hour photoperiod using warm white fluorescent tubes.

Radish (Raphanus raphanistrum) was included for ease of propagation and may be regarded as a crop or weed. To improve establishment Chenopodium album seeds were kept in 0.1 M potassium nitrate for 24 hours in the light; seeds of Polygonum aviculare were stored moist at 2^{o}C for six weeks; tubers of Cyperus esculentus were stored moist at 4^{o}C for 23 days to break dormancy and freshly harvested bulbils of Oxalis latifolia were stored at 20^{o}C for 4 weeks followed by heating at 45^{o}C for 4 hours.

Results were processed as before (Richardson and Dean, 1973a). Survivors were counted and scored on a 0-7 scale as previously where 0 = dead and 7 = control. It was not possible to computerise the data for Chenopodium album because of damage following application of Cheshunt compound but observations were made and are referred to in the text. O. latifolia, S. nigrum and cowpea failed to germinate. Emergence and development of sorghum were erratic but observations of herbicidal effects were made and are referred to in the text. Dwarf bean was raised under tropical conditions to improve growth.

Pairs of histograms are presented for each treatment, the upper representing mean plant survival and the lower, mean vigour score, both calculated as percentages of untreated controls. Each 'x' represents a 5% increment, but in the activity experiment histograms, each 'x' represents a 7% increment. A '+' indicates a value in excess of 100%; R indicates a result based on a replicate only and 'M' represents a missing treatment.

A table of observed selectivities, using the criteria specified, are presented for each compound along with comments to highlight salient points.

Soil persistence was monitored, in conjunction with the pre-emergence selectivity experiment. The technique differed from that previously described due to surface application of the compounds. Treated soil was kept in tins in the glasshouse and susceptible species were periodically sown shallowly, disturbing the soil as little as possible.

RP 20810

Code number RP 20810 **Trade name** -

Chemical name Confidential

Source

Rhône Poulenc
Division Phytosanitaire
25 quai Paul Doumer
92408 Courbevoie
France

via May and Baker Ltd
Ongar Research Station
Fyfield Road
Ongar
Essex

Information available and suggested uses

Uses suggested by the manufacturer in 1973 are: pre-emergence control of broad-leaved and certain grass weeds in cotton, groundnut, rice, soybean, sunflower, leeks, onions, potatoes and peas at 0.375-0.75 kg/ha; pre- and post-emergence directed sprays in orchards and plantation crops at 0.5-2.0 kg/ha; post-emergence potato haulm destruction at 0.75-1.0 kg/ha and post-emergence control of certain broad-leaved perennial weeds in non-crop situations at 0.5-8.0 kg/ha.

Formulation used 30% w/v a.i. emulsifiable concentrate (VT 2975)

Spray volume for both experiments 413 l/ha (36.8 gal/ac)

RESULTS

Full histogram results are given on pages 9-14 and potential selectivities are summarised in the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
2.0	groundnut soyabean	Avena fatua Alopecurus myosuroides Poa annua Sinapis arvensis Galium aparine Stellaria media + species below
0.5	species above + dwarf bean field bean pea kale swede carrot radish cotton	Tripleurospermum maritimum Oryza punctata + species below

(Table continued overleaf)

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.125	species above + wheat chickpea	Poa trivialis Senecio vulgaris Polygonum lapathifolium Polygonum aviculare Rumex obtusifolius Convolvulus arvensis Eleusine indica Echinochloa crus-galli Rottboellia exaltata Digitaria sanguinalis Amaranthus retroflexus

Comments on results

Activity experiment (see page 9)

The activity experiment showed RP 20810 to be highly active both on the foliage and through the soil. The foliar spray caused moderate to severe effects on all species. Post-emergence soil drenches were less effective than the foliar spray on the broad-leaved species but little or no difference was observed in phytotoxicity on grasses between the two methods of application. Pre-emergence treatments generally caused greater damage than post-emergence applications. The surface spray generally resulted in more activity than incorporation, particularly on the smaller seeded species. The type and level of activity is very similar to that of oxadiazon reported previously (Richardson and Dean, 1974a).

Symptoms

The foliar spray caused severe scorch and necrosis of treated leaves. At lower doses new foliage sometimes recovered while at higher rates necrosis or chlorosis preceded death. A characteristic feature of broad-leaved species treated post-emergence was a severe stem collapse and necrosis. Both pre-emergence surface and incorporated treatments caused necrosis of initial foliage of the grasses. At higher rates development was severely reduced and death followed while at lower doses leaf trapping, pale foliage and necrosis were observed. Broad-leaved species were severely stunted, the apical bud often failing to develop normally.

Soil persistence

Poa trivialis was used as the test species to detect residues in the soil. However, disappearance was relatively rapid. Even though doses of 0.125 and 0.5 kg/ha killed plants initially, nine weeks later, plants grew normally in the treated soil. At 2.0 kg/ha plants were killed after nine weeks but were as healthy as controls after eighteen weeks. Thus persistence is much less than that found with oxadiazon.

