AGRICULTURAL RESEARCH COUNCIL

WEED RESEARCH ORGANIZATION

TECHNICAL REPORT No. 32

THE ACTIVITY AND POST-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES:

OXADIAZON	NORFLURAZON
U-29,722	AC 50,191
U-27,658	AC 84,777
METFLURAZONE	IPRYMIDAM

W.G. Richardson and M.L. Dean

June 1974

Price

U.K. and overseas surface mail - £3.62
Overseas airmail - £3.88

NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate,
U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn),
U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

BEGBROKE HILL, YARNTON, OXFORD

ERRATA. Please note that throughout this report IPRYMIDAN should read IPRYMIDAM. Also, following a recent BSI Committee decision, OXADIAZONE and NORFLURAZONE should now read OXADIAZON and NORFLURAZON

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RICHARDSON, W.G. & DEAN, M.L. The activity and post-emergence selectivity of some recently developed herbicides: oxadiazone, U-29,722, U-27,658, metflurazone, norflurazone, AC 50,191, AC 84,777 and iprymidan. Tech. Rep. agric. Res. Coun. Weed Res. Orgn, 1974, 32, pp 74.

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THE ACTIVITY AND POST-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: OXADIAZONE, U-29,722, U-27,658, METFLURAZONE, NORFLURAZONE, AC 50,191, AC 84,777 AND IPRYMIDAN

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SUMMARY

The foliar and soil activity of eight recently developed herbicides was investigated in pot experiments on six species. Subsequently the early post-emergence selectivity of these compounds was determined on 36 temperate and 20 tropical and sub-tropical crops and weeds.

No selectivities were found with oxadiazone because of lack of crop tolerance. A broad spectrum of weeds were controlled although certain annual and the majority of perennial species exhibited some resistance.

A number of annual broad-leaved weeds were controlled at 6.0 kg/ha with U-29,722 but at lower rates no control was achieved. Annual and perennial grass weeds showed considerable resistance. Crop tolerance was limited to monocotyledonous species.

Results with U-27,658 were of a similar pattern to those obtained with U-29,722. Control of broad-leaved weeds and activity on grass weeds was improved without loss of selectivity.

Carrot showed outstanding tolerance to metflurazone. Several other crops were also resistant but selectivities were marginal. Control of a range of annual broad-leaved and grass species was achieved at higher doses.

Norflurazone exhibited a broad spectrum of crop tolerance at lower doses while the majority of weeds were only controlled at higher rates. Both annual and perennial weeds were susceptible but selectivities were marginal. Generally activity was greater on both crop and weed species compared with the related metflurazone.

A high specificity for Avena fatua was found with AC 50,191 although control took some time to be achieved. A few broad-leaved weeds were also controlled. Many crops showed tolerance, most notably wheat and barley.

AC 84,777 produced a very similar pattern of results to AC 50,191, although Avena fatua and wheat proved to be more susceptible.

Iprymidan was highly active and only a limited number of crops were tolerant. The majority of crop and weed species were severely affected or killed at 3.0 kg/ha. Both mono and dicotyledonous annual weeds were susceptible but selectivities were not outstanding.

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INTRODUCTION

The Herbicide Group and ODA Tropical Weeds Group of the Weed Research Organization investigate the selectivity of new herbicides which 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 selectivity experiments described here are 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, readers 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 post-emergence data on eight new compounds from two separate experiments and results are also included from Activity Experiments which elucidate the types of activity possessed by the herbicides.

METHODS AND MATERIALS

a) Activity Experiments (AE 1-6)

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 were 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 was replicated twice. Soil and environmental conditions are summarised in Table 2. Growth stages at treatment and assessment are recorded for untreated controls exclusive of cotyledons.

Table 1. Plant data for Activity Experiments

	Cultivar/ source	No. per pot at spraying		Depth of planting (cm)	Stage of growth at post-emergence treatment	Stage of growth at assessment	
		pre-	post-			pre-	post-
Dwarf bean (*Phaseolus vulgaris*)	The Prince	3	2-3	1.8	2 unifoliate leaves	$1\frac{1}{2}$-$2\frac{1}{2}$ trifoliate leaves	$1\frac{1}{2}$-2 trifoliate leaves
Kale (*Brassica oleracea acephala*)	Marrow-stem	8-15	4-5	0.6	$\frac{1}{2}$-2 leaves	$2\frac{1}{2}$-$4\frac{1}{2}$ leaves	$1\frac{1}{2}$-4 leaves
Polygonum amphibium	WRO Clone 1	6	3-6	1.2	$2\frac{1}{2}$-$4\frac{1}{2}$ leaves	$4\frac{1}{2}$-$8\frac{1}{2}$ leaves	6-10 leaves
Perennial ryegrass (*Lolium perenne*)	S23	10	10	0.6	2-$2\frac{1}{2}$ leaves	3-8 leaves	5-9 leaves
Avena fatua	Boxworth 1967	8	4-6	1.2	$1\frac{1}{2}$-$2\frac{1}{2}$ leaves	5-8 leaves	4-8 leaves
Agropyron repens	WRO Clone 31	6	4-5	1.2	$1\frac{1}{2}$-3 leaves	4-9 leaves	$5\frac{1}{2}$-9 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 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.

