AGRICULTURAL RESEARCH COUNCIL

WEED RESEARCH ORGANIZATION

TECHNICAL REPORT No. 26

THE POST-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES:

BENTAZON
EMD-IT 6412
CYPRAZINE
METRIBUZIN
CHLORNITROFEN
GLYPHOSATE
MC 4379
CHLORFENPROP-METHYL

W.G. Richardson and M.L. Dean

EMD-IT 6412 is confidential (E Merck or CelaMerck),
MC 4379 is bifenox

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Price

U.K. and overseas surface mail - £3.31
Overseas airmail - £3.56

BEGBROKE HILL, YARNTON, OXFORD

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NOTE

RICHARDSON, W.G. and DEAN, M.L. The post-emergence selectivity of some recently developed herbicides: bentazon, EMD-IT 6412, cyprazine, metribuzin, chlornitrofen, glyphosate, MC 4379 and chlorfenprop-methyl. Tech. Rep. agric. Res. Coun. Weed Res. Orgn., 1973, 26, pp 79.

THE POST-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: BENTAZON, EMD-IT 6412, CYPRAZINE, METRIBUZIN, CHLORNITROFEN, GLYPHOSATE, MC 4379 AND CHLORFENPROP-METHYL

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SUMMARY

Eight herbicides were tested on a range of 35 temperate and 20 tropical weed and crop species grown in pots, to determine their post-emergence activity.

Bentazon showed potential for selective control of a range of broad-leaved weeds, notably members of the Compositae, in cereals and leguminous crops. Annual and perennial grass weed species were particularly resistant.

Crop tolerance was limited with EMD-IT 6412 to cereals, perennial ryegrass, tropical legumes and cotton. No crops tolerated more than 0.38 kg/ha but some useful selectivities, against mainly broad-leaved weeds, were achieved.

Maize and sorghum exhibited good tolerance of cyprazine. Marginal selectivity was found in other cereals and some legumes. A wide range of broad-leaved, grass and perennial weeds showed sensitivity.

Metribuzin achieved good control of the majority of weeds but Galium aparine, Cyperus spp. and Rottboellia exaltata were particularly resistant. Crop tolerance was not outstanding but several selectivities were demonstrated.

Carrot was outstandingly tolerant to chlornitrofen. A range of grass and broad-leaved weeds were susceptible at selective doses including some of the more resistant annual and perennial species.

Glyphosate was highly active with annual and perennial weeds all showing susceptibility. Crop tolerance was very limited but a few marginal selectivities were found.

MC 4379 was particularly active against broad-leaved species. Annual grass and perennial weeds were more resistant. Few crops showed tolerance but some selectivities were found.

Cereals and a range of other crops were tolerant to chlorfenprop-methyl. A number of broad-leaved weeds were controlled in addition to Avena fatua. Many grass and perennial species were resistant but some selectivities were achieved.

INTRODUCTION

The Herbicide Evaluation Section and Tropical Weeds Group of the Weed Research Organization investigate the selectivity of new herbicides which

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are in the process of commercial development by industry. This involves application, both pre-emergence and post-emergence, to a wide range of crop and weed species grown in pots, as a preliminary stage of this process. The objectives are to discover selectivities additional to those pin-pointed by the firm which originally discovered the herbicidal properties of the chemical; to obtain experience of the type of effects produced by the chemical; and to provide a source of information on the relative susceptibility of plant species. The latter may subsequently prove useful in considering problems such as the cropping of land contaminated with the herbicide. Essentially the main value of this experimentation is as a guide in the planning of further experiments both in pots and in the field.

Attention is drawn particularly to the fact that the experiment described here is only a preliminary guide to the relative resistance or susceptibility of the species included. Pot experiments of this sort are not a reliable guide to the dose levels needed to produce the same effects in the field. Furthermore the experiments are conducted on only one widely grown variety of each crop plant or on weed material from one readily available source. Large variations in response can occur between different varieties of the same crop, or between different strains or clones of weed species. In a few instances a cultivar attributed to the same species as the weed has been used for ease of propagation and there are a number of cases where a species has been included which is a crop in some circumstances and a weed in others. The experiments are conducted on one soil type and at one particular stage of growth only. All these important variables can have a profound effect on response. For the above reasons it must be emphasised that the data reported should be regarded primarily as a source of ideas for further work.

The Weed Research Organization only accepts herbicides for inclusion in its research programme if the chemical nature is disclosed. However, in some cases this disclosure is confidential for a limited period of time. Hence there may be occasional instances in these reports where the chemical composition of a herbicide is not stated but marked as confidential. In general, recipients of these reports will find that information on this point becomes available from other sources in a relatively short period of time.

The present report gives data on eight new compounds. Results obtained in Initial Activity Tests are also recorded for those herbicides which have not been included in previous reports, i.e. bentazon, EMD-IT 6412, chlornitrofen, glyphosate, MC 4379 and chlorfenprop-methyl. Those for cyprazine and metribuzin were presented in a previous report (Richardson & Dean 1973).

METHODS AND MATERIALS

a) Initial Activity Tests (IAT 1-4)

This is the first routine test when a new herbicide is received. It provides information on levels of phytotoxicity, mode and type of action and whether the activity is associated with uptake by the roots or foliage of the plant. Herbicides are applied by four different methods to six selected species, four being raised from seeds and perennial species from one-node rhizome fragments (see Table 1 for species data). All species were grown in a sandy loam soil from a field at Begbroke Hill and every treatment is replicated twice.

Table 1. Plant data for Initial Activity Tests

Cultivar/ source		No. per pot at spraying		Depth of planting (cm)	Stage of growth of post-emergence treatments	Stage of growth at assessment	
		pre-	post-			pre-	post-
Dwarf bean (*Phaseolus vulgaris*)	The Prince	2-3	2	1.8	2 unifoliate leaves	1½-2½ trifoliate leaves	1½-2½ trifoliate leaves
Kale (*Brassica oleracea acephala*)	Marrowstem	5-12	5	0.6	1-2 leaves	3-4½ leaves	3½-5 leaves
Polygonum amphibium	WRO Clone 1	6	3-6	1.2	3½-6½ leaves	5½-8½ leaves	7-10½ leaves
Perennial ryegrass (*Lolium perenne*)	S23	8-15	8-10	0.6	1½-2 leaves	4-5½ leaves	3½-6 leaves
Avena fatua	UFS 1961, Harwell 1963 or Boxworth 1967	6-8	4-8	1.2	2-3 leaves	4½-6 leaves	4-7 leaves
Agropyron repens	WRO Clone 31	6	4-6	1.2	2-3 leaves	4½-8 leaves	4½-7 leaves

i) foliar spray, post-emergence

Plants were raised in 8.9 cm plastic disposable pots and thinned to constant number before treatment. The herbicide was applied from a Teejet fan nozzle moving at constant speed 30 cm above the level of maximum foliage. The stage of growth at spraying is given in Table 1. The soil surface was protected with a layer of perlite to intercept any spray which might reach the soil surface. After careful removal of the perlite, following spraying, the plants were transferred to fibre-glass beds in the glasshouse and sub-irrigated until assessment. The herbicide was not washed off the foliage at any time.

ii) soil drench, post-emergence

Plants were raised as for the foliar spraying but herbicides were applied by pipette to the soil surface in 10 ml water per pot. Care was taken to spread the liquid evenly over the soil surface and contact with the stem at soil level was avoided as far as possible. Following application pots were transferred to the glasshouse and watered individually from overhead in foil dishes until assessment.

iii) surface spray, pre-emergence

Test species were planted in untreated soil in 8.9 cm plastic disposable pots (see Table 1 for numbers and depths of planting). The herbicide was applied from a Teejet fan nozzle moving at constant speed 30 cm above the smoothed soil surface. Pots were transferred to foil dishes in the glasshouse and watered from overhead with a boom until emergence. Subsequent watering was individually from overhead.

iv) soil incorporated, pre-emergence

Tin plate containers (19.0 x 13.7 x 7.6 cm) were filled to a depth of 6.5 cm with untreated soil and the herbicide was applied to the soil surface as in (iii). Following complete incorporation the treated soil was used to fill 8.9 cm plastic pots to a depth of 6.5 cm and seeds or rhizome pieces were planted as detailed in Table 1 and watering was overhead as in (iii).

