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THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: ALACHLOR, METOLACHLOR, DIMETHACHLOR, ALLOXYDIM-SODIUM AND FLURIDONE

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NOTE

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THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: ALACHLOR, METOLACHLOR, DIMETHACHLOR, ALLOXYDIM-SODIUM AND FLURIDONE

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SUMMARY

In a series of pot experiments in the glasshouse, five herbicides were examined for pre-emergence selectivities, either as surface or incorporated treatments, in 61 temperate and tropical crop and weed species. Their route of action was examined in a separate test on six selected test species. In conjunction with the pre-emergence selectivity test, persistence of the herbicides in the soil was examined. Additional species included in the selectivity test for the first time were millet (Pennisetum americanum) and Phalaris minor.

Alachlor, metolachlor and dimethachlor, evaluated as surface treatments, showed some similarities in their route of action, weed control and crop tolerance spectra, with control of mainly annual grass and certain annual broad-leaved weeds in some broad-leaved crops (including brassicas and legumes) and also maize. Dimethaclor was the most active on weeds, and although fewer crops were tolerant, in some of these selectivity was marginally better.

Alloxydim-sodium, incorporated, gave outstanding control of nearly all annual and perennial grass weeds (including volunteer cereals and ryegrass) with the possible exception of Poa annua, while most broad-leaved crops and onion were tolerant.

Fluridone, incorporated, caused a striking albinism of affected plants. Most annual grass and broad-leaved weeds were controlled but certain composite weeds were resistant. Cotton showed outstanding tolerance and there is the potential for excellent selectivity against Cyperus rotundus in this crop.

Persistence in the soil was relatively short for alachlor and alloxydim-sodium, moderate for dimethaclor, moderate to long for metolachlor and very long for fluridone.

INTRODUCTION

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

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* Herbicide Group
** ODM Tropical Weeds Group

further work, as plant responses in pot experiments can be very different from those in the field.

The present report gives pre-emergence selectivity data on five herbicides. Results of activity experiments are included for alachlor, metolachlor, dimethachlor and fluridone to provide information on levels of phytotoxicity, type and route of action. The corresponding data for alloxydim-sodium (NP 48-Na) have already been published (Richardson and Parker, 1978).

METHODS AND MATERIALS

Activity experiments (AE1, AE2, AE3 and AE 4). These were carried out in the glasshouse on six selected species as described previously (Richardson and Dean, 1973). Four annual species were raised from seeds and two perennials from rhizome fragments. Herbicides were applied by four different methods:

i. a 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 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	3	2	1.8	2 unifoliate leaves	1½-2½ tri-foliate leaves	1½-3 tri-foliate leaves
Kale (*Brassica oleracea acephala*)	Marrowstem /Maris Kestrel	10-15	5	0.6	1½-2½ leaves	2½-4 leaves	3-4½ leaves
Polygonum amphibium	WRO Clone 1	6	3-5	1.2 or 1.8	3½-8 leaves	6-8 leaves	8-12 leaves
Perennial ryegrass (*Lolium perenne*)	S 23	15-20	10	0.6	2½-4 leaves	6-10 leaves tillering	8-15 leaves tillering
Avena fatua	B & S Supplies 1972/ Bourton 1973/ Farthing-hoe 1972	10-12	3-4	1.2	2-3½	4-8 leaves tillering	7-12 leaves tillering
Agropyron repens	WRO Clone 31	6	4-5	1.2	1½-3 leaves	4-7 leaves tillering	7-9 leaves tillering

Table 2. Soil and environment conditions

Experiment no., type and herbicide(s) included	AE 1 alachlor	AE 2 metolachlor	AE 3 fluridone	AE 4 dimethachlor	Pre-emergence selectivity test, alachlor, dimethachlor, metolachlor, fluridone, alloxydim-sodium
Date of spraying	29.4.76	19.8.75	31.8.77	6.7.78	15.12.77
Main assessment completed	27.5.76	24.9.75	5.10.77	7.8.78	6.2.78
Soil moisture at spraying (%)	-	-	-	-	13.0
Organic matter (%)	4.2	4.2	4.1	4.1	4.1
Clay content (%)	13	13	15	15	15
pH	7.0	7.0	7.0	7.0	7.0
John Innes Base fertilizer (g/kg)	5.0	5.0	3.75	-	-
Osmacote 15.12.15 (g/kg)	-	-	-	1.75	1.5
DDT (5% dust) (g/kg)	0.5	0.5	0.5	0.5	0.5
Fritted trace elements	0.25	0.25	-	0.01	-
Hydrated Mg SO4 (g/kg)	1.0	1.0	1.0	1.0	1.0
Temperature (°C)					Temperate / Tropical
Mean	30	19	19	21	14 / 21
Maximum	32	33	29	33	20 / 28
Minimum	9	8	13	13	8 / 13
Relative humidity (%)					
Mean	53	53	52	50	65 / 54
Maximum	90	80	80	84	92 / 68
Minimum	26	24	20	30	34 / 42

Pre-emergence selectivity experiment

Techniques for the selectivity experiment were as previously described (Richardson and Dean, 1973), two herbicides (alloxydim-sodium and fluridone) being thoroughly incorporated into the soil by mixing immediately after spraying and three (alachlor, metolachlor and dimethachlor) being applied as surface pre-emergence treatments. Species were sown as detailed in Appendix 1, each being replicated twice for every treatment. Herbicides were applied using a laboratory sprayer operated at a pressure of 207 k Pa (30 lb/in^2) and moving at constant speed, 30cm above the soil. Subsequent watering was from overhead. Soil and environmental conditions are summarized in Table 2. During the experiment plants were raised in the glasshouse, normal daylight being supplemented by high pressure sodium lighting to provide a 14 hour photoperiod for temperate species and a 12 hour photoperiod for tropical species.

Radish was included for ease of propagation and may be regarded as a crop or

weed. To improve establishment of certain species, various treatments were applied as follows: seeds of Chenopodium album were kept in 0.1 M potassium nitrate for 48 hours in the light; seeds of Chrysanthemum segetum were kept for 48 hours in the light at a pH of 5; seeds of Polygonum aviculare were soaked for 30 minutes in concentrated sulphuric acid, washed for 1 hour in running tap water and soaked for 48 hours in aqueous gibberellic acid (250 ppm); tubers of Cyperus esculentus and bulbs of Oxalis latifolia were kept at 2°C for 2 months prior to planting. Dwarf bean seeds were selected by testing their electrical conductivity, after soaking for 1 hour in water, discarding those whose conductivity was greater than 1Omhos. To protect from soil borne pathogens, all seeds (except C. album, C. segetum and P. aviculare) were pre-treated with one of the following: thiram, benomyl, (for onion only), ethylmercuric phosphate + thiram (sugar beet only), aldrin (cotton only), harvesan organomercury (Avena fatua only). Temperate cereal seeds were purchased already treated with a mercurial seed dressing, and maize with captan A + teraquinone.

For certain species, which are particularly susceptible to disease, i.e. the brassica/crucifer species (kale, rape, radish, Sinapis arvensis) and soya-bean, seeds were treated with 6% gum arabic solution, prior to dressing with thiram in order to give better adhesion of the dressing, thus giving even better protection against disease.

Assessment and processing of results

Results were processed as described before (Richardson and Dean, 1973). Survivors were counted and scored for vigour on a 0-7 scale as previously where 0 = dead, and 7 = as untreated control. It was not possible to analyse by computer the data for Cirsium arvense, Cyperus esculentus, Snowdenia polystachya, Oxalis latifolia and groundnut because of variable germination/emergence but some observations were made and are referred to in the text. Chenopodium album failed to germinate. To improve growth, dwarf bean, considered as a temperate species, was raised under tropical conditions and conversely Phalaris minor, considered as a sub-tropical species, was raised under temperate conditions.