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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 thorough mixing 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. Watering was overhead as in (iii).

Table 2. Soil and environmental conditions for Activity Experiments

Experiment number and herbicides included	AE 1 oxadiazone	AE 2 U-29,722 U-27,658	AE 3 metflurazone	AE 4 iprymidan	AE 5 norflurazone	AE 6 AC 50,191 AC 84,777
Date of spraying	15.5.70	5.6.70	25.6.70	3. 9.70	10.11.70	14.4.72
Main assessment completed	15.6.70	3.7.70	23.7.70	3.11.70	8.12.70	18.5.72
Organic matter (%)	1.8	1.8	1.8	2.1	2.1	2.8
Clay content (%)	13.0	13.0	13.0	13.0	13.0	16.0
pH	7.3	7.3	7.3	7.2	7.2	7.7
John Innes Base fertiliser (g/kg)	4.0	4.0	4.0	4.0	4.0	4.0
5% DDT dust (g/kg)	0.5	0.5	0.5	0.5	0.5	0.5
Fritted trace elements (g/kg)	-	-	-	-	-	0.25
Temperature (°C)						
Mean	20	20	21	20	19	18
Maximum	32	35	35	26	25	27
Minimum	11	11	11	15	12	8
Relative humidity (%)						
Mean	60	60	60	50	55	60
Maximum	95	90	90	78	76	90
Minimum	34	28	28	28	32	25

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b) Post-emergence selectivity experiments

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

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Experiment number and herbicides included	Experiment 1 oxadiazone U-29,722 U-27,658 metflurazone		Experiment 2 norflurazone AC 50,191 AC 84,777 iprymidan	
Date of spraying	9.9.70		6.7.72	
Assessment completed	30.9.70		26.7.72	
Organic matter (%)	2.1		2.8	
Clay content (%)	13.0		16.0	
pH	7.2		7.0	
John Innes Base fertiliser (g/kg)	1.5		2.0	
5% DDT dust (g/kg)	0.5		0.5	
Temperature (^{o}C)	Temperate	Tropical	Temperate	Tropical
Mean	15	24	13	24
Maximum	24	28	18	31
Minimum	8	20	8	15
Relative humidity (%)				
Mean	70	75	75	70
Maximum	95	90	95	95
Minimum	32	40	50	30

Before spraying all species were thinned to constant number with a maximum of nine plants per pot. Certain plant material was pre-treated to improve establishment. Chenopodium album seeds were soaked in 0.1 M potassium nitrate solution and kept in the light three days prior to planting in the first experiment but in the second experiment seeds were lightly rubbed with fine sand-paper before sowing. 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 in both experiments to break dormancy. In the second experiment bulbs of Oxalis latifolia were stored at 2°C for 14 days prior to heating at 45°C for 2 hours before planting. Perennial species were propagated vegetatively as denoted in Table 4.

Stages of growth (exclusive of cotyledons) 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.

The herbicides were used in the formulation supplied by the manufacturer for field experimentation but special surfactants were added where necessary and are referred to where appropriate. Unless otherwise indicated, all doses were in terms of active ingredient i.e. kg a.i./ha. Each treatment was replicated twice on each species and the plants were sprayed using the same laboratory sprayer as used for the Activity Experiments.

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

	Designation and computer serial number	Expt. No.	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls)
Temperate species					
Wheat (Triticum aestivum)	WHEAT (1)	1	Kolibri	3 leaves	5½ leaves, tillering
		2		3-4 leaves	6 leaves, tillering
Barley (Hordeum vulgare)	BARLEY (2)	1	Sultan	3 leaves	5½ leaves, tillering
		2		3½ leaves	7 leaves, tillering
Oat (Avena sativa)	OAT	1	Condor	2½-3 leaves	5½ leaves, tillering
		2		2½ leaves	7 leaves, tillering

Table 4 (continued)

	Designation and computer serial number	Expt. No.	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls)
Perennial ryegrass (Lolium perenne)	PER RYGR (4)	1	S 23	2 leaves	5 leaves, tillering
		2		2 leaves	6 leaves, tillering
Onion (Allium cepa)	ONION (8)	1	Rijnsburger	1½-2 leaves	2 leaves
		2	Ailsa Craig	2 leaves	2½ leaves
Dwarf bean (Phaseolus vulgaris)	DWF BEAN (9)	1	The Prince	2 unifoliate	1½ trifoliate
		2		2 unifoliate	1½ trifoliate
Field bean (Vicia faba)	FLD BEAN (10)	1	Maris Bead	2 leaves	not recorded
		2		2½ leaves	7½ leaves
Pea (Pisum sativum)	PEA (11)	1	(Dark Skinned	3 leaves	6½ leaves
		2	(Perfection	2½ leaves	9 leaves
White clover (Trifolium repens)	W CLOVER (12)	1	S 100	1 trifoliate	3½-4 trifoliate
		2		1 trifoliate	7½ trifoliate
Kale (Brassica oleracea acephala)	KALE (15)	1	Marrowstem	1½-2 leaves	3½-4 leaves
		2		2½ leaves	4 leaves
Cabbage (Brassica oleracea capitata)	CABBAGE (16)	1	Primo	1½-2 leaves	not recorded
		2		1½-2½ leaves	4½ leaves
Swede (Brassica napus)	SWEDE (17)	1	Lord Derby	2-2½ leaves	3½-4 leaves
		2		2½ leaves	3½ leaves
Carrot (Daucus carota)	CARROT (18)	1	(Chantenay Red	1-2 leaves	3½ leaves
		2	(Core	1½-2 leaves	5½ leaves
Parsnip (Pastinaca sativa)	PARSNIP (19)	1	Hollow Crown	1-1½ leaves	2½-3 leaves
		2	Avonresister	1 leaf	2½ leaves
Lettuce (Lactuca sativa)	LETTUCE (20)	1	Borough Wonder	2-2½ leaves	4½-5 leaves
		2		3½ leaves	8½ leaves
Sugar beet (Beta vulgaris)	SUG BEET (21)	1	(Klein E	2 leaves	3½-4 leaves
		2	(monogerm	2 leaves	4½ leaves
Avena fatua	AVE FATU (26)	1	Boxworth 1967	2½ leaves	5½ leaves, tillering
		2		3½ leaves	6 leaves, tillering