Selectivity among temperate species

Most annual grass weeds showed some effects at lower doses but 2.0 kg/ha was necessary for control. Poa trivialis was highly sensitive however. All polygonaceous weeds were easily controlled by 0.125 kg/ha. The annual Compositae were also sensitive. In contrast to oxadiazon, RP 20810 showed some activity on Stellaria media, providing complete control at 2.0 kg/ha and more than 50% plant kill at the lower doses. Cruciferous weeds were slightly more resistant to RP 20810 while the response of most perennial species was generally similar to oxadiazon. The composites, Tussilago farfara and Cirsium arvense, were highly resistant. Agropyron repens and Allium vineale recovered from initially severe effects although there was some kill of the latter species at the highest dose. Convolvulus arvensis suffered considerable kill of emergent foliage even at 0.5 kg/ha but survivors made excellent recovery, contrasting with the complete kill obtained with oxadiazon at the same dose.

Good crop tolerance was found in the large seeded legume crops (field bean and pea), showing greater tolerance than to oxadiazon. Carrot was tolerant at 0.5 kg/ha, whereas oxadiazon caused some damage at this dose. The brassicae, (kale, swede and radish) were also tolerant to 0.5 kg/ha, again this resistance being slightly greater than with oxadiazon.

Some variation in response to RP 20810 is apparent with five of the species tested in the activity experiment and in the selectivity test, most notably with kale and dwarf bean. These two species were very susceptible in the activity experiment. This variation could possibly be explained for dwarf bean because it was raised at a higher temperature in the selectivity test when emergence through the treated layer would be much quicker than under the cooler, slower germinating conditions of the activity experiment. However no such explanation could be given for kale. These variations suggest that RO 20810 activity may be influenced by environmental conditions. Its rapid breakdown in the soil may also be reflected in variable plant response. However in the selectivity test RP 20810 has some interesting features, especially when compared to oxadiazon. Although not quite as effective as oxadiazon on annual greas weeds with the exception of Poa trivialis, it was slightly more efficient in controlling polygonaceous and annual composite weeds and much better on Stellaria media. Crop tolerance, too, was marginally better with RP 20810 in carrot, large seeded legume and brassica crops.

Selectivity among tropical species

With the exception of Oryza punctata all the annual weeds were controlled at 0.125 kg/ha. Particularly noteworthy was the kill of Rottboellia exaltata following emergence at this dose. The apparently anomalous result at 0.5 kg/ha was due to the emergence and survival of a single plant. Amaranthus retroflexus was also particularly susceptible and no emergence was recorded at any dose. The perennials Cyperus rotundus and Cyperus esculentus were relatively resistant and eventually recovered from 2.0 kg/ha.

Groundnut and soyabean were outstandingly tolerant of RP 20810 although minor reductions in vigour and necrosis of older foliage were observed at all doses. Cotton showed some tolerance at the higher rates; cotyledons were affected but new foliage developed normally. Maize

showed some marginal resistance at 0.5 kg/ha and was recovering well from initial symptoms. Surprisingly, effects appeared more severe at 0.125 kg/ha although plants were recovering.

In groundnut and soyabean the possibility of control of a number of broad-leaved species (indicated by kill of jute, kenaf etc.), in addition to the annual grasses, could be of particular interest. In this respect it looks a little superior to oxadiazon.

ACTIVITY EXPERIMENT

RP 20810

		0.1 kg/ha	0.6 kg/ha	3.6 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxxx xxx	xxxxxxxxxxxxxxx xx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxx xxxx	o o
	I	xxxxxxxxxxxx xxxxxxxxxxxxxx	o o	o o
KALE	F	xxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx xx	xxxxxxxxxxxxxx xx
	S	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxx xxxxxxxxx	xxxxxx xxxxx	o o
	I	xxxxxxxxxxxxxx + xxxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxx	xxxxxxx xxxxx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxx xxxx	xxxxxxxxxxxxxx xx	xxxxxxxxxxxx xx
	S	xxxxxxxxxxx xxxxxxxx	xxxx xxxx	o o
	P	xxxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxx xxxxxxxx	xxxxx xxxxxx
	I	xxxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	o o
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xx
	S	xxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xx
	P	xx xxxxx	o o	o o
	I	xxxxxxxxxxxx xxxxxxxxxx	xxxxx xxx	xxxxx x
AVENA FATUA	F	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxxxxx xxx
	S	xxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxx xxxxx	o o
	P	xxxxxxxxx xxxxxx	o o	o o
	I	xxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxx	o o
AGROPYRON REPENS	F	xxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxx xxxxx
	S	xxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xxxx
	I	xxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxxxxxx + xxxxxxxx	xxxxxxxxxxxxx + xxxx

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

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	RP 20810 0.125 KG/HA		RP 20810 0.50 KG/HA		RP 20810 2.0 KG/HA	
WHEAT	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	53	xxxxxxxxxxx
(1)	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx
BARLEY	102	xxxxxxxxxxxxxxxxxxx +	75	xxxxxxxxxxxxxxx	20	xxxx
(2)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	21	xxxx
OAT	104	xxxxxxxxxxxxxxxxxxx +	85	xxxxxxxxxxxxxxxxx	46	xxxxxxxxx
(3)	64	xxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
PER RYGR	63	xxxxxxxxxxxxx	44	xxxxxxxxx	0	
(4)	57	xxxxxxxxxxx	57	xxxxxxxxxxx	0	
ONION	45	xxxxxxxxx	5	x	0	
(8)	36	xxxxxxx	21	xxxx	0	
DWF BEAN	83	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
FLD BEAN	111	xxxxxxxxxxxxxxxxxxx +	111	xxxxxxxxxxxxxxxxxxx +	63	xxxxxxxxxxxx
(10)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
PEA	100	xxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx	80	xxxxxxxxxxxxxx
(11)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
W CLOVER	42	xxxxxxxx	32	xxxxxx	0	
(12)	64	xxxxxxxxxxxxx	57	xxxxxxxxxx	0	
RAPE	47	xxxxxxxxx	63	xxxxxxxxxxxxx	22	xxxx
(14)	79	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
KALE	78	xxxxxxxxxxxxxxxx	81	xxxxxxxxxxxxxxxx	30	xxxxxx
(15)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	36	xxxxxxx
SWEDE	85	xxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx	11	xx
(17)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	21	xxxx