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 one replicate only and 'M' represents a missing treatment.

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

Soil persistence

Soil persistence was monitored, in conjunction with the pre-emergence selectivity experiment. Two sets of tins containing soil were sprayed with the herbicides. One set for the surface treatments (alachlor, metolachlor and dimethachlor), together with tins containing untreated soil for controls, were transferred to the temperate glasshouse and watered as necessary, from overhead. Susceptible species were periodically sown shallowly, disturbing the soil as little as possible. The second set of tins, for the incorporated treatments (alloxydim-sodium and fluridone), were emptied immediately after spraying and the soil thoroughly mixed to incorporate the herbicide. This soil, and also untreated soil for controls, was stored in glass jars which were kept in the dark at 23°C until samples of soil were removed for pot bioassays in the same glasshouse and at the same time as for surface treatments.

Plants were harvested three to four weeks after sowing, when they had reached a predetermined growth stage, the number and fresh weight of shoots being recorded. Periodical bioassays were carried out at six to eight week intervals for up to a year, unless the herbicides had disappeared before then. Herbicides are considered to have disappeared when shoot fresh weights of the test plants are 80% or more as compared with the controls. The soil moisture level was determined at the start of the experiment and for the soil stored in the glass jars (for the incorporated treatments) at the time of assay and adjusted if necessary. Results are presented in graphical form for each herbicide and comments are made in the text.

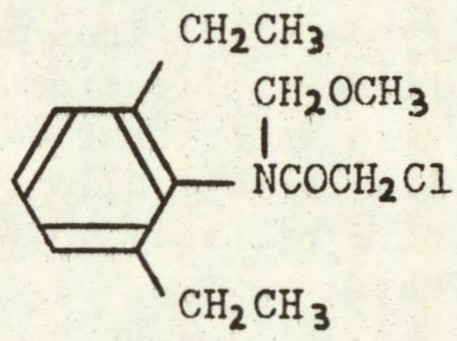
ALACHLOR

Code number CP 50144

Trade name Lasso
Alanex

Chemical name ∝-chloro-2',6'-diethyl-N-methoxymethyl acetanilide

Structure



Source Monsanto Limited,
Thames Tower,
Burley Way,
Leicester,
LE1 3TP

Information available and suggested uses

A pre-emergence herbicide for annual grass and broad-leaved weeds in maize, winter rape, planted cabbages and cauliflowers, soyabeans, sugar cane, groundnuts and sunflower at 1.92 to 2.88 kg a.i./ha. Mixtures are available with atrazine for maize and with linuron for soyabeans and sunflower.

Formulation used 48% w/v a.i. emulsifiable concentrate.

Spray volume 366 l/ha.

RESULTS

Full results are given in the histograms on pages 9-15 and potential selectivities are summarized 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
4.0	none	none listed as no crops tolerant
1.0	dwarf bean rape kale radish cowpea chickpea* soyabean sesamum	Alopecurus myosuroides Tripleurospermum maritimum Senecio vulgaris Stellaria media Rumex obtusifolius Agropyron repens Phalaris minor + species listed below
0.25	species above + wheat* field bean* pea carrot maize cotton kenaf	Avena fatua Poa annua Poa trivialis Veronica persica Holcus lanatus Oryza punctata Eleusine indica Echinochloa crus-galli Digitaria sanguinalis Amaranthus retroflexus

* some stand reduction, but probably not due to herbicide.

Comments on results

Activity experiment (see page 9)

Results were essentially the same as in an earlier WRO test with regard to the level of activity, the route of action and the species sensitivity. Thus grasses, especially the annuals, were sensitive, while broad-leaved species were tolerant. Most activity resulted from the soil treatments particularly pre-emergence, with surface applications being generally much more active than when the herbicide was incorporated into the soil. Grasses were completely resistant to the foliar spray while broad-leaved species exhibited only minor symptoms, due more probably to the solvent in the formulation than the active ingredient.

Symptoms

These were typical of herbicides of the anilide, amide or carbamate groups. The foliar spray caused minor necrotic spots on broad-leaved species. Severe retardation was apparent on grasses and broad-leaved species in pre-emergence and soil drench applications. This was usually accompanied by leaf trapping or sticking, consequently causing deformity. A darker green colour of leaves usually developed prior to necrosis. With the grasses and some broad-leaved species, high doses pre-emergence often led to kill before, at or after emergence from the soil.

Soil persistence

Results are presented in the figure on page 15 and agree with an earlier pot test at WRO, that persistence in the soil is relatively short. Using perennial ryegrass as the test species, doses of 0.25, 1.0 and 4.0 kg a.i./ha had disappeared 5, 17 and 28 weeks respectively after spraying.

Pre-emergence selectivities among temperate species

On the whole, results are comparable to an earlier WRO pot test with control of annual grasses and a few broad-leaved weeds and some marginal selectivities in a few broad-leaved crops. More activity was found in the present test on certain of the grasses, however, notably on *Avena fatua* and *Alopecurus myosuroides*. In fact, all of the smaller seeded grasses as well as *A. fatua* were adequately controlled at 0.25 kg/ha, while *A. myosuroides* was almost controlled.

As expected, tolerance was found with the large-seeded legumes and the brassica crops. Most noteworthy in the latter group is the tolerance shown by rape (not previously tested at WRO), thus lending support to the manufacturer's claim. The highest dose of 4.0 kg/ha depressed vigour only marginally.

The control of annual grass weeds (including volunteer ryegrass and possibly cereals) in rape is interesting, suggesting that further trials may be worth while. However, the control of broad-leaved weeds is, on the whole, rather weak, such that consideration will have to be given to mixing alachlor with another herbicide.

Pre-emergence selectivity among tropical species

Under the conditions of this experiment, very high activity was obtained resulting in complete control of most small-seeded annual grasses at the lowest dose of 0.25 kg/ha. *Phalaris* showed a little more tolerance but this could be due to the cooler, temperate conditions under which it was grown.

Rottboellia, on the other hand, confirmed its high degree of resistance, even at the highest dose. Amaranthus was also very susceptible but not Solanum nigrum. Selectivity against most annual grasses and Amaranthus was confirmed in most of the larger-seeded broad-leaved crops including groundnut, cotton and maize though the latter was affected somewhat at 1 kg/ha. The tolerance of sesamum, kenaf and jute was lower than in an earlier experiment (Dean & Parker, 1971) when alachlor was incorporated before sowing.