Table 4 (continued)

	Designation and computer serial number	Expt. No.	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls)
Alopecurus myosuroides	ALO MYOS (27)	1	Rothamsted 1968	2½ leaves	5 leaves, tillering
		2		2½ leaves	8 leaves, tillering
Poa annua	POA ANN (28)	1	Twyfords Ltd 1967	3 leaves	6 leaves, tillering
		2	WRO 1966	4 leaves	numerous tillers
Poa trivialis	POA TRIV (29)	1	Twyfords Ltd 1967	2½ leaves	6 leaves, tillering
		2	Watts Ltd 1972	2 leaves	5 leaves, tillering
Sinapis arvensis	SIN ARV (30)	1	WRO 1966	2½-3 leaves	3½ leaves
		2	WRO 1964	3½ leaves	6 leaves
Raphanus raphanistrum	RAPH RAP (31)	1	Black Spanish	2½ leaves	3½ leaves
		2		1½ leaves	4-4½ leaves
Chrysanthemum segetum	CHRY SEG (32)	1	WRO 1967	2-3 leaves	7½-8½ leaves
		2	WRO 1971	nil germination	
Tripleurospermum maritimum	TRIP MAR (33)	1	WRO 1969	3-4 leaves	6-7 leaves
		2	WRO 1967	4½ leaves	9½ leaves
Senecio vulgaris	SEN VULG (34)	1	WRO 1967	2-3 leaves	6 leaves
		2	WRO 1970	2 leaves	6½ leaves
Polygonum lapathifolium	POL LAPA (35)	1	WRO 1967	1 leaf	3½ leaves
		2	WRO 1970	2½ leaves	5½ leaves
Polygonum aviculare	POL AVIC (36)	1	Wytham 1967	2½ leaves	8-11 leaves
		2	WRO 1968	nil germination	
Rumex crispus	RUM CRIS (37)	1	(Bletchington	½-1 leaf	1-2 leaves
		2	(1967	2½ leaves	4-6 leaves
Galium aparine	GAL APAR (38)	1	WRO 1969	1 whorl	12-20 whorls
		2	WRO 1970	1-2 whorls	6½ whorls
Chenopodium album	CHEN ALB (39)	1	Gosford Rd 1967	2½ leaves	8 leaves
		2	WRO 1971	6 leaves	10 leaves
Stellaria media	STEL MED (40)	1	Wytham 1967	4 leaves	12 leaves
		2	WRO 1970	6-8 leaves	numerous shoots
Spergula arvensis	SPER ARV (41)	1	WRO 1964	1 whorl	7 whorls
		2	WRO 1965	1½ whorls	8 whorls

Table 4 (continued)

	Designation and computer serial number	Expt. No.	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls)
Veronica persica	VER PERS (42)	1	not tested		
		2	WRO 1970	nil germination	
Solanum nigrum	SOL NIG (43)	1	not tested		
		2	Asmer Seeds Ltd 1972	1½ leaves	6½ leaves
Agropyron repens	AG REPEN (47)	1	WRO Clone 31*	2-2½ leaves	5½ leaves, tillering
		2		3-3½ leaves	5½ leaves, tillering
Agrostis stolonifera	AG STOLO (48)	1	WRO Clone 1*	2-4 leaves	not recorded
		2		1½-4 leaves	14 shoots
Tropical species (grown under higher of temperature regimes)					
Maize (Zea mays)	MAIZE (58)	1	Inra 200	2½ leaves	6 leaves
		2		3 leaves	6-7 leaves
Sorghum (Sorghum bicolor)	SORGHUM (59)	1	SB 68	2-2½ leaves	5-6 leaves
		2	Fetereita	3 leaves	5-5½ leaves
Rice (Oryza sativa)	RICE (60)	1	Kogbandi	2 leaves	4-6 leaves, tillering
		2	IR 5	2½-3 leaves	3 leaves, tillering
Groundnut (Arachis hypogea)	GRNDNUT (64)	1	Natal Common	2½ leaves	5-6 leaves
		2		2½ leaves	5-6 leaves
Soyabean (Glycine max)	SOYABEAN (65)	1	Altona	½-1 trifoliate	3-4 trifoliate
		2	Wayne	½-1 trifoliate	3½-4 trifoliate
Cotton (Gossypium hirsutum)	COTTON (66)	1	26 J	1½ leaves	3-4 leaves
		2		1-2 leaves	2½-3 leaves
Jute (Corchorus olitorius)	JUTE (67)	1	Trinidad 1970	½-1½ leaves	5-6 leaves
		2	Egypt 1971	3-3½ leaves	8-9½ leaves
Kenaf (Hibiscus cannabinus)	KENAF (68)	1	Thai Native	1½-2 leaves	4-5 leaves
		2		1½-2 leaves	4½-5½ leaves
Tobacco (Nicotiana tabacum)	TOBACCO (69)	1	Yellow Mammoth	2 leaves	5-6 leaves
		2		4-5 leaves	4½ leaves