Table 2. Soil and environment conditions for Initial Activity Tests

Experiment number and herbicide(s) included	IAT 1 Chlorfen-prop-methyl	IAT 2 Bentazon	IAT 3 EMD-IT 6412 MC 4379	IAT 4 Chlor-nitrofen Glyphosate
Date of spraying	9.5.67	5.8.69	23.6.71	8.10.71
Main assessment completed	20.6.67	5.9.69	18.7.71	11.11.71
Organic matter (%)	2	2	3	3
Clay content (%)	14	15	16	16
pH	6.8	7.3	7.7	7.7
John Innes Base fertiliser (g/kg)	2.0	2.0	4.0	2.0
DDT (5% dust) (g/kg)	0.5	0.5	0.5	0.5
Fritted trace elements (g/kg)	-	-	-	0.25
Temperature (°C)				
Mean	19	22	20	18
Maximum	30	32	31	25
Minimum	12	15	14	11
Relative humidity (%)				
Mean	60	55	55	50
Maximum	90	85	80	78
Minimum	30	30	30	22

Pre-emergence treatments were assessed some 4-5 weeks after planting and post-emergence treatments about two weeks following treatment.

Assessments for number of survivors and plant vigour were made as described below for the post-emergence selectivity experiments with the

exception of chlorfenprop-methyl where only vigour was recorded. Spraying dates, assessment dates, soil and environmental conditions are summarised in Table 2 for all the Initial Activity Tests.

b) Post-emergence selectivity tests

Eight herbicides were tested at three doses in two separate experiments. Plants were raised in 8.9 cm diameter plastic pots in a sandy loam topsoil from a field at Begbroke Hill. Soil conditions are summarised in Table 3. Planting dates were staggered so that the majority of plants had reached the 2-4 leaf stage by the time of spraying. Temperate species were raised in the open and tropical species in the glasshouse. Environmental conditions during the course of the experiment are recorded in Table 3.

Table 3. Soil and environmental conditions for post-emergence selectivity tests

Experiment number and herbicide(s) included	Experiment 1 Bentazon EMD-IT 6412 Cyprazine		Experiment 2 Metribuzin Chlornitrofen Glyphosate MC 4379 Chlorfenprop-methyl	
Date of spraying	8.7.71		a) 10.9.71 b) 14.9.71	
Main assessment completed	26.7.71		1.10.71	
Organic matter (%)	3		3	
Clay content (%)	15		15	
pH	7.7		7.7	
John Innes Base fertiliser (g/kg)	1.0		2.0	
DDT (5% dust) (g/kg)	0.5		0.5	
Temperature (°C)	Temperate	Tropical	Temperate	Tropical
Mean	18	24	14	23
Maximum	25	35	20	28
Minimum	10	20	6	21
Relative humidity (%)				
Mean	70	60	80	70
Maximum	95	100	100	90
Minimum	42	29	42	25

All species were thinned to a constant number before spraying, with a maximum of nine plants per pot. Certain plant material was pre-treated to improve establishment. Chenopodium album seeds were soaked in 0.1M potassium nitrate solution and kept in the light three days prior to planting. Seeds of Polygonum aviculare and Veronica persica were kept moist at 2°C for at least six weeks before sowing. Tubers of Cyperus

esculentus were stored moist at 4°C for at least 14 days prior to planting to break dormancy. Rottboellia exaltata seeds were soaked for 48-72 hours in water and those which sank were selected and lightly crushed before planting. Perennial species were propagated vegetatively as denoted in Table 4.

Stages of growth at spraying and at assessment are summarised in Table 4 for both experiments. After spraying the plants were protected from rainfall for 24 hours and then given an overhead watering to wash any residues off the foliage. The pots were then returned to their original position in the glasshouse or the open. Additional fertiliser in solution and insecticide and fungicide were applied to individual species as required. In experiment 2 several species had to be sprayed at a later date in order to treat all plants at a similar growth stage.

The herbicides were used in the formulation supplied by the manufacturer for field experimentation. Each treatment was replicated twice on each species and the plants were sprayed using the same laboratory sprayer as used for the Initial Activity Tests. All rates are expressed in kg ai/ha unless otherwise indicated.

Table 4. Species, abbreviations, cultivars and stages of growth at spraying and assessment for post-emergence selectivity tests

	Designation and computer serial number	Cultivar or source	Expt. No.	Stage of growth at spraying (leaf numbers exclusive of cotyledons)	Stage of growth at assessment (untreated controls)
Temperate species					
Wheat (Triticum aestivum)	WHEAT (1)	Kolibri	1	2½ leaves	6 leaves, tillering
			2	2-2½ leaves	5 leaves, tillering
Barley (Hordeum vulgare)	BARLEY (2)	Sultan	1	3 leaves	5 leaves, tillering
			2	2-2½ leaves	5 leaves, tillering
Oat (Avena sativa)	OAT (3)	Condor	1	2½-3 leaves	6½ leaves, tillering
			2	2 leaves	5 leaves, tillering
Perennial ryegrass (Lolium perenne)	PER RYGR (4)	S.23	1	3 leaves	6 leaves, tillering
			2	2 leaves	4 leaves
Onion (Allium cepa)	ONION (8)	Rijnsburger	1	2 leaves	2-2½ leaves
			2	1½-2 leaves	2 leaves
Dwarf bean (Phaseolus vulgaris)	DWF BEAN (9)	The Prince	1	2 unifoliate	1½ trifoliate
			2	2 unifoliate	1½ trifoliate
Field bean (Vicia faba)	FLD BEAN (10)	Maris Bead	1	2½ leaves	6 leaves
			2	2 leaves	4½ leaves
Pea (Pisum sativum)	PEA (11)	Dark Skinned Perfection	1	3½ leaves	8 leaves
			2	2½ leaves	6 leaves

Table 4 (continued)

	Designation and computer serial number	Cultivar or source	Expt. No.	Stage of growth at spraying (leaf numbers exclusive of cotyledons)	Stage of growth at assessment (untreated controls)
White clover (*Trifolium repens*)	W CLOVER (12)	S100	1 2	1½ trifoliate 1 trifoliate	3 trifoliate 2½ trifoliate
Kale (*Brassica oleracea acephala*)	KALE (15)	Marrowstem	1 2	1½–2 leaves 1½ leaves	4 leaves 3½ leaves
Cabbage (*Brassica oleracea capitata*)	CABBAGE (16)	Primo	1 2	2½ leaves 1½ leaves	4 leaves 3½ leaves
Swede (*Brassica napus*)	SWEDE (17)	Lord Derby	1 2	2½ leaves 1½–2 leaves	3½–4 leaves 3½ leaves
Carrot (*Daucus carota*)	CARROT (18)	Chantenay Red Core	1 2	1½ leaves 1½–2 leaves	3½–4 leaves 3½ leaves
Parsnip (*Pastinaca sativa*)	PARSNIP (19)	Hollow Crown	1 2	1 leaf 1 leaf	3 leaves 2½ leaves
Lettuce (*Lactuca sativa*)	LETTUCE (20)	Borough Wonder	1 2	2½ leaves 2½ leaves	5½–6 leaves 7–8 leaves
Sugar beet (*Beta vulgaris*)	SUG BEET (21)	Klein E Monogerm	1 2	3½ leaves 2 leaves	5½ leaves 3½ leaves
Avena fatua	AVE FATU (26)	Boxworth 1967	1 2	3½ leaves 2½ leaves	6 leaves 5 leaves
Alopecurus myosuroides	ALO MYOS (27)	WRO 1967	1 2	2½ leaves 2½–3 leaves	5 leaves, tillering 5 leaves, tillering
Poa annua	POA ANN (28)	WRO 1966	1 2	3 leaves 2–2½ leaves	5 leaves, tillering 5 leaves, tillering
Poa trivialis	POA TRIV (29)	Watts 1971	1 2	3½ leaves 2–2½ leaves	5 leaves, tillering 5 leaves, tillering
Sinapis arvensis	SIN ARV (30)	WRO 1967	1 2	3½ leaves 2 leaves	4½–5 leaves 6½ leaves
Raphanus raphanistrum	RAPH RAP (31)	Black Spanish	1 2	2½ leaves 1½ leaves	3½–4 leaves 3½–4 leaves
Tripleurospermum maritimum	TRIP MAR (33)	WRO 1967	1 2	5½ leaves 4 leaves	8 leaves 8 leaves
Senecio vulgaris	SEN VULG (34)	WRO 1967	1 2	2½ leaves 1–2 leaves	6 leaves 4–5 leaves

Table 4 (continued)