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	RP 20810 0.125 KG/HA		RP 20810 0.50 KG/HA		RP 20810 2.0 KG/HA	
CARROT	102	xxxxxxxxxxxxxxxxxxxx +	102	xxxxxxxxxxxxxxxxxxxx +	17	xxx
(18)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	43	xxxxxxxxx
LETTUCE	57	xxxxxxxxxxx	39	xxxxxxxx	4	x
(20)	64	xxxxxxxxxxxxx	50	xxxxxxxxxx	21	xxxx
SUG BEET	10	xx	40	xxxxxxxx	10	xx
(21)	36	xxxxxxx	64	xxxxxxxxxxxxx	21	xxxx
AVE FATU	98	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	6	x
(26)	64	xxxxxxxxxxxxx	64	xxxxxxxxxxxxx	14	xxx
ALO MYOS	57	xxxxxxxxxxx	51	xxxxxxxxxx	0	
(27)	43	xxxxxxxxx	43	xxxxxxxxx	0	
POA ANN	77	xxxxxxxxxxxxxxx	41	xxxxxxxx	3	x
(28)	57	xxxxxxxxxxx	50	xxxxxxxxxx	21	xxxx
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	28	xxxxxx	39	xxxxxxxx	7	x
(30)	64	xxxxxxxxxxxxx	64	xxxxxxxxxxxxx	21	xxxx
RAPH RAP	111	xxxxxxxxxxxxxxxxxxxx +	105	xxxxxxxxxxxxxxxxxxxx +	53	xxxxxxxxxxx
(31)	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
TRIP MAR	33	xxxxxxx	16	xxx	0	
(33)	50	xxxxxxxxxx	29	xxxxxx	0	
SEN VULG	10	xx	0		0	
(34)	29	xxxxxx	0		0	
POL LAPA	15	xxx	0		0	
(35)	21	xxxx	0		0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES		RP 20810 0.125 KG/HA		RP 20810 0.50 KG/HA		RP 20810 2.0 KG/HA
POL AVIC	3	x	0		0	
(36)	14	xxx	0		0	
GAL APAR	52	xxxxxxxxxx	55	xxxxxxxxxxx	0	
(38)	57	xxxxxxxxxxx	57	xxxxxxxxxx	0	
STEL MED	46	xxxxxxxxx	46	xxxxxxxxx	2	xxxxxxxxxxxx
(40)	64	xxxxxxxxxxxx	71	xxxxxxxxxxxxx	21	xxxx
RUM OBTU	7	x	0		0	
(44)	21	xxxx	0		0	
AG REPEN	97	xxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
ALL VIN	100	xxxxxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxx	42	xxxxxxxx
(49)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxx	50	xxxxxxxxx
CIRS ARV	83	xxxxxxxxxxxxxxx	133	xxxxxxxxxxxxxxxxxxx +	83	xxxxxxxxxxxxxxxx
(50)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
TUS FARF	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
CONV ARV	27	xxxxx	27	xxxxx	7	x
(52)	57	xxxxxxxxxx	79	xxxxxxxxxxxxxxx	14	xxx
MAIZE	71	xxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
(58)	71	xxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
RICE	88	xxxxxxxxxxxxxxxxx	110	xxxxxxxxxxxxxxxxxxx +	80	xxxxxxxxxxxxxxx
(60)	71	xxxxxxxxxxxxx	36	xxxxxxx	36	xxxxxxx
CHICKPEA	129	xxxxxxxxxxxxxxxxxxx +	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
(63)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	50	xxxxxxxxxx

SPECIES		RP 20810 0.125 KG/HA		RP 20810 0.50 KG/HA		RP 20810 2.0 KG/HA
GRNDNUT	120	xxxxxxxxxxxxxxxxxxx +R	90	xxxxxxxxxxxxxxxxx	60	xxxxxxxxxxx
(64)	86	xxxxxxxxxxxxxxxx R	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
SOYABEAN	131	xxxxxxxxxxxxxxxxxxx +	131	xxxxxxxxxxxxxxxxxxx +	94	xxxxxxxxxxxxxxxxxx
(65)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
COTTON	92	xxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx R	92	xxxxxxxxxxxxxxxxx
(66)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx R	71	xxxxxxxxxxxxx
JUTE	12	xx	0		0	
(67)	36	xxxxxxx	0		0	
KENAF	20	xxxx	41	xxxxxxxx	0	
(68)	29	xxxxxx	43	xxxxxxxxx	0	
SESAMUM	9	xx	19	xxxx	0	
(70)	36	xxxxxxx	29	xxxxxx	0	
TOMATO	22	xxxx	0		0	
(71)	14	xxx	0		0	
OR PUNCT	62	xxxxxxxxxxxx	81	xxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(73)	50	xxxxxxxxxx	29	xxxxxx	29	xxxxxx
ELEU IND	7	x	0		0	
(74)	43	xxxxxxxxx	0		0	
ECH CRUS	30	xxxxxx	4	x	0	
(75)	50	xxxxxxxxxx	7	x	0	
ROTT EXA	0		16	xxx	0	
(76)	0		29	xxxxxx	0	
DIG SANG	17	xxx	0		0	
(77)	43	xxxxxxxxx	0		0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