Table 4 (continued)

	Designation and computer serial number	Expt. No.	Cultivar or source	Stage of growth at spraying	Stage of growth at assessment (untreated controls)
Sesamum (Sesamum indicum)	SESAMUM (70)	1	not tested		
		2	Addis Ababa 1970	1½-2 leaves	4 leaves
Eleusine indica	ELEU IND (74)	1	WRO 1964	2½-3 leaves	6-7 leaves
		2		3½-4 leaves	7-7½ leaves, tillering
Echinochloa crusgalli	ECH CRUS (75)	1	WRO 1966	2½-3 leaves	6-7 leaves
		2	WRO 1969	3-4½ leaves	6 leaves
Rottboellia exaltata	ROT EXAL (76)	1	Philippines 1970	2-2½ leaves	5-6 leaves
		2	Rhodesia 1971	3-3½ leaves	4½-6 leaves
Digitaria sanguinalis	DIG SANG (77)	1	not tested		
		2	WRO 1968	2-3 leaves	6-7 leaves, tillering
Amaranthus retroflexus	AMAR RET (78)	1	WRO 1968	4½ leaves	10-12 leaves
		2		2-3 leaves	8½-10 leaves
Portulaca oleracea	PORT OLE (79)	1	WRO 1967	2-4 leaves	12 leaves
		2	WRO 1969	2-4 leaves	12-16 leaves
Cynodon dactylon	CYN DACT (82)	1	WRO Clone 2*	3½-5½ leaves	Numerous shoots
		2	(ex Sudan)	4½-7 leaves	25-35 shoots/pot
Cyperus esculentus	CYP ESCU (85)	1	not tested		
		2	WRO Clone 2** (ex South Africa)	2-5½ leaves	10-11 leaves
Cyperus rotundus	CYP ROTU (86)	1	WRO Clone 1**	5½ leaves	9 leaves
		2	(ex Rhodesia)	4-5 leaves	13 leaves
Oxalis latifolia	OXAL LAT (87)	1	not tested		
		2	WRO Clone 2/// (ex Cornwall)	2-2½ leaves	6-14 leaves

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

c) Assessment and processing of results

In the Activity Experiments, the number of surviving plants was recorded and plant vigour was assessed on the 0-7 scale as defined below. Histograms were prepared with similar format to those described for the selectivity experiments.

In selectivity experiment 1 the number of plants per pot for each species was recorded on punch cards before spraying and the main assessment

was made directly on to punch cards 2-3 weeks after treatment. In selectivity experiment 2 all information was tabulated prior to assembly on papertape. The number of survivors and their vigour 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 punch cards used in experiment 1 were processed by ORION computer while the data from experiment 2 was processed by an ICL 470 computer. 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. With Activity Experiment histograms, each 'x' represents a 7% increment. An 'R' indicates a result based on one replicate only, 'M' represents a missing treatment and '+' indicates a value in excess of 100%.

For a variety of reasons it was not possible to process the data for certain species. In the first experiment there was severe mortality of plants of Rumex crispus, even in control pots, which was believed due to contamination. Onion plants also suffered a premature die-back but as this occurred only in control pots it was possible to draw some conclusions from the herbicide treatments. In the second experiment, Chrysanthemum segetum, Polygonum aviculare and Veronica persica showed inadequate germination. Dwarf bean control plants were contaminated but some assessment of the herbicide treatments was possible.

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.

OXADIAZONE

Code numbers RP 17623, Vt 2569 Trade name Ronstar

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

Source Rhone Poulenc
Societe des Usines Chimiques
21me rue Jean Goujon
Paris 8me
France
via May and Baker Ltd
Ongar Research Station
Fyfield Road
Ongar
Essex

Information available and suggested uses

Introduced at the 3rd EWRC Symposium (1969) for selective control of annual grass and broad-leaved weeds in potatoes, groundnut, cotton and soyabean at 0.56-1.68 kg/ha, applied pre-crop emergence. Good activity was also reported on Convolvulus arvensis and Calystegia sepium with pre-emergence application of 2.0 kg/ha. Burgaud et al (1969) suggest two main uses of oxadiazone under temperate conditions; a) selective weed control in certain ornamental and garden crops and b) selective weed control in woody species. The herbicide persists in the soil and shows a useful 'knock-down' post-emergence effect. It is also suggested for total weed control and in rice.