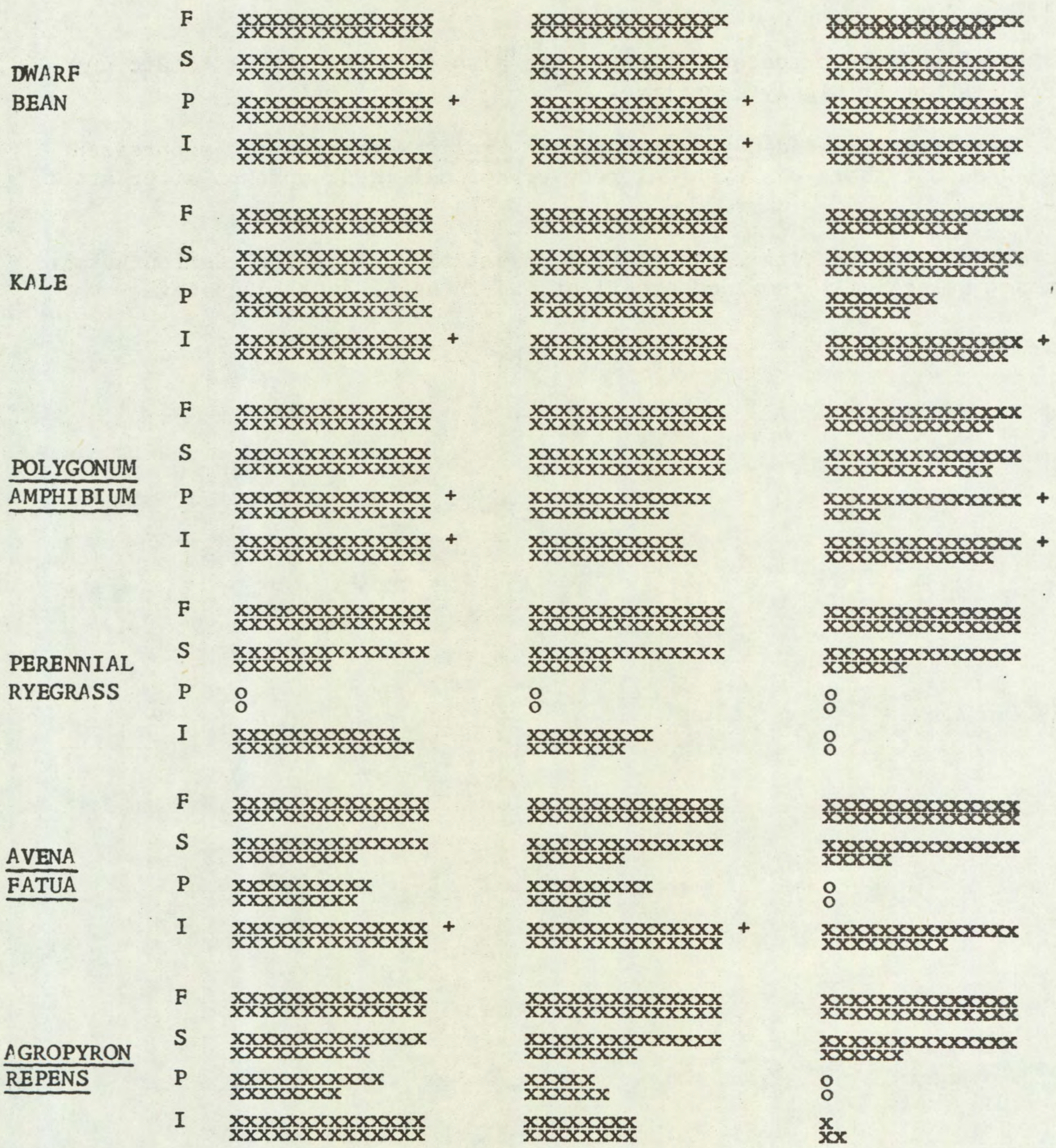
Results with cowpea and chickpea are also encouraging but tomato and pigeon pea appear highly sensitive.

The perennial weeds Cyperus spp. and Oxalis were severely suppressed at 4 kg/ha but there was eventual recovery of all these species after about 3 months.

Selectivity in jute was lost as a result of surface application but in sesamum, selectivity remained excellent and in kenaf just adequate.

ACTIVITY EXPERIMENT

ALACHLOR



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

ALACHLOR

SPECIES		0.25 Kg/ha		1.00 kg/ha		4.00 kg/ha
WHEAT	71	xxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx
(1)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxx
(2)	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	21	xxxx
OAT	102	xxxxxxxxxxxxxxxxxxx+	102	xxxxxxxxxxxxxxxxxxx+	83	xxxxxxxxxxxxxxxx
(3)	57	xxxxxxxxxxx	21	xxxx	14	xxx
PER RYGR	58	xxxxxxxxxxxx	0		0	
(4)	21	xxxx	0		0	
ONION	29	xxxxxx	0		0	
(8)	29	xxxxxx	0		0	
DWF BEAN	112	xxxxxxxxxxxxxxxxxxx+	94	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
FLD BEAN	68	xxxxxxxxxxxxxx	109	xxxxxxxxxxxxxxxxxxx+	55	xxxxxxxxxx
(10)	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	29	xxxxxx
PEA	114	xxxxxxxxxxxxxxxxxxx+	71	xxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx
W CLOVER	102	xxxxxxxxxxxxxxxxxx+	71	xxxxxxxxxxxxxx	0	
(12)	64	xxxxxxxxxxxxx	36	xxxxxxx	0	
RAPE	102	xxxxxxxxxxxxxxxxxx+	93	xxxxxxxxxxxxxxxxxx	99	xxxxxxxxxxxxxxxxxx
(14)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
KALE	107	xxxxxxxxxxxxxxxxxx+	114	xxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxx+
(15)	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
CARROT	117	xxxxxxxxxxxxxxxxxx+	102	xxxxxxxxxxxxxxxxxx+	7	x
(18)	93	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	14	xxx

ALACHLOR

SPECIES	0.25 kg/ha		1.00 kg/ha		4.00 kg/ha	
LETTUCE	99	xxxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx	4	x
(20)	64	xxxxxxxxxxxxx	29	xxxxxx	7	x
Sug BEET	100	xxxxxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
(21)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
AVE FATU	50	xxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(26)	29	xxxxxx	14	xxx	14	xxx
ALO MYOS	102	xxxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx	0	
(27)	36	xxxxxxx	21	xxxx	0	
POA ANN	0		0		0	
(28)	0		0		0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	54	xxxxxxxxxxx	54	xxxxxxxxxxx	54	xxxxxxxxxxx
(30)	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	50	xxxxxxxxxx
RAPH RAP	109	xxxxxxxxxxxxxxxxxxx+	98	xxxxxxxxxxxxxxxxxxx	103	xxxxxxxxxxxxxxxxxxx+
(31)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
CHRY SEG	77	xxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx	7	x
(32)	71	xxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
TRIP MAR	78	xxxxxxxxxxxxxxxx	59	xxxxxxxxxxxx	44	xxxxxxxxx
(33)	71	xxxxxxxxx	21	xxxx	7	x
SEN VULG	107	xxxxxxxxxxxxxxxxxxx+	49	xxxxxxxxxx	12	xx
(34)	64	xxxxxxxxxxxxx	29	xxxxxx	7	x
POL LAPA	82	xxxxxxxxxxxxxxxx	41	xxxxxxxx	14	xxx
(35)	93	xxxxxxxxxxxxxxxxxx	36	xxxxxxx	7	x

ALACHLOR

SPECIES	0.25 kg/ha		1.00 kg/ha		4.00 kg/ha	
POL AVIC	94	xxxxxxxxxxxxxxxxxxx	112	xxxxxxxxxxxxxxxxxxxx+	75	xxxxxxxxxxxxxxx
(36)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	43	xxxxxxxxx
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(38)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx
STEL MED	95	xxxxxxxxxxxxxxxxxx	12	xx	0	
(40)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	
VER PERS	5	x	0		0	
(42)	14	xxx	0		0	
RUM OBTU	114	xxxxxxxxxxxxxxxxxxx+	43	xxxxxxxxx	43	xxxxxxxxx
(44)	57	xxxxxxxxxxx	29	xxxxxx	7	x
HOLC LAN	4	x	0		0	
(45)	14	xxx	0		0	
AG REPEN	92	xxxxxxxxxxxxxxxxx	25	xxxxx	0	
(47)	86	xxxxxxxxxxxxxxxxx	21	xxxx	0	
ALL VIN	148	xxxxxxxxxxxxxxxxxxx+	135	xxxxxxxxxxxxxxxxxxx+	26	xxxxx
(49)	100	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	36	xxxxxxx
TUS FARF	111	xxxxxxxxxxxxxxxxxxx+	95	xxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx
(51)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	21	xxxx
CONV ARV	96	xxxxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx
(52)	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
MILLET	0		0		0	
(57)	0		0		0	
MAIZE	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(58)	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	50	xxxxxxxxxx