	Designation and computer serial number	Cultivar or source	Expt. No.	Stage of growth at spraying (leaf numbers exclusive of cotyledons)	Stage of growth at assessment (untreated controls)
Polygonum lapathifolium	POL LAPA (35)	WRO 1967	1 2	2 leaves 1½ leaves	6½ leaves 4½ leaves
Polygonum aviculare	POL AVIC (36)	WRO 1968	1 2	5 leaves 2 leaves	7–8 leaves 5 leaves
Rumex crispus	RUM CRIS (37)	Bletchingdon 1967	1 2	2 leaves 1½ leaves	4 leaves 4–5 leaves
Galium aparine	GAL APAR (38)	WRO 1970	1 2	2½ whorls 1½–2 whorls	8–12 whorls 3–4 whorls
Chenopodium album	CHEN ALB (39)	UFS Wytham 1965	1 2	4–5 leaves 1–2 leaves	10 leaves 4 leaves
Stellaria media	STEL MED (40)	WRO 1970	1 2	6–7 leaves 2–4 leaves	10–12 leaves 8 leaves
Spergula arvensis	SPER ARV (41)	WRO 1965	1 2	1½ whorls 1 whorl	12–16 whorls >10 whorls
Veronica persica	VER PERS (42)	WRO 1969	1 2	4 leaves 2 leaves	10 leaves 6 leaves
Agropyron repens	AG REPEN (47)	WRO Clone 31*	1 2	3½ leaves 2–2½ leaves	5½ leaves, tillering 5 leaves, tillering
Agrostis stolonifera	AG STOLO (48)	WRO Clone 1*	1 2	3½ leaves 2½–3 leaves	6 shoots 3 shoots
"Tropical" species (grown under higher of temperature regimes)					
Maize (Zea mays)	MAIZE (58)	Inra 200	1 2	4½ leaves 3½–4 leaves	4–5 leaves 5–6 leaves
Sorghum (Sorghum vulgare)	SORGHUM (59)	Fetereita	1 2	4 leaves 3½–4 leaves	3½–4½ leaves 5½–6 leaves
Rice (Oryza sativa)	RICE (60)	Kogbandi	1 2	3 leaves 2 leaves	3–4 leaves, tillering 4–5 leaves, tillering
Groundnut (Arachis hypogea)	GRND NUT (64)	Natal Common	1 2	4 leaves 3 leaves	5–8 leaves 5–5½ leaves
Soyabean (Glycine max)	SOYABEAN (65)	Merit	1 2	1½ trifoliate 0–½ trifoliate	2–3 trifoliate 2–3 trifoliate
Cotton (Gossypium hirsutum)	COTTON (66)	Samara 26J	1 2	1½ leaves 1–1½ leaves	2½–3 leaves 3–4 leaves

Table 4 (continued)

	Designation and computer serial number	Cultivar or source	Expt. No.	Stage of growth at spraying (leaf numbers exclusive of cotyledons)	Stage of growth at assessment (untreated controls)
Jute (Corchorus olitorius)	JUTE (67)	Trinidad	1	2½ leaves	6–8 leaves
			2	3–3½ leaves	7–8 leaves
Kenaf (Hibiscus cannabinus)	KENAF (68)	Thai Native	1	1 leaf	3–4 leaves
			2	1 leaf	3–3½ leaves
Tobacco (Nicotiana tabacum)	TOBACCO (69)	Yellow Mammoth	1	1½ leaves	6–6½ leaves
			2	2½–3 leaves	5–6 leaves
Sesamum (Sesamum indicum)	SESAMUM (70)	Addis Ababa 1970	1	2 leaves	4–6 leaves
			2	2 leaves	4 leaves
Eleusine indica	ELEU IND (74)	WRO 1964	1	4½ leaves	5–6 leaves, tillering
			2	3½–4 leaves	5–6 leaves, tillering
Echinochloa crus-galli	ECH CRUS (75)	UFS Wytham 1970	1	5 leaves	4–5 leaves
			2	3–3½ leaves	5–6 leaves
Rottboellia exaltata	ROTT EXA (76)	Mozambique 1970	1	4½ leaves	3–4 leaves
			2	2½–3 leaves	5½–7 leaves, tillering
Digitaria sanguinalis	DIG SANG (77)	UFS Wytham 1961	1	3½–4 leaves	3–5 leaves, tillering
			2	3½–4 leaves	5 leaves, tillering
Amaranthus retroflexus	AMAR RET (78)	WRO 1968	1	3 leaves	8–10 leaves
			2	3½–4 leaves	9 leaves
Portulaca oleracea	PORT OLE (79)	WRO 1969	1	POOR GERMINATION	NOT ASSESSED
			2	4 leaves	8–10 leaves
Cynodon dactylon	CYN DACT (82)	WRO Clone 2* (ex Sudan)	1	6½ leaves/shoot, tillering	7–10 leaves/shoot, tillering
			2	4–6½ leaves/shoot	11 leaves/shoot, tillering
Cyperus esculentus	CYP ESCU (85)	WRO Clone 2** (ex South Africa)	1	NIL GERMINATION	
			2	3–4½ leaves	6–8 leaves
Cyperus rotundus	CYP ROTU (86)	WRO Clone 1** (ex Rhodesia)	1	6½ leaves	13 leaves
			2	3½–5½ leaves	8–13 leaves
Oxalis latifolia	OXAL LAT (87)	WRO Clone 2// (ex Cornwall)	1	6 leaves	7–15 leaves
			2	2½–5 leaves	17 leaves

/ = one node rhizome fragments
// = bulbs
* = shoot fragments
** = tubers

c) Assessment and processing of results (post-emergence selectivity experiments)

The number of plants per pot for each species was recorded before spraying and the main assessment was made directly on to punch cards 2-3 weeks after treatment. The numbers of survivors and their vigour, expressed on a 0-7 scoring scale, were recorded for each treatment. Scale points were defined as follows:

0 = completely dead
1 = moribund but not all tissue dead
2 = alive, with some green tissue, but unlikely to make much further growth
3 = very stunted, but apparently still making some growth
4 = considerable inhibition of growth
5 = readily distinguishable inhibition of growth
6 = some detectable adverse effect as compared with control - colour difference, morphological abnormality, epinasty or very slight reduction in growth
7 = indistinguishable from control

The punched cards were processed by ORION computer and these results give rise to the histograms which form the main diagrammatic presentation of the data and are given separately for each herbicide. Each histogram indicates the herbicide used, dose applied and species tested, abbreviations for the latter being summarised in Table 4. For individual species at each dose of herbicide there is a pair of figures; the upper figure represents mean plant survival as a percentage of untreated controls, corrected for any natural mortality in these controls, and the lower figure shows mean vigour score as a percentage of untreated controls. Directly to the right of each figure is the same information presented as a horizontal histogram where each 'x' represents a 5% increment in the value being plotted. (In the Initial Activity Test histograms each 'x' represents a 7% increment). An 'R' indicates a result based on one replicate only, an 'M' represents a missing treatment and a '+' indicates a value in excess of 100%.

For a variety of reasons it was not possible to record the final assessment of certain species on to punch cards. In experiment 1 Portulaca oleracea showed very poor germination and Cyperus esculentus tubers failed to sprout. Emergence of Digitaria sanguinalis was delayed and consequently had to be sprayed on 6.9.71 and assessed on 20.9.71 in this experiment.

Several species, notably the perennials, were kept for a period of several months to observe later effects on the degree of recovery from injury and these final observations are referred to in the text.

Throughout the interpretation of the results arbitrary levels of vigour reduction of 15% or less compared with control in respect of crops, and number or vigour reduction of 70% or more as compared with control in respect of weeds have been taken as the criteria of selectivity. A summary table of observed selectivities and a series of individual comments have been made on the results for each herbicide to highlight the salient points.

BENTAZON

Code number: BAS 3510H **Trade name:** Basagran

Chemical name: 2-isopropyl-1,2,8-benzothiadiazin-3-one-1,1-dioxide

Source:
BASF United Kingdom Ltd
Agricultural Division
Lady Lane
Hadleigh
Suffolk IP7 6BQ

Information available and suggested uses:

Technical information received from the manufacturer during 1969 and 1970 and papers by Fischer (1968, 1969) reveal the post-emergence activity and weed spectrum of this herbicide. It has been effective as a post-emergence treatment, in cereals, maize and rice against a range of weeds and has also been suggested for use against *Cyperus* spp. In combination with dichlorprop (Basagran DP) it has been found effective for post-emergence control of *Matricaria* spp. and *Chrysanthemum segetum* in cereals.