Formulation used 40% w/v a.i. emulsifiable concentrate

Spray volume 338 l/ha (30.1 gal/ac) in both experiments

RESULTS

Full histogram results are given on pages 14-18 and potential selectivities are summarised in the following Table.

Rate (kg ai/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
4.5, 1.5 and 0.5	None	None listed as no crops tolerant

Comments on results

General

Activity was found on all species in the activity experiment especially following the foliar and pre-emergence treatments. In the latter, surface application tended to be more phytotoxic than incorporation, this being particularly noticeable with the smaller seeded species. Post-emergence soil drenches tended to be less active against broad-leaved species than comparable foliar applications. These results would support the manufacturer's report that uptake is largely through the emerging shoot.

Results from the selectivity experiment showed a high level of phytotoxicity such that no crop species were tolerant, although a wide range of weeds were susceptible.

Symptoms

Severe scorch symptoms appeared on treated foliage within a few days of spraying. Axillary buds and main shoots were not always affected however, and in some instances there was recovery. New leaves were frequently shiny and showed deformity due to leaf-trapping. In pre-emergence treatments higher doses resulted in a failure of grass seedlings to emerge from the coleoptile while at lower rates leaf trapping was again a feature.

Temperate weeds and crops

0.5 kg/ha was sufficient to control several important broad-leaved weeds including Galium aparine. A serious limitation was observed however, with the high resistance of Stellaria media and to a lesser extent Polygonum aviculare. [A similar result was found with pre-emergence applications on S. media (Richardson and Dean, unpublished data)]. Grass weeds were generally more tolerant with Poa trivialis being the only representative controlled at 0.5 kg/ha. The perennials Agropyron repens and Agrostis stolonifera showed considerable resistance.

No temperate crop species satisfied the criteria for selectivity in this test. However, carrot exhibited some marginal resistance at 0.5 kg/ha and new healthy leaves were produced even at 4.5 kg/ha following severe initial scorch. [In an earlier pre-emergence experiment carrot and lettuce showed good tolerance at 1.3 kg/ha but only Chenopodium album and Convolvulus arvensis were controlled]. Amongst the grasses, Poa trivialis proved to be more susceptible than perennial ryegrass.

Tropical weeds and crops

All annual weed species were severely affected at 0.5 kg/ha with the exception of Rottboellia exaltata. [This species showed greater susceptibility to pre-emergence treatments in an earlier experiment]. Cynodon dactylon showed considerable sensitivity with the majority of plants eventually being killed at 1.5 kg/ha. Slow recovery was apparent at 0.5 kg/ha but no new rhizome was produced. Cyperus rotundus was recovering from 4.5 kg/ha 10 weeks after application but no tuber or rhizome development had occurred.

As in the temperate situation, no crops showed definite tolerance. However, rice showed only mild symptoms at 0.5 kg/ha and vigour was only slightly reduced at higher doses.

Possible uses and further testing

Post-emergence margins of selectivity were negligible but the results obtained in these experiments suggest some potential as a contact pre-crop emergence herbicide with some residual soil activity and for selective control of Echinochloa crus-galli in rice at low doses.

The recovery of several perennial species and the resistance of certain annual weeds suggests limitations to the value of oxadiazone for total weed control.

However in other pot trials oxadiazone has proved to be an effective treatment for the control of well established plants of Convolvulus arvensis, Calystegia sepium and Pteridium aquilinum.

ACTIVITY EXPERIMENT

OXADIAZONE

		0.3 kg/ha	1.3 kg/ha	5.1 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xxxx
	S	xxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx
	P	xxxxx xxxx	xxxxxxx xxx	o o
	I	xxxxxxxxxxxx xxxxxxxxxx	o o	o o
KALE	F	xxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xxx
	S	xxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx
	P	xxxxxx xxxxxxxxxx	x xxx	o o
	I	xxxxxxxxxxxxx xxxxxxxxxxxx +	xxxxxxxxxxxxx xxxxxxxxxx	x xxxxxx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxx	xxxxxxx xxx
	S	xxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxx
	P	xxxxxxxxxxx xxxxxxxxxxxx	xxxx xxxx	o o
	I	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxx xxxxxxxxxxxx	xxxxx xxxx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxx xxx
	S	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxx xxx
	P	o o	o o	o o
	I	xxxxxxxxxx xxxxxxxxxxx	o o	o o
AVENA FATUA	F	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxxxx	xxxxxxxxx xxxx
	S	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxx	xxxxxxxxx xxxxxx
	P	xxxxxxxxxxx xxxxxxxxx	xx xxxx	o o
	I	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxx xxxxxx	o o
AGROPYRON REPENS	F	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxx
	S	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxx
	P	xxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx +	xxxxxxxxxx xxxxx
	I	xxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxx xxxxxx	xxxxxxxx xxxx