PRE-EMERGENCE SELECTIVITY EXPERIMENT

ALACHLOR

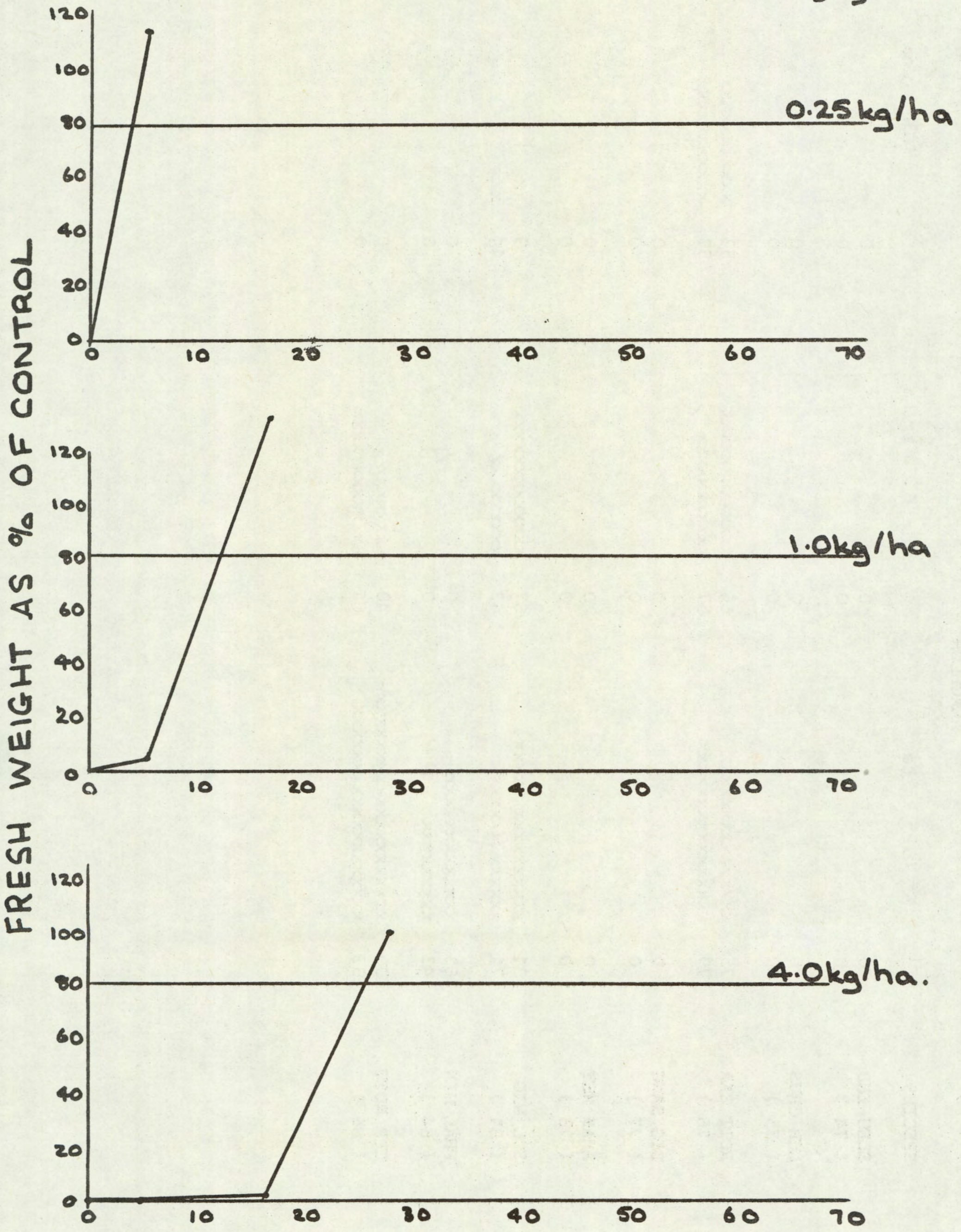
SPECIES	0.25 kg/ha		1.00 kg/ha		4.00 kg/ha	
SORGHUM	46	xxxxxxxxx	8	xx	0	
(59)	29	xxxxxx	21	xxxx	0	
RICE	0		0		0	
(60)	0		0		0	
PIGEON P	41	xxxxxxxx	10	xx	10	xx
(61)	57	xxxxxxxxxxx	29	xxxxxx	14	xxx
COWPEA	116	xxxxxxxxxxxxxxxxxxxx+	106	xxxxxxxxxxxxxxxxxxxx+	77	xxxxxxxxxxxxxx
(62)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
CHICKPEA	106	xxxxxxxxxxxxxxxxxxx+	58	xxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx
(63)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
SOYABEAN	135	xxxxxxxxxxxxxxxxxxx+	97	xxxxxxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxx+
(65)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
COTTON	97	xxxxxxxxxxxxxxxxxx	77	xxxxxxxxxxxxxxx	58	xxxxxxxxxxxx
(66)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
JUTE	107	xxxxxxxxxxxxxxxxxxx+	150	xxxxxxxxxxxxxxxxxxx+	43	xxxxxxxxx
(67)	64	xxxxxxxxxxxxx	43	xxxxxxxxx	21	xxxx
KENAF	229	xxxxxxxxxxxxxxxxxxx+	171	xxxxxxxxxxxxxxxxxxx+	0	
(68)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	0	
SESAMUM	177	xxxxxxxxxxxxxxxxxxx+	68	xxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxx
(70)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	36	xxxxxxx
TOMATO	90	xxxxxxxxxxxxxxxxx	0		0	
(71)	57	xxxxxxxxxxx	0		0	
OR PUNCT	0		0		0	
(73)	0		0		0	

ALACHLOR

SPECIES	0.25 kg/ha		1.00 kg/ha		4.00 kg/ha	
ELEU IND	0		0		0	
(74)	0		0		0	
ECH CRUS	0		0		0	
(75)	0		0		0	
ROTT EXA	75	xxxxxxxxxxxxxxx	66	xxxxxxxxxxxxx	53	xxxxxxxxxxx
(76)	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	50	xxxxxxxxxx
DIG SANG	0		0		0	
(77)	0		0		0	
AMAR RET	0		0		0	
(78)	0		0		0	
SOL NIG	81	xxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx	9	xx
(81)	71	xxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
PHAL MIN	63	xxxxxxxxxxxxx	0		0	
(84)	43	xxxxxxxxx	0		0	
CYP ROTU	100	xxxxxxxxxxxxxxxxxxxx	40	xxxxxxxx	0	
(86)	93	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	

PERSISTENCE OF ALACHLOR

(surface spray) Species. Perennial ryegrass



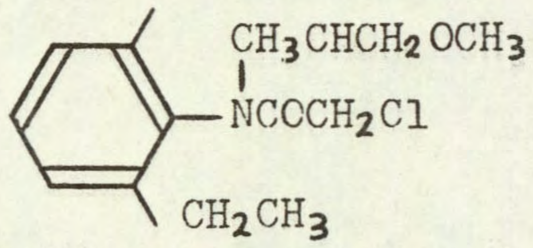
METOLACHLOR

Code number CGA 24705 Trade name Dual

Former common name Metetilachlor

Chemical name ∝-chloro-6'-ethyl-N-(2-methoxy-1-methylethyl) acet-O-toluidide

Structure



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

Information available and suggested uses

Pre-emergence control of annual grass weeds in soybeans, groundnuts, sunflowers, sugar beet and maize at 1.0 to 2.0 kg a.i./ha but up to 4.0 kg a.i./ha may be needed to control sedges and broad-leaved weeds. In situations where the latter are present, mixture with other herbicides is recommended, e.g. with atrazine in maize.