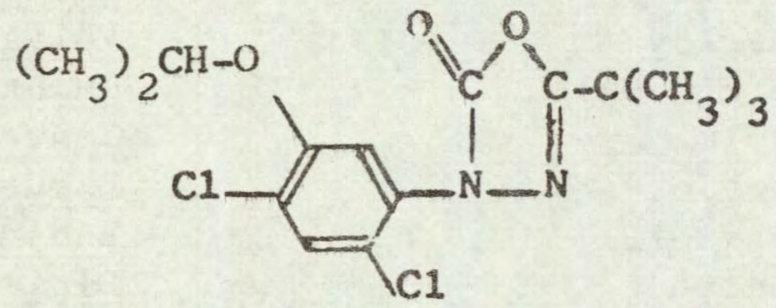
SPECIES		RP 20810 0.125 KG/HA		RP 20810 0.50 KG/HA		RP 20810 2.0 KG/HA
AMAR RET	0		0		0	
(78)	0		0		0	
CYP ESCU	75	xxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxxx	112	xxxxxxxxxxxxxxxxxxx +
(85)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	57	xxxxxxxxxx
CYP ROTU	82	xxxxxxxxxxxxxxxx	120	xxxxxxxxxxxxxxxxxxx +	127	xxxxxxxxxxxxxxxxxxx +
(86)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx

OXADIAZON

Code number RP 17623, Vt 2569 **Trade name** Ronstar

Chemical name 3-(2,4-dichloro-5-isopropoxyphenyl)-5-t-butyl-1,3,4-oxadiazolin-2-one

Structure



Source

Rhône Poulenc
Division Phytosanitaire
25 quai Paul Doumer
92408 Courbevoie
France

via May and Baker Ltd
Ongar Research Station
Fyfield Road
Ongar
Essex

Information available and suggested uses

Introduced in 1969 for selective control of annual grass and broad-leaved weeds in potatoes, groundnut, cotton and soyabean at 0.56-1.68 kg/ha, applied pre-crop emergence. Good activity was also reported on Convolvulus arvensis and Calystegia sepium with pre-emergence applications of 2.0 kg/ha. Burgaud et al (1969) reveal two main uses of oxadiazon under temperate conditions: a) selective weed control in certain ornamental and garden crops, b) selective weed control in woody species. The herbicide persists in the soil and shows a useful 'knock-down' post-emergence effect. It is also suggested for total weed control.

Formulation used 25% w/v a.i. emulsifiable concentrate

Spray volume for activity experiment 338 l/ha (30.1 gal/ac)
for selectivity experiment 413 l/ha (36.8 gal/ac)

RESULTS

Full histogram results are given on pages 18-22 and potential selectivities are summarised in the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
2.0	None	None listed as no crop tolerant
0.5	dwarf bean pea soyabean	Avena fatua Alopecurus myosuroides Sinapis arvensis Tripleurospermum maritimum Senecio vulgaris Polygonum lapathifolium Galium aparine Oryza punctata Rottboellia exaltata + species below

(Table continued overleaf)

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.125	species above + wheat barley field bean kale swede carrot lettuce sugar beet radish maize rice chickpea groundnut	Poa annua Poa trivialis Polygonum aviculare Rumex obtusifolius Convolvulus arvensis Eleusine indica Echinochloa crus-galli Digitaria sanguinalis Amaranthus retroflexus

Comments on results

Activity experiment

Oxadiazon was included in this test primarily as a standard for comparison with the closely related RP 20810. Activity experiment results were reported in full by Richardson and Dean (1974). These lent support to the manufacturer's claim that uptake is mostly through the emerging shoot, as greater activity followed pre-emergence surface application than incorporation. The foliar spray was also very active but post-emergence soil drenches had little effect.

Symptoms

These were reported in full by Richardson and Dean (1974). Seedlings often failed to emerge after treatment at the high dose pre-emergence, or they failed to produce leaves. At low doses, leaves which were produced were often trapped and consequently deformed.

Soil persistence

Using white clover as the sensitive test species to detect residues in the soil, a considerable period of soil persistence was found. A dose of 0.125 kg/ha was undetectable 34 weeks after application but at 45 weeks, 0.5 and 2.0 kg/ha were still causing fresh weight reductions of 60 and 93% respectively.

Selectivity among temperate species

Annual grass weeds were very susceptible especially the Poa species. An interesting feature of the annual broad-leaved weed control spectrum was the susceptibility of certain problem weeds. P. aviculare was controlled at 0.125 kg/ha and Galium aparine and composite weeds at 0.5 kg/ha. This contrasts with the high resistance of S. media, which is usually easily controlled by most broad-leaved weed herbicides. Convolvulus arvensis was very sensitive but Cirsium arvense and Tussilago farfara were resistant. Agropyron repens recovered from 2.0 kg/ha although this

dose had initially reduced vigour by 50%. There was an 80% kill of Allium vineale, but the remaining plants recovered.