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

NB:AC 50-NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate (AC 21,053 is 3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	OXADIAZONE 0.50 KG/HA		OXADIAZONE 1.5 KG/HA		OXADIAZONE 4.5 KG/HA	
WHEAT	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	13	xxx
(1)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxxxx	13	xxx	0	
(2)	71	xxxxxxxxxxxxxx	14	xxx	0	
OAT	100	xxxxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	0	
(3)	64	xxxxxxxxxxxxxx	36	xxxxxxx	0	
PER RYGR	81	xxxxxxxxxxxxxxxx	31	xxxxxx	19	xxxx
(4)	57	xxxxxxxxxxx	36	xxxxxxx	14	xxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	25	xxxxx
(9)	43	xxxxxxxxx	21	xxxx	7	x
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(10)	43	xxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
PEA	100R	xxxxxxxxxxxxxxxxxxxxxx	100R	xxxxxxxxxxxxxxxxxxxxxx	100R	xxxxxxxxxxxxxxxxxxxxxx
(11)	29R	xxxxxx	29R	xxxxxx	29R	xxxxxx
W CLOVER	31	xxxxxx	13	xxx	0	
(12)	29	xxxxxx	29	xxxxxx	0	
KALE	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(15)	57	xxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
CABBAGE	100	xxxxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(16)	43	xxxxxxxxx	29	xxxxxx	14	xxx
SWEDE	100	xxxxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(17)	57	xxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
CARROT	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(18)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	50	xxxxxxxxxx
PARSNIP	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(19)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	43	xxxxxxxxx

SPECIES	OXADIAZONE 0.50 KG/HA		OXADIAZONE 1.5 KG/HA		OXADIAZONE 4.5 KG/HA	
LETTUCE	0		0		0	
(20)	0		0		0	
SUG BEET	80	xxxxxxxxxxxxxxxx	20	xxxx	0	
(21)	50	xxxxxxxxxx	14	xxx	0	
AVE FATU	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	0	
(26)	71	xxxxxxxxxxxxxx	36	xxxxxxx	0	
ALO MYOS	100	xxxxxxxxxxxxxxxxxxxx	6	x	6	x
(27)	64	xxxxxxxxxxxxx	14	xxx	14	xxx
POA ANN	50	xxxxxxxxxx	6	x	0	
(28)	43	xxxxxxxxx	14	xxx	0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	58	xxxxxxxxxxxx	50	xxxxxxxxxx	8	xx
(30)	29	xxxxxx	21	xxxx	14	xxx
RAPH RAP	10	xx	0		0	
(31)	14	xxx	0		0	
CHRY SEG	89	xxxxxxxxxxxxxxxxxx	0		0	
(32)	50	xxxxxxxxxx	0		0	
TRIP MAR	75	xxxxxxxxxxxxxxx	8	xx	0	
(33)	50	xxxxxxxxxx	14	xxx	0	
SEN VULG	31	xxxxxx	0		0	
(34)	29	xxxxxx	0		0	
POL LAPA	0		0		0	
(35)	0		0		0	
POL AVIC	94	xxxxxxxxxxxxxxxxxx	56	xxxxxxxxxxx	44	xxxxxxxxx
(36)	57	xxxxxxxxxxx	43	xxxxxxxxx	36	xxxxxxx

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	OXADIAZONE 0.50 KG/HA		OXADIAZONE 1.5 KG/HA		OXADIAZONE 4.5 KG/HA	
GAL APAR	100	xxxxxxxxxxxxxxxxxxxxxx	40	xxxxxxxx	20	xxxx
(38)	21	xxxx	14	xxx	7	x
CHEN ALB	0		0		0	
(39)	0		0		0	
STEL MED	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	69	xxxxxxxxxxxxxx
(40)	100	xxxxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	57	xxxxxxxxxxx
SPER ARV	0		0		0	
(41)	0		0		0	
AG REPEN	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(47)	71	xxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	50	xxxxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx
(48)	64	xxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
MAIZE	100	xxxxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	25	xxxxx
(58)	64	xxxxxxxxxxxxx	43	xxxxxxxxx	21	xxxx
SORGHUM	25	xxxxx	0		0	
(59)	14	xxx	0		0	
RICE	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(60)	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(64)	64	xxxxxxxxxxxxx	57	xxxxxxxxxxx	43	xxxxxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(65)	64	xxxxxxxxxxxxx	64	xxxxxxxxxxxxx	36	xxxxxxx
COTTON	100	xxxxxxxxxxxxxxxxxxxxxx	25	xxxxx	0	
(66)	29	xxxxxx	7	x	0	
JUTE	0		0		0	
(67)	0		0		0	

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES		OXADIAZONE 0.50 KG/HA		OXADIAZONE 1.5 KG/HA		OXADIAZONE 4.5 KG/HA
KENAF	50	xxxxxxxxxx	38	xxxxxxxx	0	
(68)	7	x	7	x	0	
TOBACCO	0		0		0	
(69)	0		0		0	
ELEU IND	56	xxxxxxxxxxx	0		0	
(74)	36	xxxxxxx	0		0	
ECH CRUS	33	xxxxxxx	0		0	
(75)	21	xxxx	0		0	
ROT EXAL	100	xxxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(76)	71	xxxxxxxxxxxxxx	29	xxxxxx	21	xxxx
AMAR RET	63	xxxxxxxxxxxxx	0		0	
(78)	21	xxxx	0		0	
PORT OLE	8	xx	0		0	
(79)	14	xxx	0		0	
CYN DACT	100	xxxxxxxxxxxxxxxxxxx	38	xxxxxxxx	38	xxxxxxxx
(82)	57	xxxxxxxxxxx	21	xxxx	29	xxxxxx
CYP ROTU	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(86)	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxx

NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

U-29,722

Code number U-29,722 **Trade name** -

Chemical name 3,4,5-tribromo-α-methyl-pyrazole-1-acetic acid

Source The Upjohn Company
Kalamazoo
Michigan 49001
USA

Information available and suggested uses

Manufacturer's literature from 1970 suggests post-emergence control of broad-leaved weeds at 1.12-6.72 kg/ha. Tropical and temperate cereals are reported to be tolerant as well as sugar cane. This compound can also be used for broad-leaved weed control in plantation and non-crop areas. Treatment of established turf at 1.12-6.72 kg/ha and control of brush species at 5.60-16.80 kg/ha is suggested. The use of surfactants may enhance activity.

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

Spray volume 338 l/ha (30.1 gal/ac) in both experiments

RESULTS

Full histogram results are on pages 21-25 and potential selectivities are summarised in the following Table.

Rate (kg ai/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
6.00	wheat oat perennial ryegrass rice	Sinapis arvensis Raphanus raphanistrum Chenopodium album Stellaria media Amaranthus retroflexus Portulaca oleracea
2.00 and 0.67	None listed as no weeds controlled	None

Comments on results

General

The activity experiment results showed that broad-leaved species were susceptible to post-emergence treatments, especially the foliar spray. Pre-emergence treatments were also active on these species with more phytotoxicity occurring from surface applications than with incorporation. This suggested the possibility of uptake by the emerging shoot. Grasses were more resistant in all treatments.

NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

In the post-emergence selectivity experiment, control of certain broad-leaved weeds was achieved. Annual and perennial grass weeds showed considerable resistance and crop tolerance was limited to monocotyledonous species.

Symptoms

Symptoms were typical of those caused by phenoxyalkanoic herbicides. Severe epinasty of leaves and stems of broad-leaved species occurred with leaves often failing to expand normally. The effects produced in brassicae, (the severe inhibition of lamina expansion), were reminiscent of "whip-tail disease" known in this family. Dwarf bean exhibited a severe swelling and eventual splitting of stems. Main shoot inhibition, leaf trapping and premature tillering were evident in the grasses. Pre-emergence treatment of these species sometimes produced cylindrical leaves, reminiscent of the "onion leaf" effect caused by phenoxyalkanoic herbicides.

Temperate weeds and crops

Only four broad-leaved weeds were controlled at 6.0 kg/ha, including the two cruciferous species Raphanus raphanistrum and Sinapis arvensis. The composite weeds, Tripleurospermum maritimum and Chrysanthemum segetum were very resistant as was Spergula arvensis. Grass weeds were generally very tolerant but Poa trivialis was severely reduced in vigour at 2.0 kg/ha.

Perennial ryegrass and the cereals, wheat and oat were tolerant to 6.0 kg/ha. Barley however, was sensitive at all doses, as shown by premature and excessive tillering. Broad-leaved crops were very susceptible, especially the leguminous species.

Potential selective control of four broad-leaved weeds was achieved in wheat, oat and perennial ryegrass.

Tropical weeds and crops

Only the tropical broad-leaved annual weeds were controlled at 6.0 kg/ha. Annual grass weeds were highly resistant, particularly Rottboellia exaltata. The perennials Cyperus rotundus and Cynodon dactylon showed little or no symptoms even at 6.0 kg/ha.

Of the crops, only the cereals showed resistance. Rice was tolerant at 6.0 kg/ha although plant number was slightly reduced and there was a tendency to increased tillering. Maize showed marginal resistance at this dose but all broad-leaved crops were susceptible, particularly cotton.

Only Amaranthus retroflexus and Portulaca oleracea were controlled at rates where rice was tolerant.

Possible uses and further testing

The activity and symptoms of U-29,722 resembles currently used phenoxyalkanoic herbicides. From the present test, no advantages were apparent over these established compounds in either the temperate or tropical situation. The lack of activity on members of the Compositae was similar to the phenoxyalkanoic compounds. A growth-regulatory activity on certain cereals, producing increased tillering, was observed.