Formulation used 72% w/v a.i. emulsifiable concentrate.

Spray volume 366 l/ha

RESULTS

Full results are given in the histograms on pages 19 - 25 and potential selectivities are summarized 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
4.0	soyabean	Polygonum lapathifolium Polygonum aviculare Galium aparine Convolvulus arvensis Solanum nigrum + species listed below
1.0	species above + dwarf bean pea rape kale radish cowpea chickpea* cotton*	Avena fatua Alopecurus myosuroides Poa trivialis Chrysanthemum segetum Tripleurospermum maritimum Senecio vulgaris Stellaria media Rumex obtusifolius Agropyron repens Phalaris minor Cyperus rotundus + species below

Table cont.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.25	species above +	Poa annua
	oat	Veronica persica
	field bean	Holcus lanatus
	carrot	Oryza punctata
	sugar beet	Eleusine indica
	maize	Echinochloa crus-galli
	kenaf	Digitaria sanguinalis
	sesamum	Amaranthus retroflexus

* but note some stand reduction

Comments on results

Activity experiment (see page 19)

Results were similar to those found with alachlor, with grasses more susceptible than broad-leaved species, especially to the soil treatments. Pre-emergence treatments had greater activity than did the post-emergence soil drenches with the exception of Avena fatua and dwarf bean. Surface pre-emeregence treatments were generally more effective than when the herbicide was incorporated into the soil but the loss of activity with incorporation was less pronounced than with alachlor. The level of activity found with pre-emergence treatments was generally of the same order as with alachlor. However, Avena fatua and perennial ryegrass were marginally more sensitive to alachlor, while Agropyron repens was marginally more sensitive to metolachlor.

Symptoms

These were very similar to those caused by alachlor.

Soil persistence

Results are presented in the graph on page 25. A moderate to long period of persistence in the soil is indicated for metolachlor. Although the lowest dose of 0.25 kg/ha was undetectable with perennial ryegrass, 28 weeks after treatment, 1.0 and 4.0 kg/ha doses were still causing severe effects even after 49 weeks.

Pre-emergence selectivity among temperate species

The level of activity against weeds and the spectrum of control are generally very similar to alachlor, with good control of mainly annual grass and certain broad-leaved weeds. Cruciferous weeds were again resistant, while the high doses were needed for control of Polygonum species and Galium aparine. Perennials were fairly resistant with the exception of Agropyron repens, which was adequately controlled at 1.00 kg/ha, this species thus showing marginally more sensitivity to metolachlor than alachlor, corresponding to results in the activity experiments.

Crop tolerance also was generally similar to that found with alachlor, with regard to both species range and the level of tolerance shown. Thus brassica and large-seeded legume crops were tolerant. In the latter, dwarf bean and pea showed marginally greater tolerance than to alachlor. In

addition, sugar beet tolerated the lowest dose of metolachlor and was reduced in vigour by only 29% at 1.0 kg/ha.

As with alachlor, metolachlor can be expected to give control of many annual grass (including volunteer ryegrass and possibly cereals) and certain broad-leaved weeds in some broad-leaved crops, but even so, consideration will have to be given to extending the broad-leaved weed control spectrum by mixing with another herbicide.

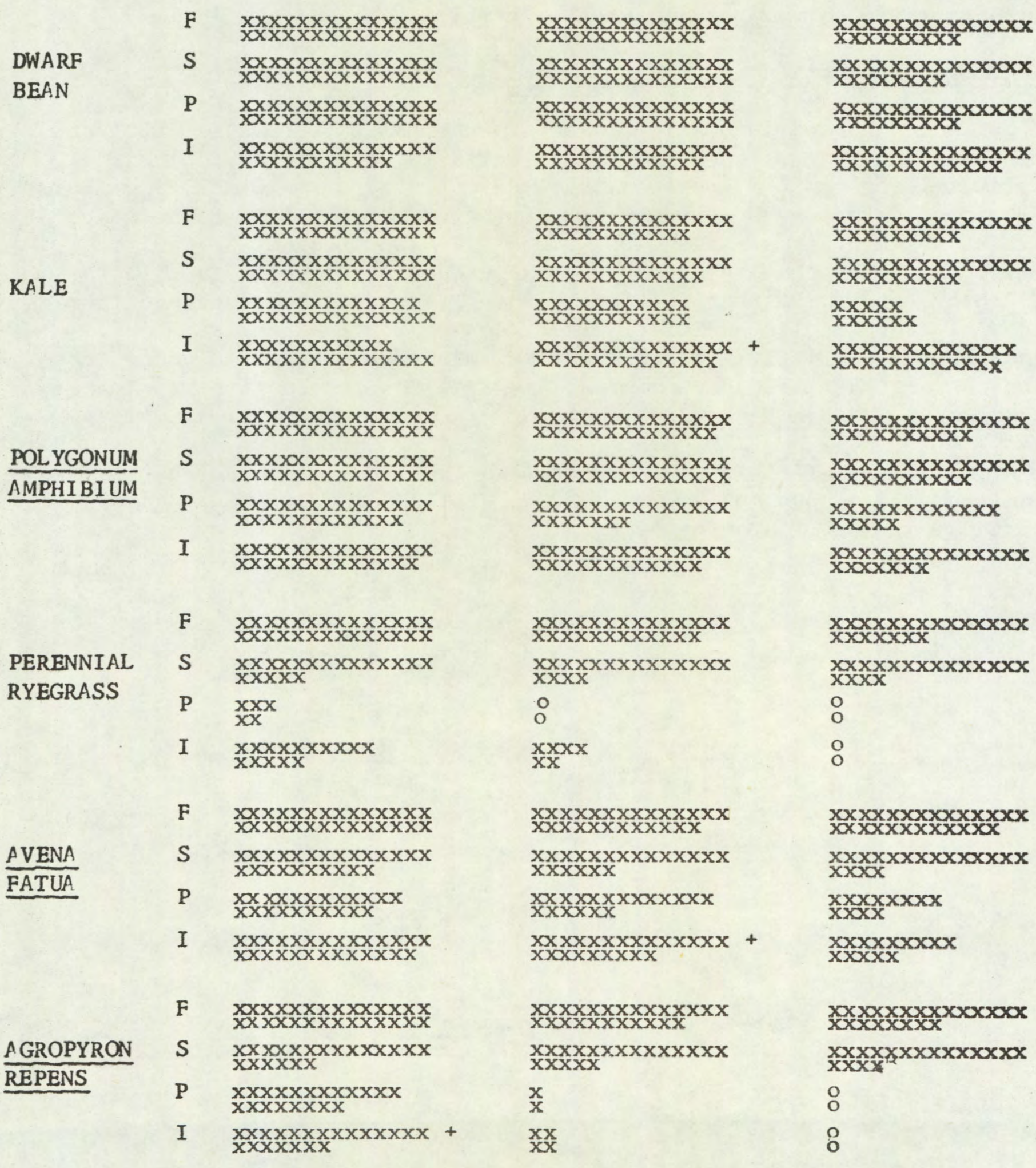
Pre-emergence selectivities among tropical species

Owing to the complete kill of many weed species by both alachlor and metolachlor, it is not possible to make definite comparisons of their selectivity. It can only be seen that the activity of metolachlor on maize and Rottboellia was at least as great as that of alachlor, and the stage of growth at which other grasses were killed was also at least as early. Assuming therefore that activity on grass weeds is at least equal to that of alachlor, it is interesting to note the slightly lesser degree of damage on several crop species, particularly pigeon pea, cowpea and soyabean, indicating the possibility of slightly improved selectivity in these crops. Cotton was also a little healthier at 1 kg/ha, but more seriously damaged at 4 kg/ha.