Dwarf bean was the most tolerant crop with only a 21% vigour reduction by the highest dose. [This contrasts with post-emergence results when this species and indeed all other crops were quite sensitive (Richardson and Dean, 1974)]. The earlier activity experiment also showed a greater sensitivity of dwarf bean and kale in pre-emergence surface sprays than was found in the current test, as was the case with RP 20810. However it is known that environmental factors, especially light, play an important role in determining the toxicity of oxadiazon (Kawamura, 1975). Also dwarf bean was raised at a higher temperature in the selectivity experiment.

Pea was tolerant to 0.5 kg/ha and field bean was only reduced in vigour by 21%. Nine other species were tolerant to 0.125 kg/ha. White clover was very sensitive, being completely killed at 0.125 kg/ha.

In this experiment oxadiazon verified its potential for control of annual grass and certain broad-leaved weeds in some crops. However the resistance of Stellaria media is a serious defect and its compatibility with other herbicides will have to be considered. It is interesting too, that its type of activity, symptoms and species responses are very comparable to dinitrophenyl ether herbicides. In contrast however, and perhaps the most interesting feature, is its activity against Convolvulus arvensis.

Selectivity among tropical species

With the exception of Oryza punctata and Rottboellia exaltata, all the annual weeds were controlled at 0.125 kg/ha. Eleusine indica and Amaranthus retroflexus were particularly sensitive. O. punctata and R. exaltata were susceptible at 0.5 kg/ha, the latter being completely killed. Both of these species were severely reduced at 0.125 kg/ha however. The perennials Cyperus rotundus and Cyperus esculentus were relatively resistant. The latter was still severely affected nine weeks after treatment at 2.0 kg/ha but had recovered from lower doses. C. rotundus eventually recovered from all doses.

Soyabean was the only crop tolerant at 0.5 kg/ha and although plant number was lower by 25% this was due to erratic germination and not herbicide activity.

The tolerance of rice and groundnut reported by the manufacturer was confirmed to a limited extent. The possible use of oxadiazon in chickpea would be worth further testing but this compound does not offer any distinct advantage in maize. Cotton, surprisingly, does not appear in the table of potential selectivities, due to the variation in results and only marginal tolerance. However in a previous experiment this crop was tolerant to 3.8 kg/ha incorporated. The manufacturer has reported tolerance at rates up to 1.5 kg/ha in certain areas but phytotoxicity is reported under cold conditions where the crop is slow growing.

SPECIES		OXADIAZON 0.125 KG/HA		OXADIAZON 0.50 KG/HA		OXADIAZON 2.0 KG/HA
WHEAT	107	xxxxxxxxxxxxxxxxxxxx +	107	xxxxxxxxxxxxxxxxxxxx +	40	xxxxxxxx
(1)	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
BARLEY	109	xxxxxxxxxxxxxxxxxxxx +	75	xxxxxxxxxxxxxxx	20	xxxx
(2)	86	xxxxxxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
OAT	104	xxxxxxxxxxxxxxxxxxxx +	85	xxxxxxxxxxxxxxxxx	13	xxx
(3)	57	xxxxxxxxxxx	43	xxxxxxxxx	7	x
PER RYGR	37	xxxxxxx	0		0	
(4)	57	xxxxxxxxxxx	0		0	
ONION	35	xxxxxxx	5	x	0	
(8)	29	xxxxxx	7	x	0	
DWF BEAN	83	xxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
FLD BEAN	95	xxxxxxxxxxxxxxxxxx	126	xxxxxxxxxxxxxxxxxxxx +	95	xxxxxxxxxxxxxxxxxx
(10)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
PEA	80	xxxxxxxxxxxxxxxx	140	xxxxxxxxxxxxxxxxxxx +	20	xxxx
(11)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	36	xxxxxxx
W CLOVER	0		0		0	
(12)	0		0		0	
RAPE	76	xxxxxxxxxxxxxxx	38	xxxxxxxx	0	
(14)	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
KALE	92	xxxxxxxxxxxxxxxxxx	76	xxxxxxxxxxxxxxx	41	xxxxxxxx
(15)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx
SWEDE	96	xxxxxxxxxxxxxxxxxxx	52	xxxxxxxxxx	0	
(17)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES		OXADIAZON 0.125 KG/HA		OXADIAZON 0.50 KG/HA		OXADIAZON 2.0 KG/HA
CARROT	119	xxxxxxxxxxxxxxxxxxx +	79	xxxxxxxxxxxxxxx	40	xxxxxxxx
(18)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	50	xxxxxxxxxx
LETTUCE	100	xxxxxxxxxxxxxxxxxxx	35	xxxxxxx	4	x
(20)	86	xxxxxxxxxxxxxxxx	36	xxxxxxx	14	xxx
SUG BEET	73	xxxxxxxxxxxxxxx	30	xxxxxx	7	x
(21)	86	xxxxxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
AVE FATU	87	xxxxxxxxxxxxxxxx	0		0	
(26)	57	xxxxxxxxxx	0		0	
ALO MYOS	45	xxxxxxxxx	0		0	
(27)	43	xxxxxxxxx	0		0	
POA ANN	3	x	0		0	
(28)	7	x	0		0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	67	xxxxxxxxxxxx	16	xxx	2	
(30)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
RAPH RAP	100	xxxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx	21	xxxx
(31)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	29	xxxxxx
TRIP MAR	49	xxxxxxxxxx	0		0	
(33)	43	xxxxxxxxx	0		0	
SEN VULG	41	xxxxxxxx	0		0	
(34)	50	xxxxxxxxxx	0		0	
POL LAPA	44	xxxxxxxxx	0		0	
(35)	50	xxxxxxxxxx	0		0	