Formulation used: 50% w/w a.i. wettable powder

Spray volume: for selectivity experiment 392 l/ha (34.9 gal/ac)
for initial activity test 338 l/ha (30.1 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE kg ai/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
6.84	barley oat perennial ryegrass dwarf bean pea maize sorghum rice groundnut	All species below
1.71	species above + field bean white clover wheat	*Sinapis arvensis* *Spergula arvensis* *Veronica persica* + species below
0.43	All species above	*Raphanus raphanistrum* *Tripleurospermum maritimum* *Senecio vulgaris* *Polygonum lapathifolium* *Rumex crispus* *Stellaria media* *Galium aparine* *Chenopodium album*

Comments on results

General

Initial Activity Test results showed Polygonum amphibium and particularly kale to be susceptible to the foliar spray. Dwarf bean and the three grass species exhibited substantial resistance to this and all other applications of this product. Post-emergence soil drench was the most active soil treatment with a similar spectrum of activity to the foliar spray. Pre-sowing incorporation reduced activity compared with the soil-surface treatment but both treatments exhibited some degree of activity. This pre-emergence activity has been the subject of a separate report (Richardson and Dean, 1972).

With the exception of soyabean all cereal and leguminous crops were tolerant at 1.71 kg/ha or greater in the post-emergence test. Several broad-leaved weeds were controlled at 0.43 kg/ha but all grass and vegetatively propagated perennial weed species were resistant at 6.84 kg/ha in this experiment.

Symptoms

Sensitive broad-leaved species exhibited a high degree of foliar scorch accompanying chlorosis of newly developing foliage. Pre-emergence applications showed no effect on germination but caused chlorosis of foliage before die-back. These symptoms are typical of herbicides which inhibit photosynthesis.

Temperate weeds and crops

The low dose of 0.43 kg/ha was sufficient to control eight of the twelve broad-leaved weeds tested, while three of those not controlled were reduced in number or vigour by more than 50%. Most notable of the weeds controlled were Galium aparine, Veronica persica and the composite Tripleurospermum maritimum. The two cruciferous weeds, Raphanus raphanistrum and Sinapis arvensis were controlled at 0.43 and 1.71 kg/ha respectively. Of the polygonaceous weeds, Rumex crispus and Polygonum lapathifolium were controlled at 0.43 kg/ha but Polygonum aviculare was resistant at all doses. The resistance of P. aviculare was possibly due to the advanced growth stage at treatment (5 true leaves) as none of the other herbicides in this test (EMD-IT 6412 and cyprazine) were effective on this species. However, resistance of P. aviculare to bentazon has been reported by other workers. All annual and perennial grass weeds were unaffected.

Wheat exhibited minor symptoms at 6.84 kg/ha but barley, oat and perennial ryegrass were all tolerant at this dose. Pea and dwarf bean were also resistant at this rate while the remaining legume crops were tolerant at 1.71 kg/ha only. All other crops were either severely affected or even killed at 0.43 kg/ha.

The selective control of Tripleurospermum maritimum and Galium aparine in cereals and legumes is of considerable interest while several other important weeds such as Veronica persica and Spergula arvensis were also selectively controlled in these crops.

Tropical weeds and crops

No tropical weeds were controlled by bentazon in this test. The grass weeds were characteristically resistant but Amaranthus retroflexus

was also resistant even at 6.84 kg/ha. The perennial species Oxalis latifolia and Cynodon dactylon showed only very minor or no symptoms at all. Cyperus rotundus was reduced at 6.84 kg/ha being killed in one replicate but completely recovered in the second. [In a subsequent post-emergence experiment both C. rotundus and C. esculentus were treated at 2.0 and 4.0 kg/ha. C. rotundus was unaffected at both rates while C. esculentus did show some adverse effects, although there was evidence of recovery at 4.0 kg/ha. These results may however, have been biased by spraying at a more advanced stage of growth than is usual].

The three cereals maize, sorghum and rice were all highly tolerant at 6.84 kg/ha. Groundnut was also resistant at this dose while soyabean only exhibited marginal tolerance at 0.43 kg/ha (reduced by 21% of control). No selective control was achieved in these crops.

Possible uses and further testing

Bentazon would appear to fill a gap in broadleaved weed control in cereals which has existed for many years. Phenoxyalkanoic herbicides have consistently controlled the majority of broadleaved weeds, but their lack of activity on certain composite species, especially Matricaria spp. and Chrysanthemum spp., has been partly responsible for the increase of these weeds in cereals. The high specificity exhibited by bentazon for these species is therefore of great benefit as is the control of several other important weeds such as Galium aparine. Furthermore as reported earlier (Richardson and Dean, 1972) this control also extends to the pre-emergence situation. The present test suggests that bentazon would be safe for use, post-emergence, in cereals undersown with perennial ryegrass and white clover. The earlier pre-emergence test, however, showed white clover to be tolerant only at very low doses while perennial ryegrass was completely tolerant.

Bentazon also shows a very useful selectivity in leguminous crops, such as peas and beans, but the high resistance of Polygonum aviculare would prove a disadvantage. However, as bentazon is compatible with phenoxy-alkanoic compounds it may be possible to broaden the weed control spectrum by combination with these and/or other herbicides.

Perennial broadleaved weeds are not included in these selectivity experiments but in other tests here, bentazon has shown some potential for the control of well established Cirsium arvense if applied well before flowering. Later treatments, even with the addition of dichlorprop, showed little promise however.

From this selectivity experiment bentazon would appear to have only limited application in the tropical situation. The sensitivity of soya-bean in this test was somewhat surprising especially in view of the excellent tolerance reported by Rogers (1973) at doses up to 1.12 kg/ha with plants of a similar stage of growth. The variation between cultivars may partly explain this difference while the effects of air temperature, relative humidity and soil moisture reported by Wills and McWhorter (1972) may also affect responses. Further investigations into groundnut and soyabean tolerance would, therefore, appear worthwhile as well as experiments on the suggested susceptibility of some Cyperus spp.

INITIAL ACTIVITY TEST

BENTAZON

		0.37 kg/ha	1.12 kg/ha	3.36 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxx
	S	xxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxx
	P	xxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx
	I	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxx
KALE	F	xxxx xxxxxx	xxxxxx xxxxx	xxx xx
	S	xxxxxxxxxxx xxxxxxx	x x	o o
	P	xxxxxxxxxxxxxx xxxxxxxxxxxx +	xxxx xxxxxxx	o o
	I	xxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxxxx	x xxxxxxx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xxxx
	S	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxx	xxxxxxxxxxxxx xxx
	P	xxxxxxxxxx xxxxxxxxxxx	xxxxxxx xxxxxxx	xxxx xxxx
	I	xxxxxxxxxxxxx xxxxxxxxxxxx +	xxxxxxxxxx xxxxxxxxx	xx xxxxxxxx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxx xxxxxxxxxxx	xxxxxxx xxxxxxxxxx
	P	xxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxx xxxxxxxxxx
	I	xxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxx xxxxxxxxx
AVENA FATUA	F	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxx
	S	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx
	P	xxxxxxxxxxxxx xxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxx +
	I	xxxxxxxxxxxxx xxxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxxx +
AGROPYRON REPENS	F	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxx
	P	xxxxxxxxxxxxx xxxxxxxxxxx +	xxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxx +
	I	xxxxxxxxxxxxx xxxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxxx +

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

POST-EMERGENCE SELECTIVITY TEST

SPECIES	BENTAZON 0.43 KG/HA		BENTAZON 1.71 KG/HA		BENTAZON 6.84 KG/HA	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(2)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
OAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
PER RYGR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(4)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
ONION	60	xxxxxxxxxxxx	20	xxxx	0	
(8)	71	xxxxxxxxxxxxxx	36	xxxxxxx	0	
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(10)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
PEA	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
W CLOVER	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(12)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
KALE	70	xxxxxxxxxxxxx	0		0	
(15)	57	xxxxxxxxxx	0		0	
CABBAGE	20	xxxx	0		0	
(16)	29	xxxxxx	0		0	
SWEDE	0		0		0	
(17)	0		0		0	
CARROT	25	xxxxx	0		0	
(18)	29	xxxxxx	0		0	