Effects on Phalaris were somewhat less than from alachlor, but the perennials were suppressed for longer, perhaps because of the longer persistence of metolachlor.

ACTIVITY EXPERIMENT

Metolachlor



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

METOLACHLOR

SPECIES	0.25 Kg/ha		1.00 Kg/ha		4.00 Kg/ha	
WHEAT	71	xxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	14	xxx
(1)	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx	7	x
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(2)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx
OAT	96	xxxxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxx+	83	xxxxxxxxxxxxxxxxx
(3)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	21	xxxx
PER RYGR	62	xxxxxxxxxxxx	0		0	
(4)	14	xxx	0		0	
ONION	71	xxxxxxxxxxxxxx	14	xxx	0	
(8)	50	xxxxxxxxxx	14	xxx	0	
DWF BEAN	112	xxxxxxxxxxxxxxxxxxx+	94	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
FLD BEAN	109	xxxxxxxxxxxxxxxxxxx+	95	xxxxxxxxxxxxxxxxxx	109	xxxxxxxxxxxxxxxxxx+
(10)	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	50	xxxxxxxxxx
PEA	57	xxxxxxxxxx	86	xxxxxxxxxxxxxxxx	114	xxxxxxxxxxxxxxxxxx+
(11)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
W CLOVER	81	xxxxxxxxxxxxxxx	51	xxxxxxxxxx	0	
(12)	57	xxxxxxxxxx	29	xxxxxx	0	
RAPE	93	xxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
(14)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
KALE	99	xxxxxxxxxxxxxxxxxxx	107	xxxxxxxxxxxxxxxxxx+	95	xxxxxxxxxxxxxxxxxx
(15)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
CARROT	80	xxxxxxxxxxxxxxx	66	xxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxx
(18)	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx	43	xxxxxxxx

METOLACHLOR

SPECIES	0.25 Kg/ha		1.00 Kg/ha		4.00 Kg/ha	
LETTUCE	94	xxxxxxxxxxxxxxxxxx	73	xxxxxxxxxxxxxx	43	xxxxxxxxx
(20)	64	xxxxxxxxxxxxx	36	xxxxxxx	21	xxxx
SUG BEET	95	xxxxxxxxxxxxxxxxxx	109	xxxxxxxxxxxxxxxxxxx+	86	xxxxxxxxxxxxxxxx
(21)	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	36	xxxxxxx
AVE FATU	56	xxxxxxxxxxx	81	xxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxx
(26)	36	xxxxxxx	29	xxxxxx	14	xxx
ALO MYOS	97	xxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	0	
(27)	57	xxxxxxxxxxx	21	xxxx	0	
POA ANN	0		0		0	
(28)	0		0		0	
POA TRIV	42	xxxxxxxx	0		0	
(29)	36	xxxxxxx	0		0	
SIN ARV	80	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	70	xxxxxxxxxxxxx
(30)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	50	xxxxxxxxx
RAPH RAP	83	xxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxx
(31)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
CHIRY SEG	49	xxxxxxxxxx	28	xxxxxx	7	x
(32)	71	xxxxxxxxxxxxx	57	xxxxxxxxxx	14	xxx
TRIP MAR	93	xxxxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxx	4	x
(33)	43	xxxxxxxxx	29	xxxxx	7	x
SEN VULG	148	xxxxxxxxxxxxxxxxxxx+	29	xxxxxxxxxx	62	xxxxxxxxxxx
(34)	71	xxxxxxxxxxxxx	29	xxxxxx	21	xxxx
POL LAPA	27	xxxxx	95	xxxxxxxxxxxxxxxxxx	41	xxxxxxxx
(35)	36	xxxxxxx	57	xxxxxxxxxx	29	xxxxxx

METOLACHLOR

SPECIES	0.25 Kg/ha		1.00 Kg/ha		4.00 Kg/ha	
POL AVIC	56	xxxxxxxxxxx	37	xxxxxxx	19	xxxx
(36)	93	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	14	xxx
GAL APAR	56	xxxxxxxxxxx	78	xxxxxxxxxxxxxxxx	56	xxxxxxxxxxx
(38)	64	xxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
STEL MED	61	xxxxxxxxxxxx	18	xxxx	0	
(40)	64	xxxxxxxxxxxx	29	xxxxxx	0	
VER PERS	19	xxxx	11	xx	0	
(42)	36	xxxxxxx	14	xxx	0	
RUM OBTU	186	xxxxxxxxxxxxxxxxxxx+	286	xxxxxxxxxxxxxxxxxxx+	57	xxxxxxxxxx
(44)	79	xxxxxxxxxxxxxxx	29	xxxxxx	7	x
HOLC LAN	0		0		0	
(45)	0		0		0	
AG REPEN	75	xxxxxxxxxxxxxx	17	xxx	8	xx
(47)	64	xxxxxxxxxxxx	14	xxx	7	x
ALL VIN	100	xxxxxxxxxxxxxxxxxx	130	xxxxxxxxxxxxxxxxxx+	83	xxxxxxxxxxxxxxxx
(49)	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxx	43	xxxxxxxxx
TUS FARF	95	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxx	36	xxxxxxx
CONV ARV	132	xxxxxxxxxxxxxxxxxx+	120	xxxxxxxxxxxxxxxxxx+	24	xxxxx
(52)	64	xxxxxxxxxxxx	50	xxxxxxxxx	21	xxxx
MILLET	0		0		0	
(57)	0		0		0	
MAIZE	92	xxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
(58)	93	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxx	36	xxxxxxx