SPECIES	OXADIAZON 0.125 KG/HA		OXADIAZON 0.50 KG/HA		OXADIAZON 2.0 KG/HA	
POL AVIC	21	xxxx	8	xx	0	
(36)	43	xxxxxxxxx	29	xxxxxx	0	
GAL APAR	87	xxxxxxxxxxxxxxxx	29	xxxxxx	0	
(38)	100	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
STEL MED	96	xxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx
(40)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
RUM OBTU	0		0		0	
(44)	0		0		0	
AG REPEN	106	xxxxxxxxxxxxxxxxxxx +	88	xxxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
ALL VIN	68	xxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxx	21	xxxx
(49)	71	xxxxxxxxxxxxx	71	xxxxxxxxxxxxx	43	xxxxxxxx
CIRS ARV	50	xxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	117	xxxxxxxxxxxxxxxxxxx +
(50)	79	xxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
TUS FARF	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxx
CONV ARV	20	xxxx	0		0	
(52)	36	xxxxxxx	0		0	
MAIZE	97	xxxxxxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxx +	79	xxxxxxxxxxxxxxx
(58)	86	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	36	xxxxxxx
RICE	102	xxxxxxxxxxxxxxxxxxx +	88	xxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxx
(60)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	36	xxxxxxx
CHICKPEA	114	xxxxxxxxxxxxxxxxxxx +	100	xxxxxxxxxxxxxxxxxx	43	xxxxxxxxx
(63)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	43	xxxxxxxxx

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES		OXADIAZON 0.125 KG/HA		OXADIAZON 0.50 KG/HA		OXADIAZON 2.0 KG/HA
GRNDNUT	90	xxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxxx	120	xxxxxxxxxxxxxxxxxxx +
(64)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
SOYABEAN	94	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(65)	86	xxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx
COTTON	35	xxxxxxx	58	xxxxxxxxxxx	69	xxxxxxxxxxxxxx
(66)	71	xxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
JUTE	0		0		0	
(67)	0		0		0	
KENAF	89	xxxxxxxxxxxxxxxxx	27	xxxxx	0	
(68)	71	xxxxxxxxxxxxx	57	xxxxxxxxxx	0	
SESAMUM	9	xx	0		0	
(70)	36	xxxxxxx	0		0	
TOMATO	56	xxxxxxxxxx	6	x	0	
(71)	57	xxxxxxxxxx	14	xxx	0	
OR PUNCT	100	xxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx	69	xxxxxxxxxxxxx
(73)	36	xxxxxxx	21	xxxx	14	xxx
ELEU IND	0		0		0	
(74)	0		0		0	
ECH CRUS	19	xxxx	0		0	
(75)	29	xxxxxx	0		0	
ROTT EXA	79	xxxxxxxxxxxxxxxx	0		0	
(76)	50	xxxxxxxxxx	0		0	
DIG SANG	17	xxx	0		0	
(77)	14	xxx	0		0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

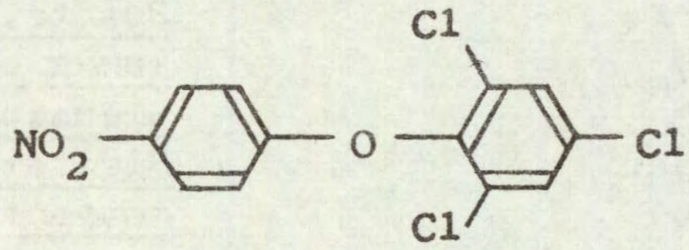
SPECIES	OXADIAZON 0.125 KG/HA		OXADIAZON 0.50 KG/HA		OXADIAZON 2.0 KG/HA	
AMAR RET	0		0		0	
(78)	0		0		0	
CYP ESCU	94	xxxxxxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx
(85)	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx
CYP ROTU	105	xxxxxxxxxxxxxxxxxxxx +	112	xxxxxxxxxxxxxxxxxxxx +	105	xxxxxxxxxxxxxxxxxxxx +
(86)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx

CHLORNITROFEN

Code number MO 338, CNP **Trade name** MO

Chemical name 4-nitrophenyl-2,4,6-trichlorophenyl ether

Structure



Source Mitsui Toatsu Chemicals Inc
2-5 Kasumigaseki 3-Chome
Chiyada-ku
Tokyo
Japan

Information available and suggested uses

Manufacturer's literature received in 1972 details use at 2.0 to 3.0 kg/ha as a pre-emergence treatment in upland and paddy rice for the control of the majority of grass and broad-leaved weed species. Use following seeding of burdock and carrot at 2.5 to 3.0 kg/ha or Japanese radish at 2.0 to 2.5 kg/ha is also suggested. Cabbage and Chinese cabbage can be treated at 2.5 to 3.0 kg/ha immediately following transplanting.