SPECIES	BENTAZON 0.43 KG/HA		BENTAZON 1.71 KG/HA		BENTAZON 6.84 KG/HA	
PARSNIP	8	xx	0		0	
(19)	21	xxxx	0		0	
LETTUCE	0		0		0	
(20)	0		0		0	
SUG BEET	8	xx	0		0	
(21)	14	xxx	0		0	
AVE FATU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(26)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
ALO MYOS	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(27)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
POA ANN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(28)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
POA TRIV	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(29)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
SIN ARV	42	xxxxxxxx	17	xxx	0	
(30)	43	xxxxxxxxx	36	xxxxxxx	0	
RAPH RAP	30	xxxxxx	0		0	
(31)	21	xxxx	0		0	
TRIP MAR	6	x	0		0	
(33)	36	xxxxxxx	0		0	
SEN VULG	0		0		0	
(34)	0		0		0	
POL LAPA	0		0		0	
(35)	0		0		0	
POL AVIC	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx
(36)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx

POST-EMERGENCE SELECTIVITY TEST

SPECIES	BENTAZON 0.43 KG/HA		BENTAZON 1.71 KG/HA		BENTAZON 6.84 KG/HA	
RUM CRIS	0		0		0	
(37)	0		0		0	
GAL APAR	17	xxx	0		0	
(38)	50	xxxxxxxxxx	0		0	
CHEN ALB	17	xxx	0		0	
(39)	50	xxxxxxxxxx	0		0	
STEL MED	7	x	0		0	
(40)	21	xxxx	0		0	
SPER ARV	50	xxxxxxxxxx	0		0	
(41)	43	xxxxxxxxx	0		0	
VER PERS	50	xxxxxxxxxx	20	xxxx	0	
(42)	64	xxxxxxxxxxxxx	29	xxxxxx	0	
AG REPEN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(48)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
MAIZE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(58)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
SORGHUM	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(59)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
RICE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(60)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(64)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
(65)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	

POST-EMERGENCE SELECTIVITY TEST

SPECIES	BENTAZON 0.43 KG/HA		BENTAZON 1.71 KG/HA		BENTAZON 6.84 KG/HA	
COTTON	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(66)	57	xxxxxxxxxx	36	xxxxxxx	21	xxxx
JUTE	8	xx	0		0	
(67)	7	x	0		0	
KENAF	100	xxxxxxxxxxxxxxxxxxxx	38	xxxxxxxx	0	
(68)	43	xxxxxxxxx	21	xxxx	0	
TOBACCO	0		0		0	
(69)	0		0		0	
SESAMUM	56	xxxxxxxxxx	25	xxxxx	0	
(70)	50	xxxxxxxxxx	36	xxxxxxx	0	
ELEU IND	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(74)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
ECH CRUS	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxx
(75)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
ROT EXAL	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(76)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
DIG SANG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(77)	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
AMAR RET	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx
(78)	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
CYN DACT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(82)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
CYP ROTU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx
(86)	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	43	xxxxxxxx
OXAL LAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(87)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx

EMD-IT 6412

Code number: EMD-IT 6412 Trade name: -

Chemical name: Confidential

Source: Celamerck
6507 Ingelheim
P O Box 202
F R Germany

Information available and suggested uses:

Manufacturer's information from 1971 reports contact activity against a broad weed spectrum, including Chrysanthemum segetum, with post-emergence selectivity in cereals.

Formulation used: 12.5% a.i. emulsifiable concentrate (EMD-IT 7181H)

Spray volume: for selectivity experiment 392 l/ha (34.9 gal/ac)
for initial activity test 392 l/ha (34.9 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE kg ai/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
1.14	None	None listed as no crops tolerant
0.38	oat perennial ryegrass maize sorghum	Poa annua Sinapis arvensis Raphanus raphanistrum + species below
0.12	species above + wheat barley rice groundnut soyabean cotton	Tripleurospermum maritimum Senecio vulgaris Polygonum lapathifolium Rumex crispus Galium aparine Chenopodium album Stellaria media Spergula arvensis Veronica persica

Comments on results

General

Initial Activity Test results showed that the foliar spray was highly toxic on the broad-leaved species but not on the grasses. In contrast to the manufacturer's information received, herbicidal activity was found with

the soil treatments but only on kale, Polygonum amphibium and perennial ryegrass. Pre-emergence treatments were much more effective as a surface spray than when incorporated into the soil or applied as a post-emergence soil drench.

Good control of mainly broad-leaved weeds was achieved in the post-emergence selectivity test at rates as low as 0.12 kg/ha. Crop tolerance was limited to cereals, perennial ryegrass, tropical legumes and cotton. No crops tolerated greater than 0.38 kg/ha but some useful selectivities were achieved at lower doses.

Symptoms

A rapid contact scorch was seen on susceptible broad-leaved species within 24 hours of spraying. Buds and axillary shoots were not always affected however, suggesting that there is very little or no translocated effect. The higher sensitivity of the broad-leaved species seemed to be correlated with a high retention of the spray on the foliage. The pre-emergence treatments, in the Initial Activity Test, caused some inhibition of germination or necrosis at an early growth stage.

Temperate weeds and crops

The broad-leaved weed spectrum was very similar to that found with bentazon. Polygonum aviculare was the only broad-leaved weed to tolerate 0.38 kg/ha while the majority were susceptible to 0.12 kg/ha. Some effects were seen on the small seeded weed grasses Alopecurus myosuroides and Poa trivialis and both species suffered serious vigour reductions at 0.38 kg/ha. Poa annua was killed at this dose. Avena fatua and the perennials, Agropyron repens and Agrostis stolonifera were resistant at 0.38 kg/ha.

Crop tolerance was found with the cereals and perennial ryegrass. Oat was the most tolerant of the cereals, satisfying the criteria of selectivity at 0.38 kg/ha while wheat and barley only tolerated the lower dose of 0.12 kg/ha. Perennial ryegrass was resistant at 0.38 kg/ha. Broad-leaved crop species were exceedingly susceptible.

The selective control of a wide range of broad-leaved weeds and Poa annua in cereals was achieved. Results with Tripleurospermum maritimum and Senecio vulgaris suggest that these Compositae would be controlled selectively in cereals. Unfortunately, no information was obtained regarding Chrysanthemum segetum because of its failure to germinate. The selective control of Poa annua in perennial ryegrass at 0.38 kg/ha is also of considerable interest.

Tropical weeds and crops

Tropical weed species were particularly resistant to EMD-IT 6412. The only species controlled were Echinochloa crus-galli and Eleusine indica at 1.14 kg/ha. Even the broad-leaved Amaranthus retroflexus was not controlled at this dose. The perennial species Cyperus rotundus, Cynodon dactylon and Oxalis latifolia showed slight to moderate symptoms at 1.14 kg/ha but were recovering two weeks after treatment.

Sorghum and maize were both tolerant at 0.38 kg/ha and the latter was only slightly reduced at 1.14 kg/ha. Rice and groundnut were resistant at

0.12 kg/ha and were almost so at 0.38 kg/ha. Soyabean and cotton were also tolerant at 0.12 kg/ha. With the exception of cotton and soyabean of the above species, observations suggested that despite severe injury, all plants could well recover from 1.14 kg/ha eventually. The smaller seeded broad-leaved crops were particularly susceptible.

No definite selectivities were found but there is some suggestion from the results for selective control of Eleusine indica and Echinochloa crus-galli in maize at a rate between 0.38 and 1.14 kg/ha.

Possible uses and further testing

The high level of foliar contact action on broad-leaved temperate weeds, coupled with the selectivities found in temperate cereals, are very reminiscent of the phenolic herbicides such as dinoseb. Unfortunately the high mammalian toxicity of EMD-IT 6412 also closely resembles this group of compounds. Although dwarf bean was tolerant to soil treatments of EMD-IT 6412, temperate legumes were not resistant to foliar sprays, unlike the phenolic herbicides. Some further investigation of the control of composite weeds in cereals and Poa annua in perennial ryegrass may well be worthwhile.