METOLACHLOR

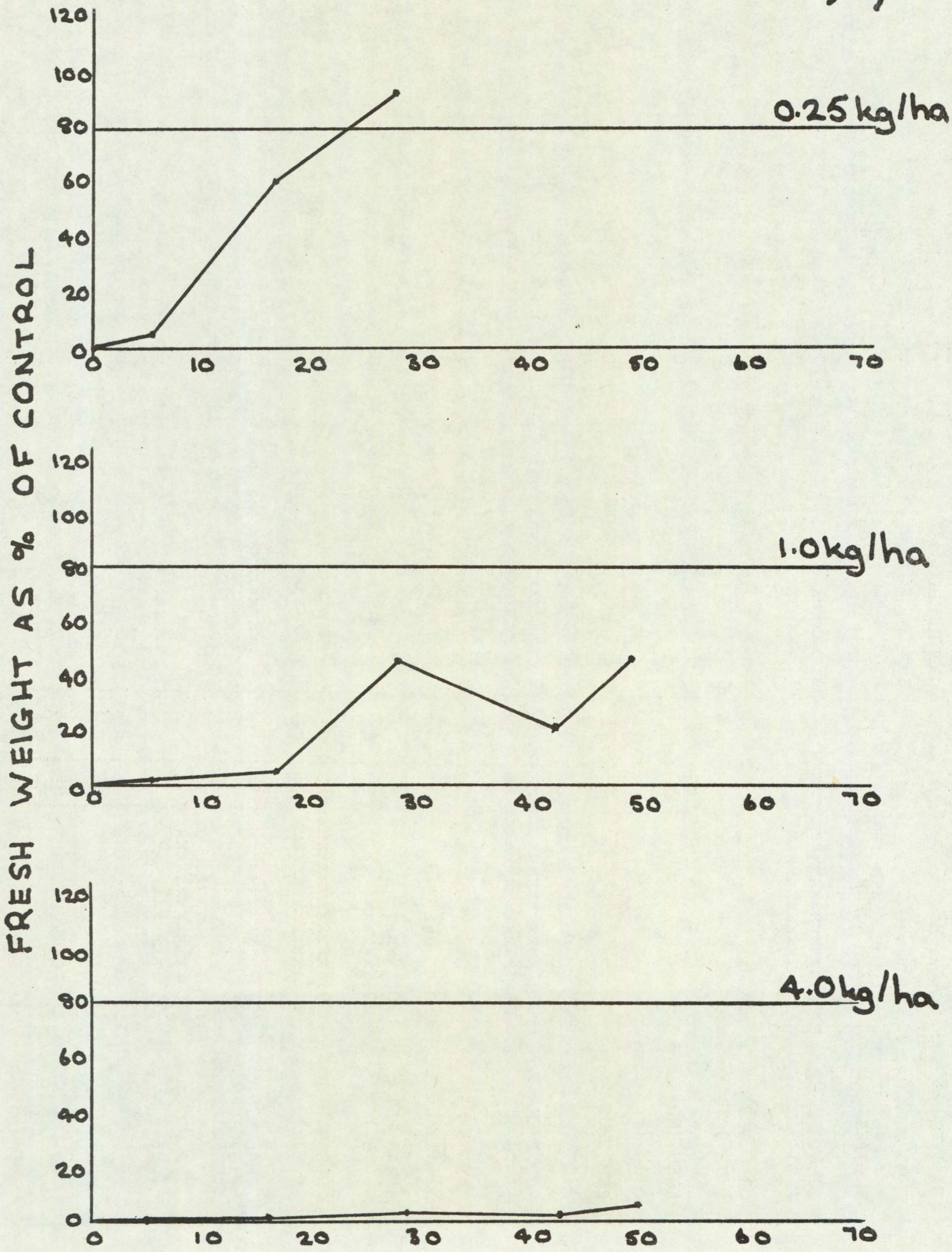
SPECIES	0.25 Kg/ha		1.00 Kg/ha		4.000 Kg/ha	
SORGHUM	31	xxxxxx	0		0	
(59)	57	xxxxxxxxxxx	0		0	
RICE	0		0		0	
(60)	0		0		0	
PIGEON P	124	xxxxxxxxxxxxxxxxxxxx+	41	xxxxxxxx	0	
(61)	64	xxxxxxxxxxxx	50	xxxxxxxxxx	0	
COWPEA	58	xxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxx+	97	xxxxxxxxxxxxxxxxx
(62)	93	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
CHICK PEA	97	xxxxxxxxxxxxxxxxx	77	xxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxx
(63)	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxx
SOYABEAN	97	xxxxxxxxxxxxxxxxx	116	xxxxxxxxxxxxxxxxxx+	126	xxxxxxxxxxxxxxxxxx+
(65)	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxx
COTTON	97	xxxxxxxxxxxxxxxxx	68	xxxxxxxxxxxxx	39	xxxxxxx
(66)	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
JUTE	64	xxxxxxxxxxxx	107	xxxxxxxxxxxxxxxxxx+	21	xxxx
(67)	50	xxxxxxxxx	36	xxxxxx	7	x
KENAF	186	xxxxxxxxxxxxxxxxxx+	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
(68)	86	xxxxxxxxxxxxxxxx	50	xxxxxxxxx	43	xxxxxxxx
SESAMUM	191	xxxxxxxxxxxxxxxxxx+	123	xxxxxxxxxxxxxxxxxx+	0	
(70)	100	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	0	

METOLACHLOR

SPECIES	0.25 Kg/ha		1.00 Kg/ha		4.00 Kg/ha	
TOMATO	100	xxxxxxxxxxxxxxxxxxxx	30	xxxxxx	0	
(71)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	
OR PUNCT	0		0		0	
(73)	0		0		0	
ELEU IND	0		0		0	
(74)	0		0		0	
ECH CRUS	0		0		0	
(75)	0		0		0	
ROTT EXA	97	xxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	40	xxxxxxxx
(76)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	43	xxxxxxxxx
DIG SANG	0		0		0	
(77)	0		0		0	
AMAR RET	20	xxxx	0		0	
(78)	29	xxxxxx	0		0	
SOL NIG	99	xxxxxxxxxxxxxxxxxxxx	36	xxxxxxx	0	
(81)	64	xxxxxxxxxxxxx	36	xxxxxxx	0	
PHAL MIN	97	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
(84)	50	xxxxxxxxxx	29	xxxxxx	0	
CYP ROTU	70	xxxxxxxxxxxxxx	10	xx	0	
(86)	71	xxxxxxxxxxxxxx	21	xxxx	0	

PERSISTENCE OF METOLACHLOR

(surface spray) Species Perennial ryegrass

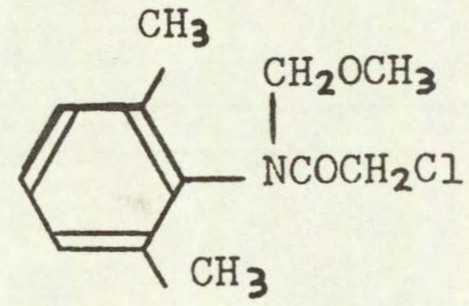


DIMETHACHLOR

Code number CGA 17020

Chemical name ∝-chloro-N-(2-methoxyethyl) aceto-2',6'-xylidide

Structure



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

Information available and suggested uses

Pre-emergence for annual grass and some broad-leaved weed control at 1.0 - 2.0 kg a.i./ha in soyabeans, groundnuts, sugar cane and oil seed rape.

Formulation used 50% w/w a.i. emulsifiable concentrate.

Spray volume 366 l/ha.

RESULTS

Full results are given in the histograms on pages 29-35 and potential selectivities are summarized the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
4.0	none	none listed as no crops tolerant
1.0	dwarf bean rape radish	Tripleurospermum maritimum Polygonum lapathifolium Polygonum aviculare Galium aparine Convolvulus arvensis Solanum nigrum Cyperus rotundus + species below
0.25	species above + kale maize cowpea chickpea* soyabean	Avena fatua Alopecurus myosuriodes Poa annua Poa trivialis Senecio vulgaris Stellaria media Veronica persica Rumex obtusifolius Holcus lanatus Agropyron repens Oryza punctata Eleusine indica Echinochloa crus-galli

* numbers reduced but not due to herbicide

(table continued overleaf)

Table cont.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.25		Digitaria sanguinalis Amaranthus retroflexus Phalaris minor

Comments on results

Activity experiment (see page 29)

The route of action was similar to that found for alachlor and metolachlor, grasses being particularly susceptible to soil, especially pre-emergence treatments. The foliar spray caused minor effects, but only on broad-leaved species. In the pre-emergence treatments, applying the herbicide as a surface spray caused more phytotoxicity than did incorporation for the grasses and kale but differences were less distinct with dwarf bean and Polygonum. This should be borne in mind when considering the results of the pre-emergence selectivity test, where the herbicide was applied as a surface spray. Activity via the soil treatments appeared to be marginally greater than with alachlor and metolachlor.

Symptoms

These were identical to those caused by alachlor and metolachlor.

Soil persistence

Results are presented in the graph on page 35. Using perennial ryegrass as the sensitive test species, a period of persistence in the soil, intermediate between that of alachlor and metolachlor is indicated. The doses of 0.25 and 1.0 kg/ha were not detected when bioassays were run 17 and 28 weeks respectively after spraying. The highest dose of 4.0 kg/ha was still detectable after 49 weeks however.