Formulation used 19.3% w/v a.i. emulsifiable concentrate

Spray volume for selectivity experiment 413 l/ha (36.8 gal/ac)

RESULTS

Full histogram results are given on pages 26-30 and potential selectivities are summarised in the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
6.00	dwarf bean field bean rape kale swede carrot radish chickpea cotton	Avena fatua Polygonum lapathifolium + species below
2.00	species above + lettuce sugar beet maize rice soyabean kenaf	Alopecurus myosuroides Polygonum aviculare Convolvulus arvensis Oryza punctata Echinochloa crus-galli Rottboellia exaltata + species below

(Table continued overleaf)

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.67	species above + wheat barley oat groundnut tomato	Poa annua Poa trivialis Rumex obtusifolius Eleusine indica Digitaria sanguinalis Amaranthus retroflexus

Comments on results

Activity experiment

Activity experiment results were reported previously (Richardson and Dean 1973b) and these showed the type and level of activity to be similar to other nitrophenyl ethers such as nitrofen. A high level of foliar contact activity on broad-leaved species was noted while pre-emergence surface sprays were highly effective against perennial ryegrass.

Symptoms

These were described previously for post-emergence treatments (Richardson and Dean, 1973b). Pre-emergence treatments showed that annual grasses are severely inhibited, often failing to emerge from the coleoptile at higher doses. At lower rates, where some development of leaves occurred, leaf capture with consequent deformity was often noted. Affected broad-leaved species usually developed to the cotyledon leaf stage, when partial or complete inhibition of the main bud was seen. As with grasses, leaves which do develop are pinched or trapped and often dark green. These symptoms are typical of nitrophenyl ether herbicides.

Soil persistence

A longer period of persistence in the soil was found, compared with nitrofen. Using Poa trivialis as the sensitive test species, rates of 0.67, 2.0 and 6.0 kg/ha were reducing plant fresh weights by 48, 95 and 100% respectively, 45 weeks after treatment.

Selectivity among temperate species

Poa spp. were particularly susceptible and Alopecurus myosuroides was almost controlled at 0.67 kg/ha. Avena fatua was severely reduced at 2.0 kg/ha but 6.0 kg/ha was required for control. Of the broad-leaved annual weeds, only members of the Polygonaceae proved susceptible. Stellaria media and crucifers were very resistant as they were to nitrofen. The composites were also resistant to chlornitrofen. Convolvulus arvensis was the only susceptible perennial weed with a 73% kill at 2.0 kg/ha. Thus the weed control spectrum was similar to that of nitrofen but the latter was somewhat more active, especially against Polygonum spp. and A. vineale.

The large seeded legumes, field bean and dwarf bean, were tolerant. Although symptoms were seen on pea at the two lower doses, there was no

conventional dose response, and greater tolerance was found at the higher dose. All four brassica crops and carrot showed a high degree of resistance. Lettuce and sugar beet were tolerant at 2.0 kg/ha and the three cereals at 0.67 kg/ha. Crop tolerance was slightly greater than with nitrofen.

Chlornitrofen would appear to have some potential use for control of mainly annual grass weeds pre-emergence in beans, brassicas and carrot. Unfortunately it has certain omissions in its weed control spectrum e.g. S. media, cruciferous and composite weeds, such that compatibility with other herbicides will have to be considered. Comparison with the earlier post-emergence selectivity experiment (Richardson and Dean, 1973b) shows that generally, broad-leaved weeds were more susceptible post-emergence, including even S. media, some composites and Galium aparine. Polygonaceous weeds were again susceptible with the exception of P. aviculare which showed considerable resistance, It would seem however that annual grass weeds were more susceptible pre-emergence than post-emergence. With regard to the crops, carrot was highly tolerant to both types of application but others, including beans and brassicas, were more sensitive to the post-emergence spray. Bearing these facts in mind it could be worth considering use of chlornitrofen as a contact pre-emergence herbicide in carrot and possibly beans, where emergence is quite slow. The fairly long period of persistence could also then be beneficial for the control of late germinating weeds, while danger to subsequent crops could be avoided by cultivation/incorporation prior to sowing these.

Selectivity among tropical species

Excellent annual weed control was noted at 2.0 kg/ha, all being severely reduced or killed at this dose. Although the majority of Rottboellia exaltata plants were killed at 6.0 kg/ha, two had 'escaped' and could possibly have recovered. Both Cyperus rotundus and C. esculentus recovered from minor symptoms. The response of weeds was similar to that found with nitrofen.

A wide range of crops showed tolerance to chlornitrofen. Chickpea and cotton were particularly outstanding. The legumes were generally fairly resistant. It is unfortunate that no data are available for groundnut at 2.0 kg/ha although the reduced vigour at 0.67 kg/ha suggests that it may well not be tolerant at the higher dose.

The resistance of maize and rice at 2.0 kg/ha was not paralleled with sorghum which only showed tolerance at 0.67 kg/ha. Crop response was generally similar to nitrofen. The pre-emergence weed control spectrum of chlornitrofen resembled that following its post-emergence application (Richardson and Dean, 1973b). However rates required for control were generally less pre-emergence and crop safety was better in all cases. The range of crops tolerant was also much greater pre-emergence.