INITIAL ACTIVITY TEST

EMD-IT 6412

		0.14 kg/ha (S 0.125 kg/ha)	0.57 kg/ha (S 0.50 kg/ha)	2.28 kg/ha (S 2.00 kg/ha)
DWARF BEAN	F	0	0	0
	S	0	0	0
	P	0	0	0
	I	0	0	0
KALE	F	0	0	0
	S	0	0	0
	P	0	0	0
	I	0	0	0
POLYGONUM AMPHIBIUM	F	0	0	0
	S	0	0	0
	P	0	0	0
	I	0	0	0
PERENNIAL RYEGRASS	F	0	0	0
	S	0	0	0
	P	0	0	0
	I	0 +	0 +	0
AVENA FATUA	F	0	0	0
	S	0	0	0
	P	0	0	0
	I	0 +	0 +	0 +
AGROPYRON REPENS	F	0	0	0
	S	0	0	0
	P	0 +	0 +	0 +
	I	0	0	0 +

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

POST-EMERGENCE SELECTIVITY TEST

SPECIES	EMD-IT 6412 0.12 KG/HA	EMD-IT 6412 0.38 KG/HA	EMD-IT 6412 1.14 KG/HA
WHEAT (1)	100 xxxxxxxxxxxxxxxxxxxx 100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx 57 xxxxxxxxxxx	63 xxxxxxxxxxxxx 43 xxxxxxxxx
BARLEY (2)	100 xxxxxxxxxxxxxxxxxxxx 86 xxxxxxxxxxxxxxxxx	50 xxxxxxxxxx 43 xxxxxxxxx	38 xxxxxxxx 43 xxxxxxxxx
OAT (3)	100 xxxxxxxxxxxxxxxxxxxx 100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx 86 xxxxxxxxxxxxxxxxx	25 xxxxx 50 xxxxxxxxxx
PER RYGR (4)	100 xxxxxxxxxxxxxxxxxxxx 100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx 86 xxxxxxxxxxxxxxxxx	19 xxxx 50 xxxxxxxxxx
ONION (8)	10 xx 43 xxxxxxxxx	0 0	0 0
DWF BEAN (9)	100 xxxxxxxxxxxxxxxxxxxx 71 xxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx 64 xxxxxxxxxxxxx	50 xxxxxxxxxx 29 xxxxxx
FLD BEAN (10)	100 xxxxxxxxxxxxxxxxxxxx 57 xxxxxxxxxxx	75 xxxxxxxxxxxxxxx 57 xxxxxxxxxxx	0 0
PEA (11)	100 xxxxxxxxxxxxxxxxxxxx 79 xxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx 57 xxxxxxxxxxx	25 xxxxx 7 x
W CLOVER (12)	100 xxxxxxxxxxxxxxxxxxxx 71 xxxxxxxxxxxxxx	17 xxx 21 xxxx	0 0
KALE (15)	10 xx 14 xxx	0 0	0 0
CABBAGE (16)	70 xxxxxxxxxxxxxx 43 xxxxxxxxx	0 0	0 0
SWEDE (17)	0 0	0 0	0 0
CARROT (18)	100 xxxxxxxxxxxxxxxxxxxx 71 xxxxxxxxxxxxxx	50 xxxxxxxxxx 43 xxxxxxxxx	0 0

POST-EMERGENCE SHLBCTIVITY TEST

SPECIES	EMD-IT 6412 0.12 KG/HA		EMD-IT 6412 0.38 KG/HA		EMD-IT 6412 1.14 KG/HA	
PARSNIP	75	xxxxxxxxxxxxxxx	58	xxxxxxxxxxxx	0	
(19)	57	xxxxxxxxxxx	43	xxxxxxxxx	0	
LETTUCE	0		0		0	
(20)	0		0		0	
SUG BEET	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	8	xx
(21)	64	xxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
AVE FATU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(26)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
ALO MYOS	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	0	
(27)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	
POA ANN	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(28)	100	xxxxxxxxxxxxxxxxxxxx	0		0	
POA TRIV	100	xxxxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx	0	
(29)	100	xxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	
SIN ARV	42	xxxxxxxx	8	xx	0	
(30)	36	xxxxxxx	14	xxx	0	
RAPH RAP	50	xxxxxxxxxx	20	xxxx	0	
(31)	64	xxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	
TRIP MAR	0		0		0	
(33)	0		0		0	
SEN VULG	0		0		0	
(34)	0		0		0	
POL LAPA	0		0		0	
(35)	0		0		0	
POL AVIC	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	8	xx
(36)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx

POST-EMERGENCE SELECTIVITY TEST

SPECIES	EMD-IT 6412 0.12 KG/HA		EMD-IT 6412 0.38 KG/HA		EMD-IT 6412 1.14 KG/HA	
RUM CRIS	8	xx	0		0	
(37)	43	xxxxxxxxxx	0		0	
GAL APAR	42	xxxxxxxxx	0		0	
(38)	29	xxxxxx	0		0	
CHEN ALB	0		0		0	
(39)	0		0		0	
STEL MED	0		0		0	
(40)	0		0		0	
SPER ARV	0		0		0	
(41)	0		0		0	
VER PERS	0		0		0	
(42)	0		0		0	
AG REPEN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	0	
(48)	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	0	
MAIZE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(58)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
SORGHUM	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	17	xxx
(59)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	21	xxxx
RICE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx
(60)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(64)	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	65	xxxxxxxxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	0	
(65)	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	0	

POST-EMERGENCE SELECTIVITY TEST

SPECIES		EMD-IT 6412 0.12 KG/HA		EMD-IT 6412 0.38 KG/HA		EMD-IT 6412 1.14 KG/HA
COTTON	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(66)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx
JUTE	42	xxxxxxxx	0		0	
(67)	14	xxx	0		0	
KENAF	88	xxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx	13	xxx
(68)	43	xxxxxxxxx	29	xxxxxx	7	x
TOBACCO	10	xx	0		0	
(69)	21	xxxx	0		0	
SESAMUM	0		0		0	
(70)	0		0		0	
ELEU IND	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	6	x
(74)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	14	xxx
ECH CRUS	100	xxxxxxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxx	0	
(75)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	0	
ROT EXAL	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(76)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
DIG SANG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(77)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
AMAR RET	100	xxxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx	33	xxxxxxx
(78)	64	xxxxxxxxxxxxx	64	xxxxxxxxxxxxx	64	xxxxxxxxxxxxx
CYN DACT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(82)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
CYP ROTU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(86)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
OXAL LAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	73	xxxxxxxxxxxxxxx
(87)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	50	xxxxxxxxxx

CYPRAZINE

Code number: S 6115 **Trade name:** Outfox

Chemical name: 2-chloro-4-cyclopropylamino-6-isopropylamino-1,3,5-triazine

Source: Gulf Oil Corporation
0990 West 67th Street
Merriam
Kansas 66204
USA

Information available and suggested uses:

Manufacturer's information received in 1970 reports selective post-emergence control of seedling grasses and broad-leaved weeds in maize at 0.75 kg ai/ha. Pre-emergence applications are also reported as selective in this crop but higher rates of application are necessary.

Formulation used: 12% a.i. emulsifiable liquid

Spray volume: for selectivity experiment 392 l/ha (34.9 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE kg ai/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
1.43	None	None listed as no crops tolerant
0.29	maize sorghum	Avena fatua Alopecurus myosuroides Poa annua Poa trivialis Sinapis arvensis Tripleurospermum maritimum Rumex crispus Spergula arvensis Veronica persica Agropyron repens Agrostis stolonifera Amaranthus retroflexus + species below
0.06	species above + barley oat perennial ryegrass field bean pea rice groundnut	Senecio vulgaris Polygonum lapathifolium Chenopodium album Stellaria media

Comments on results

General

The Initial Activity Test results are given in full in a previous report (Richardson and Dean, 1973). These showed a high level of post-emergence phytotoxicity with this compound which was largely due to root uptake. Broad-leaved species however also exhibited susceptibility to the foliar spray.

In the present test cyprazine exhibited control of a wide range of broad-leaved, grass and perennial weeds. Complete kill of all temperate species occurred at 1.43 kg/ha. Selective control was achieved in the larger seeded temperate and tropical cereals and in some legume crops. The range of weeds controlled and crops tolerant were very similar to the pre-emergence test (Richardson and Dean, 1973), but the rates required for selective control were lower.

Symptoms

Symptoms produced in susceptible species were very similar to those caused by simazine and atrazine. Some initial scorch was evident and the foliage developed chlorosis or became pale prior to dying back.

Temperate weeds and crops

Although the majority of weeds showed susceptibility at 0.29 kg/ha, four annual species were controlled at 0.06 kg/ha. Only Raphanus raphanistrum, Galium aparine and Polygonum aviculare were resistant at 0.29 kg/ha. Thus a broad weed control spectrum was evident including annual and perennial species. The resistance of G. aparine to cyprazine follows the pattern of activity of the other triazines while the resistance of P. aviculare was in common with all the other compounds in this test. The reduction of Agropyron repens and Agrostis stolonifera at 0.29 kg/ha was impressive, which suggests that perennial species are perhaps more susceptible to cyprazine than to atrazine.