Pre-emergence selectivity among temperate species

The weed control spectrum was similar to alachlor and metolachlor but activity appeared to be marginally greater. Thus, all five annual grasses were killed or controlled at the lowest dose of 0.25 kg/ha. Broad-leaved weed control too was generally more efficient than with the other two herbicides, both as regards species range and the level of effect, while more toxicity was observed also on the perennial weeds. Thus Convolvulus arvensis and Agropyron repens were controlled by 1.0 kg/ha. The latter species appeared to be adequately controlled by 0.25kg/ha at assessment, but a few plants later made good recovery. Cruciferous weeds were resistant.

Only four crops tolerated dimethachlor; dwarf bean and the brassicas, rape, radish and kale, but the level of tolerance was somewhat less than with alachlor and metolachlor. Cereals, perennial ryegrass and onion were very sensitive.

Although dimethachlor is more active on weeds than alachlor and metolachlor, this advantage is offset a little in that fewer crops were tolerant. Even so, in rape, radish and dwarf bean, more weeds were controlled than with the other two herbicides, including Galium aparine and Polygonum spp., as well as volunteer ryegrass and cereals.

Pre-emergence selectivity among tropical species

The activity of this compound was appreciably greater than alachlor and metolachlor on all types of weed and crop, both grasses and broad-leaved. Its relative selectivity in the few crops tolerant to 0.25 kg/ha cannot be clearly determined but seems likely to be comparable. Its greater activity would therefore be of interest if its price were the same as the other compounds, but such an apparent advantage over metolachlor could be outweighed if its shorter residual life on the soil surface were confirmed in the field. Cyperus rotundus and Oxalis recovered more rapidly from dimethachlor than from metolachlor, in accordance with this shorter persistence.

ACTIVITY EXPERIMENT

DIMETHACHLOR

		0.125 kg/ha	0.75 kg/ha	4.50 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx
	P	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxx
	I	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx + xxxxxxxxxxxx	xxxxxxxxxx xxxxxxxx
KALE	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxx xxxxxxx
	P	xxxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxx xxxxxxxxxxxx	oo
	I	xxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxx xxxxxxxxxxxxx	xxxx xxxx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxx xxxxxxx
	P	xxxxxxxxxxxxxx + xxxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxx	x xx
	I	xxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx + xxxxxxxx	oo
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxxx xxxx
	P	x xxxx	oo	oo
	I	xxxxxxxxxxxxx xxxxxxxxxxxx	x xxx	oo
AVENA FATUA	F	xxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxx xxxxxxxxxxxx	x xx	oo
	I	xxxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxxx xxxxxxx	x x
AGROPYRON REPENS	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxxxx
	P	xxxxxxxxxxxx xxxxxxxxxxx	oo	oo
	I	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxx xxxxx	oo

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

SPECIES	DIMETHACHLOR 0.25 kg/ha		1.00kg/ha		4.00 kg/ha	
WHEAT	93	xxxxxxxxxxxxxxxxxxx	21	xxxx	0	
(1)	36	xxxxxxx	7	x	0	
BARLEY	69	xxxxxxxxxxxxxx	69	xxxxxxxxxxxxxx	0	
(2)	64	xxxxxxxxxxxxx	29	xxxxxx	0	
OAT	89	xxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxx	0	
(3)	36	xxxxxxx	14	xxx	0	
PER RYGR	16	xxx	0		0	
(4)	14	xxx	0		0	
ONION	0		0		14	xxx
(8)	0		0		14	xxx
DWF BEAN	112	xxxxxxxxxxxxxxxxxxx+	112	xxxxxxxxxxxxxxxxxxx+	94	xxxxxxxxxxxxxxxxxx
(9)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	21	xxxx
FLD BEAN	95	xxxxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx	0	
(10)	79	xxxxxxxxxxxxxxxx	36	xxxxxxx	0	
PEA	71	xxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
(11)	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
W CLOVER	107	xxxxxxxxxxxxxxxxxxx+	0		0	
(12)	43	xxxxxxxxx	0		0	
RAPE	93	xxxxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxx+
(14)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx
KALE	114	xxxxxxxxxxxxxxxxxxx+	111	xxxxxxxxxxxxxxxxxxx+	107	xxxxxxxxxxxxxxxxxxx+
(15)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx
CARROT	88	xxxxxxxxxxxxxxxxx	0		0	
(18)	57	xxxxxxxxxxx	0		0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

DIMETHACHLOR

SPECIES		0.25 kg/ha		1.00 kg/ha		4.00 kg/ha
LETTUCE	94	xxxxxxxxxxxxxxxxxx	30	xxxxxx	30	xxxxxx
(20)	43	xxxxxxxxx	14	xxx	14	xxx
SUG BEET	95	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	
(21)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	
AVE FATU	87	xxxxxxxxxxxxxxxx	56	xxxxxxxxxxx	0	
(26)	21	xxxx	14	xxx	0	
ALO MYOS	77	xxxxxxxxxxxxxxx	0		0	
(27)	21	xxxx	0		0	
POA ANN	0		0		0	
(28)	0		0		0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	54	xxxxxxxxxxx	48	xxxxxxxxxx	64	xxxxxxxxxxxxx
(30)	79	xxxxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
RAPH RAP	109	xxxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxxx+	88	xxxxxxxxxxxxxxxxx
(31)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
CHRY SEG	49	xxxxxxxxxx	119	xxxxxxxxxxxxxxxxxxx+	0	
(32)	57	xxxxxxxxxxx	36	xxxxxxx	0	
TRIP MAR	96	xxxxxxxxxxxxxxxxxx	44	xxxxxxxxx	0	
(33)	50	xxxxxxxxxx	29	xxxxxx	0	
SEN VULG	37	xxxxxxx	4	x	0	
(34)	29	xxxxxx	7	x	0	
POL LAPA	55	xxxxxxxxxxx	0		0	
(35)	36	xxxxxxx	0		0	
POL AVIC	56	xxxxxxxxxxx	75	xxxxxxxxxxxxxx	0	
(36)	36	xxxxxxx	29	xxxxxx	0	

DIMETHACHLOR

SPECIES		0.25 kg/ha		1.00 kg/ha		4.00 kg/ha	
GAL APAR	83	xxxxxxxxxxxxxxxxx	28	xxxxxx	17	xxx	
(38)	71	xxxxxxxxxxxxxx	29	xxxxxx	7	x	
STEL MED	6	x	0		0		
(40)	21	xxxx	0		0		
VER PERS	0		3	x	0		
(42)	0		7	x	0		
RUM OBTU	129	xxxxxxxxxxxxxxxxxxx+	0		0		
(44)	29	xxxxxx	0		0		
HOLC LAN	0		0		0		
(45)	0		0		0		
AG REPEN	8	xx	0		0		
(47)	14	xxx	0		0		
ALL VIN	122	xxxxxxxxxxxxxxxxxx+	122	xxxxxxxxxxxxxxxxxx+	22	xxxx	
(49)	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	29	xxxxxx	
TUS FARF	111	xxxxxxxxxxxxxxxxxx+	79	xxxxxxxxxxxxxxx	32	xxxxxx	
(51)	100	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	21	xxxx	
CONV ARV	96	xxxxxxxxxxxxxxxxxx	24	xxxxx	12	xx	
(52)	71	xxxxxxxxxxxxxx	36	xxxxxxx	14	xxx	
MILLET	0		0		0		
(57)	0		0		0		
MAIZE	92	xxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	
(58)	86	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx	
SORGHUM	8	xx	0		0		
(59)	14	xxx	0		0		
RICE	0		0		0		
(60)	0		0		0		
PIGEON P	62	xxxxxxxxxxx	0		0		
(61)	57	xxxxxxxxxx	0		0		

Click here to continue