A possible advantage of chlornitrofen over nitrofen was the greater apparent selectivity against R. exaltata and O. punctata which can be problem weeds in maize and rice respectively in certain areas. Trials in legumes and cotton would also seem worthwhile.

SPECIES		CHLORNITROFEN 0.67 KG/HA		CHLORNITROFEN 2.00 KG/HA		CHLORNITROFEN 6.00 KG/HA
WHEAT	107	xxxxxxxxxxxxxxxxxxxx +	87	xxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
BARLEY	102	xxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxx +	102	xxxxxxxxxxxxxxxxxxx +
(2)	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
OAT	98	xxxxxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxxx +	98	xxxxxxxxxxxxxxxxxxx
(3)	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	43	xxxxxxxxx
PER RYGR	30	xxxxxx	7	x	0	
(4)	36	xxxxxxx	36	xxxxxxx	0	
ONION	75	xxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx	10	xx
(8)	79	xxxxxxxxxxxxxxxx	36	xxxxxxx	14	xxx
DWF BEAN	83	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
FLD BEAN	111	xxxxxxxxxxxxxxxxxxx +	79	xxxxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxx
(10)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxx
PEA	60	xxxxxxxxxxxx	40	xxxxxxxx	100	xxxxxxxxxxxxxxxxxx
(11)	64	xxxxxxxxxxxx	57	xxxxxxxxxx	79	xxxxxxxxxxxxxxx
W CLOVER	77	xxxxxxxxxxxxxxx	37	xxxxxxx	29	xxxxxx
(12)	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx	43	xxxxxxxxx
RAPE	95	xxxxxxxxxxxxxxxxxx	101	xxxxxxxxxxxxxxxxxxx +	88	xxxxxxxxxxxxxxxxx
(14)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
KALE	97	xxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxx +
(15)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
SWEDE	115	xxxxxxxxxxxxxxxxxxx +	115	xxxxxxxxxxxxxxxxxx +	107	xxxxxxxxxxxxxxxxxx +
(17)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx

SPECIES		CHLORNITROFEN 0.67 KG/HA		CHLORNITROFEN 2.00 KG/HA		CHLORNITROFEN 6.00 KG/HA
CARROT	125	xxxxxxxxxxxxxxxxxxxx +	108	xxxxxxxxxxxxxxxxxxxx +	96	xxxxxxxxxxxxxxxxxxx
(18)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
LETTUCE	83	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	65	xxxxxxxxxxxxx
(20)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
SUG BEET	105	xxxxxxxxxxxxxxxxxxxx +	73	xxxxxxxxxxxxxxx	66	xxxxxxxxxxxxx
(21)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
AVE FATU	110	xxxxxxxxxxxxxxxxxxxx +	58	xxxxxxxxxxxx	17	xxx
(26)	43	xxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
ALO MYOS	45	xxxxxxxxx	13	xxx	6	x
(27)	36	xxxxxxx	14	xxx	14	xxx
POA ANN	3	x	0		0	
(28)	7	x	0		0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	103	xxxxxxxxxxxxxxxxxxxx +	91	xxxxxxxxxxxxxxxxx	77	xxxxxxxxxxxxxxx
(30)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
RAPH RAP	111	xxxxxxxxxxxxxxxxxxxx +	111	xxxxxxxxxxxxxxxxxxxx +	100	xxxxxxxxxxxxxxxxxxx
(31)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
TRIP MAR	69	xxxxxxxxxxxxxx	76	xxxxxxxxxxxxxxx	59	xxxxxxxxxxxx
(33)	57	xxxxxxxxxxx	57	xxxxxxxxxxx	50	xxxxxxxxxx
SEN VULG	134	xxxxxxxxxxxxxxxxxxxx +	31	xxxxxx	52	xxxxxxxxx
(34)	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
POL LAPA	37	xxxxxxx	51	xxxxxxxxxx	0	
(35)	64	xxxxxxxxxxxxx	43	xxxxxxxxx	0	

SPECIES		CHLORNITROFEN 0.67 KG/HA		CHLORNITROFEN 2.00 KG/HA		CHLORNITROFEN 6.00 KG/HA
POL AVIC	54	xxxxxxxxxxx	0		0	
(36)	64	xxxxxxxxxxxxx	0		0	
GAL APAR	82	xxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx	47	xxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
STEL MED	96	xxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx
(40)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
RUM OBTU	22	xxxx	0		0	
(44)	43	xxxxxxxxx	0		0	
AG REPEN	97	xxxxxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxx +
(47)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
ALL VIN	84	xxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
(49)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
CIRS ARV	67	xxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx	117	xxxxxxxxxxxxxxxxxxx +
(50)	79	xxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
TUS FARF	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
CONV ARV	73	xxxxxxxxxxxxxxx	27	xxxxx	0	
(52)	93	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
MAIZE	97	xxxxxxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxx +	106	xxxxxxxxxxxxxxxxxxx +
(58)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
RICE	110	xxxxxxxxxxxxxxxxxxx +	110	xxxxxxxxxxxxxxxxxxx +	110	xxxxxxxxxxxxxxxxxxx +
(60)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
CHICKPEA	143	xxxxxxxxxxxxxxxxxxx +	129	xxxxxxxxxxxxxxxxxxx +	129	xxxxxxxxxxxxxxxxxxx +
(63)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx

Click here to continue