The cereals, oat and barley, were tolerant at 0.06 kg/ha but wheat was susceptible. Perennial ryegrass was also resistant at this dose. The large seeded legumes, field bean and pea also showed tolerance at 0.06 kg/ha but dwarf bean was susceptible. Cabbage and carrot showed marginal resistance at this rate (reduced by only 21% of control).

Selective control of four broad-leaved species was achieved at 0.06 kg/ha in barley, oat, perennial ryegrass, field bean and pea.

Tropical weeds and crops

Only Amaranthus retroflexus was controlled at 0.29 kg/ha. At this dose both Eleusine indica and Echinochloa crus-galli were severely reduced but 1.43 kg/ha was necessary for complete control. This higher rate also controlled Digitaria sanguinalis but not Rottboellia exaltata. This represents a similar pattern of activity as atrazine and simazine. Oxalis latifolia was severely affected at 1.43 kg/ha and was completely dead 7 weeks after treatment. There was, however, some recovery from 0.29 kg/ha. Cyperus rotundus was also severely inhibited at 1.43 kg/ha initially but recovery was commencing 7 weeks after treatment. Cynodon dactylon was eventually completely killed at this dose although it did recover from 0.29 kg/ha.

Maize exhibited outstanding tolerance in this test and was completely tolerant at 0.29 kg/ha and only reduced by 21% of control at 1.43 kg/ha. These results are confirmed by those of MacDiarmid (1971) who also found maize highly tolerant of cyprazine and reported this compound to be twice as active against annual grass weeds as atrazine. Sorghum showed more damage than maize at the higher dose but did tolerate 0.29 kg/ha. The smaller seeded crop species were all particularly susceptible.

Only Amaranthus retroflexus was selectively controlled in maize and sorghum at 0.29 kg/ha in this experiment, but selective control of some annual grasses might be expected at a slightly higher dose.

Possible uses and further testing

The majority of weeds controlled in this test were of temperate origin and would not always be found in tolerant crops such as maize and sorghum. However, the outstanding tolerance of maize is of great interest. The activity against perennial species may be of potential use in these crops but this compound does suffer from a lack of activity against certain annual grass weeds which are a particular problem in maize.

POST-EMERGENCE SELECTIVITY TEST

SPECIES		CYPRAZINE 0.06 KG/HA		CYPRAZINE 0.29 KG/HA	CYPRAZINE 1.43 KG/HA
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	0		0
(1)	71	xxxxxxxxxxxxxx	0		0
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	0		0
(2)	86	xxxxxxxxxxxxxxxxx	0		0
OAT	100	xxxxxxxxxxxxxxxxxxxx	0		0
(3)	93	xxxxxxxxxxxxxxxxxxx	0		0
PER RYGR	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx	0
(4)	93	xxxxxxxxxxxxxxxxxxx	21	xxxx	0
ONION	50	xxxxxxxxxx	0		0
(8)	64	xxxxxxxxxxxx	0		0
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx	0
(9)	64	xxxxxxxxxxxxx	21	xxxx	0
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0
(10)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0
PEA	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0
(11)	86	xxxxxxxxxxxxxxxxx	21	xxxx	0
W CLOVER	33	xxxxxxx	0		0
(12)	57	xxxxxxxxxxx	0		0
KALE	80	xxxxxxxxxxxxxxxx	10	xx	0
(15)	71	xxxxxxxxxxxxxx	14	xxx	0
CABBAGE	100	xxxxxxxxxxxxxxxxxxxx	20	xxxx	0
(16)	79	xxxxxxxxxxxxxxxx	36	xxxxxxx	0
SWEDE	80	xxxxxxxxxxxxxxxx	0		0
(17)	50	xxxxxxxxxx	0		0
CARROT	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0
(18)	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0

POST-EMERGENCE SELECTIVITY TEST

SPECIES		CYPRAZINE 0.06 KG/HA		CYPRAZINE 0.29 KG/HA		CYPRAZINE 1.43 KG/HA
PARSNIP	92	xxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxx	0	
(19)	71	xxxxxxxxxxxxxx	43	xxxxxxxxx	0	
LETTUCE	0		0		0	
(20)	0		0		0	
SUG BEET	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(21)	71	xxxxxxxxxxxxxx	0		0	
AVE FATU	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(26)	71	xxxxxxxxxxxxxx	0		0	
ALO MYOS	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(27)	79	xxxxxxxxxxxxxxxx	0		0	
POA ANN	81	xxxxxxxxxxxxxxxx	0		0	
(28)	36	xxxxxxx	0		0	
POA TRIV	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(29)	57	xxxxxxxxxxx	0		0	
SIN ARV	100	xxxxxxxxxxxxxxxxxxxx	42	xxxxxxxx	0	
(30)	79	xxxxxxxxxxxxxxxx	29	xxxxxx	0	
RAPH RAP	100	xxxxxxxxxxxxxxxxxxxx	40	xxxxxxxx	0	
(31)	71	xxxxxxxxxxxxxx	43	xxxxxxxxx	0	
TRIP MAR	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(33)	86	xxxxxxxxxxxxxxxxx	0		0	
SEN VULG	0		0		0	
(34)	0		0		0	
POL LAPA	6	x	0		0	
(35)	14	xxx	0		0	
POL AVIC	100	xxxxxxxxxxxxxxxxxxxx	58	xxxxxxxxxxx	0	
(36)	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	

POST-EMERGENCE SELECTIVITY TEST

SPECIES		CYPRAZINE 0.06 KG/HA		CYPRAZINE 0.29 KG/HA		CYPRAZINE 1.43 KG/HA	
RUM CRIS	42	xxxxxxxx	0		0		
(37)	50	xxxxxxxxxx	0		0		
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	0		
(38)	86	xxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0		
CHEN ALB	8	xx	0		0		
(39)	36	xxxxxxx	0		0		
STEL MED	14	xxx	0		0		
(40)	21	xxxx	0		0		
SPER ARV	100	xxxxxxxxxxxxxxxxxxxx	0		0		
(41)	86	xxxxxxxxxxxxxxxxx	0		0		
VER PERS	100	xxxxxxxxxxxxxxxxxxxx	0		0		
(42)	79	xxxxxxxxxxxxxxxx	0		0		
AG REPEN	100	xxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx	0		
(47)	93	xxxxxxxxxxxxxxxxxxx	14	xxx	0		
AG STOLO	63	xxxxxxxxxxxxx	0		0		
(48)	57	xxxxxxxxxxx	0		0		
MAIZE	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	
(58)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	
SORGHUM	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx	
(59)	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	
RICE	100	xxxxxxxxxxxxxxxxxxx	25	xxxxx	0		
(60)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0		
GRNDNUT	100	xxxxxxxxxxxxxxxxxxx	100R	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	
(64)	86	xxxxxxxxxxxxxxxx	21R	xxxx	14	xxx	
SOYABEAN	100	xxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx	50	xxxxxxxxxx	
(65)	64	xxxxxxxxxxxxx	14	xxx	7	x	

SPECIES	CYPRAZINE 0.06 KG/HA		CYPRAZINE 0.29 KG/HA		CYPRAZINE 1.43 KG/HA	
COTTON	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx
(66)	64	xxxxxxxxxxxxx	36	xxxxxxx	7	x
JUTE	33	xxxxxxx	0		0	
(67)	14	xxx	0		0	
KENAF	100	xxxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx	0	
(68)	64	xxxxxxxxxxxxx	36	xxxxxxx	0	
TOBACCO	10	xx	0		0	
(69)	29	xxxxxx	0		0	
SESAMUM	19	xxxx	0		0	
(70)	21	xxxx	0		0	
ELEU IND	100	xxxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx	0	
(74)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	
ECH CRUS	100	xxxxxxxxxxxxxxxxxxxx	33	xxxxxxx	0	
(75)	93	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	
ROT EXAL	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(76)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
DIG SANG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx
(77)	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	21	xxxx
AMAR RET	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	25	xxxxx
(78)	71	xxxxxxxxxxxxxx	21	xxxx	14	xxx
CYN DACT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	17	xxx
(82)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	36	xxxxxxx
CYP ROTU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(86)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx
OXAL LAT	100	xxxxxxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx	73	xxxxxxxxxxxxxxx
(87)	100	xxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx

METRIBUZIN

Code number: BAYER 94337

Trade name: Sencor, Sencorex

Chemical name: 4-amino-6-t-butyl-3-methylthio-1,2,4-triazin-5-one

Source: Bayer Agrochem Ltd
Eastern Way
Bury St Edmunds
Suffolk

Information available and suggested uses:

Now in use for selective pre- and post-emergence control of annual broad-leaved and grass weeds in potato at 0.84 to 1.40 kg product/ha. Manufacturer's information from 1972 and 1973 also suggests selectivity in flax, tomatoes, maize, beans, peas, soyabeans, lupins and asparagus at 0.5 to 1.5 kg product/ha; pineapples up to 2.0 kg product/ha and raspberries at 2.0-4.0 kg product/ha; also in carrots post-emergence at 0.5 kg product/ha.

Formulation used: 70% w/w a.i. wettable powder (BAY 6159H)

Spray volume: for selectivity experiment 396 l/ha (35.2 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE kg ai/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
1.15	None	None listed as no crops tolerant
0.29	pea carrot	Avena fatua Poa annua Tripleurospermum maritimum Agropyron repens Agrostis stolonifera Echinochloa crus-galli + species below

(Table continued overleaf)

TABLE OF SELECTIVITIES (continued)

RATE kg ai/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
0.07	species above + field bean maize groundnut	Alopecurus myosuroides Poa trivialis Sinapis arvensis Raphanus raphanistrum Senecio vulgaris Polygonum lapathifolium Polygonum aviculare Rumex crispus Chenopodium album Stellaria media Spergula arvensis Veronica persica Eleusine indica Digitaria sanguinalis Amaranthus retroflexus Portulaca oleracea

Comments on results

General

The full results of the Initial Activity Test for metribuzin are reported elsewhere (Richardson and Dean, 1973). Foliar activity was found to be greater than with simazine and atrazine. However, soil treatments were generally more active than foliar application.

Good control of the majority of grass and broad-leaved weeds was achieved post-emergence but crop tolerances were few. Carrot and pea showed outstanding tolerance. Galium aparine, Cyperus spp. and particularly Rottboellia exaltata exhibited outstanding resistance. [In a recent pre-emergence experiment (Richardson and Dean, 1973), at comparable rates of application, the range of weeds controlled was smaller while crop tolerance was similar or slightly better although carrot proved to be more sensitive].

Symptoms

Symptoms exhibited were typical of a photosynthetic inhibitor. Plants became stunted and new foliage developed chlorosis, leading to death, in many cases. Scorch was observed on some young foliage present at the time of spraying.

Temperate weeds and crops

Excellent control of broad-leaved weeds occurred with the low dose of 0.07 kg/ha. Two of the annual grasses were also controlled at this dose. At 0.29 kg/ha all other grass weeds including Avena fatua and the perennials Agropyron repens and Agrostis stolonifera, were controlled as well as Tripleurospermum maritimum. Galium aparine proved to be very resistant.

Pea and carrot showed outstanding tolerance at 0.29 kg/ha while field bean withstood 0.07 kg/ha. The selective control of all weed species except Galium aparine in pea and carrot was outstanding.

Tropical weeds and crops

Metribuzin was highly active on both grass and broad-leaved small seeded annual weeds. Digitaria sanguinalis was particularly sensitive but Echinochloa crus-galli proved to be somewhat more resistant and Rottboellia exaltata exhibited extreme resistance recovering from 1.15 kg/ha one month after assessment. Symptoms in both Cyperus spp. were slow to reach their maximum. C. rotundus exhibited severe symptoms at 1.15 kg/ha some 8 weeks after assessment and tubers were discoloured, but there was recovery from lower rates. C. esculentus proved more susceptible with some tubers rotting at 0.29 kg/ha. Cynodon dactylon was well controlled at 1.15 kg/ha at this time but was recovering from lower doses. Oxalis latifolia was the most susceptible perennial tested with symptoms apparent at all doses 4 weeks after assessment. Bulbs rotted at 0.29 and 1.15 kg/ha.

Crop tolerance was limited to the larger seeded species. Only maize and groundnut exhibited definite tolerance at 0.07 kg/ha. Both species showed minor symptoms but new healthy regrowth was commencing one month later. [Maize proved to be tolerant at 0.30 kg/ha pre-emergence].

Selective control of Eleusine indica, Digitaria sanguinalis, Amaranthus retroflexus and Portulaca oleracea was achieved in maize and groundnut at 0.07 kg/ha.

Possible uses and further testing

The broad weed control spectrum found in pea and carrot, and to a lesser extent in field bean, is worth further investigation, even though Galium aparine proved resistant. Particularly noteworthy is the possible control of Polygonum aviculare which has been an increasing problem, especially in peas, over the past few years.

Although good activity was found on a range of tropical weed species, levels of crop tolerance were only marginal. It may be worthwhile testing this compound further in groundnut and maize, despite the lack of activity on Rottboellia exaltata.

POST-EMERGENCE SELECTIVITY TEST

SPECIES	METRIBUZIN 0.07 KG/HA		METRIBUZIN 0.29 KG/HA		METRIBUZIN 1.15 KG/HA	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx	20	xxxx
(1)	50	xxxxxxxxxx	21	xxxx	7	x
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	0		0	
(2)	71	xxxxxxxxxxxxxx	0		0	
OAT	30	xxxxxx	0		0	
(3)	21	xxxx	0		0	
PER RYGR	19	xxxx	0		0	
(4)	14	xxx	0		0	
ONION	0		0		0	
(8)	0		0		0	
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	36	xxxxxxx	29	xxxxxx	29	xxxxxx
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx	25	xxxxx
(10)	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx	21	xxxx
PEA	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
W CLOVER	0		0		0	
(12)	0		0		0	
KALE	0		0		0	
(15)	0		0		0	
CABBAGE	0		0		0	
(16)	0		0		0	
SWEDE	0		0		0	
(17)	0		0		0	
CARROT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	30	xxxxxx
(18)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	36	xxxxxxx

POST-EMERGENCE SELECTIVITY TEST

SPECIES	METRIBUZIN 0.07 KG/HA		METRIBUZIN 0.29 KG/HA	METRIBUZIN 1.15 KG/HA
PARSNIP	0		0	0
(19)	0		0	0
LETTUCE	0		0	0
(20)	0		0	0
SUG BEET	0		0	0
(21)	0		0	0
AVE FATU	50	xxxxxxxxxx	0	0
(26)	79	xxxxxxxxxxxxxxx	0	0
ALO MYOS	50	xxxxxxxxxx	0	0
(27)	29	xxxxxx	0	0
POA ANN	38	xxxxxxxx	0	0
(28)	43	xxxxxxxxx	0	0
POA TRIV	6	x	0	0
(29)	14	xxx	0	0
SIN ARV	0		0	0
(30)	0		0	0
RAPH RAP	0		0	0
(31)	0		0	0
TRIP MAR	100	xxxxxxxxxxxxxxxxxxxx	0	0
(33)	64	xxxxxxxxxxxxx	0	0
SEN VULG	0		0	0
(34)	0		0	0
POL LAPA	0		0	0
(35)	0		0	0
POL AVIC	63	xxxxxxxxxxxxx	0	0
(36)	21	xxxx	0	0

POST-EMERGENCE SELECTIVITY TEST

SPECIES	METRIBUZIN 0.07 KG/HA		METRIBUZIN 0.29 KG/HA		METRIBUZIN 1.15 KG/HA	
RUM CRIS	0		0		0	
(37)	0		0		0	
GAL APAR	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	0	
(38)	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	0	
CHEN ALB	10	xx	0		0	
(39)	14	xxx	0		0	
STEL MED	0		0		0	
(40)	0		0		0	
SPER ARV	0		0		0	
(41)	0		0		0	
VER PERS	0		0		0	
(42)	0		0		0	
AG REPEN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxx
(47)	79	xxxxxxxxxxxxxxx	29	xxxxxx	14	xxx
AG STOLO	67	xxxxxxxxxxxxx	17	xxx	17	xxx
(48)	64	xxxxxxxxxxxxx	14	xxx	14	xxx
MAIZE	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(58)	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	57	xxxxxxxxxxx
SORGHUM	100	xxxxxxxxxxxxxxxxxxx	17	xxx	0	
(59)	71	xxxxxxxxxxxxxx	14	xxx	0	
RICE	38	xxxxxxxx	0		0	
(60)	29	xxxxxx	0		0	
GRNDNUT	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(64)	86	xxxxxxxxxxxxxxxx	29	xxxxxx	29	xxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(65)	64	xxxxxxxxxxxxx	14	xxx	14	xxx

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