ACTIVITY EXPERIMENT

U-29,722

		0.8 kg/ha	2.5 kg/ha	7.5 kg/ha
DWARF BEAN	F			
	S			
	P	+		0
	I			0
KALE	F			
	S			
	P	+		0
	I			
POLYGONUM AMPHIBIUM	F			
	S			
	P	+		0
	I			
PERENNIAL RYEGRASS	F			
	S			
	P		+	+
	I	+	+	
AVENA FATUA	F			
	S			
	P		+	
	I	+	+	
AGROPYRON REPENS	F			
	S			
	P		+	
	I			

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

NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-29,722 0.67 KG/HA		U-29,722 2.0 KG/HA		U-29,722 6.0 KG/HA	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(2)	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
OAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
PER RYGR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(4)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx	50	xxxxxxxxxx
(9)	43	xxxxxxxxx	29	xxxxx	14	xxx
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx
(10)	57	xxxxxxxxxxx	43	xxxxxxxxx	14	xxx
PEA	100R	xxxxxxxxxxxxxxxxxxxx	100R	xxxxxxxxxxxxxxxxxxxx	100R	xxxxxxxxxxxxxxxxxxxx
(11)	71R	xxxxxxxxxxxxxx	57R	xxxxxxxxxxx	43R	xxxxxxxxx
W CLOVER	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	38	xxxxxxxx
(12)	57	xxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
KALE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx
(15)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
CABBAGE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(16)	79	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
SWEDE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	20	xxxx
(17)	64	xxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
CARROT	100	xxxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(18)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx
PARSNIP	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxxx
(19)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx

Type text here

NB:AC 50-191 is confidential (Cyanamid), AG 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-29,722 0.67 KG/HA		U-29,722 2.0 KG/HA		U-29,722 6.0 KG/HA	
LETTUCE	33	xxxxxxx	50	xxxxxxxxxx	33	xxxxxxx
(20)	36	xxxxxxx	43	xxxxxxxxx	29	xxxxxx
SUG BEET	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxxxxx
(21)	71	xxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx
AVE FATU	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(26)	100	xxxxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxxx
ALO MYOS	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(27)	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
POA ANN	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(28)	93	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
POA TRIV	88	xxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(29)	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx	36	xxxxxxx
SIN ARV	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx
(30)	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx	29	xxxxxx
RAPH RAP	90	xxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxx	10	xx
(31)	57	xxxxxxxxxx	57	xxxxxxxxxx	29	xxxxxx
CHRY SEG	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(32)	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxxx
TRIP MAR	133	xxxxxxxxxxxxxxxxxxxxxx +	133	xxxxxxxxxxxxxxxxxxxxxx +	133	xxxxxxxxxxxxxxxxxxxxxx +
(33)	93	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxxx
SEN VULG	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	38	xxxxxxxx
(34)	93	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	43	xxxxxxxxx
POL LAPA	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(35)	86	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	43	xxxxxxxxx
POL AVIC	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(36)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	50	xxxxxxxxxx

NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

SPECIES	U-29,722 0.67 KG/HA		U-29,722 2.0 KG/HA		U-29,722 6.0 KG/HA	
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(38)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	50	xxxxxxxxxx
CHEN ALB	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	0	
(39)	57	xxxxxxxxxx	64	xxxxxxxxxxxx	0	
STEL MED	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	6	x
(40)	57	xxxxxxxxxx	43	xxxxxxxx	14	xxx
SPER ARV	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(41)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
AG REPEN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(48)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
MAIZE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(58)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxx
SORGHUM	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(59)	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
RICE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx
(60)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(64)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxx	43	xxxxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(65)	57	xxxxxxxxxx	57	xxxxxxxxxx	36	xxxxxx
COTTON	50	xxxxxxxxx	0		25	xxxxx
(66)	7	x	0		7	x
JUTE	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	0	
(67)	21	xxxx	36	xxxxxx	0	

NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjohn)

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-29,722 0.67 KG/HA		U-29,722 2.0 KG/HA		U-29,722 6.0 KG/HA	
KENAF	50	xxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxx
(68)	14	xxx	43	xxxxxxxxx	36	xxxxxxx
TOBACCO	100	xxxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx	30	xxxxxx
(69)	50	xxxxxxxxxx	43	xxxxxxxxx	36	xxxxxxx
ELEU IND	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(74)	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
ECH CRUS	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(75)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
ROT EXAL	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(76)	93	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
AMAR RET	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	0	
(78)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	
PORT OLE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	42	xxxxxxxx
(79)	64	xxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
CYN DACT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(82)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
CYP ROTU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(86)	93	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx

U-27,658

Code number U-27,658 Trade name -

Chemical name 3,4,5-tribromopyrazole-1-acetic acid

Source The Upjohn Company
Kalamazoo
Michigan 49001
USA

Information available and suggested uses

Manufacturer's literature from 1970 reports selective post-emergence broad-leaved weed control in established turf and in small and large seeded grain crops at 1.12-6.72 kg/ha. Use in non-crop situations and in plantation crops is also suggested. The control of brush at 5.60-16.80 kg/ha is recommended. Variations in surfactants can enhance activity. Pre-emergence applications in tolerant annual crops at 3.36-6.72 kg/ha are suggested.

Formulation used 36% w/v a.i. emulsifiable concentrate

Spray volume 338 l/ha (30.1 gal/ac) in both experiments

RESULTS

Full histogram results are given on pages 28-32 and potential selectivities are summarised in the following Table.

Rate (kg ai/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
6.00	wheat oat perennial ryegrass	Poa annua Poa trivialis Raphanus raphanistrum Chrysanthemum segetum Senecio vulgaris Polygonum lapathifolium Galium aparine Stellaria media Spergula arvensis Amaranthus retroflexus Portulaca oleracea + species below
2.00	species above + barley maize	Sinapis arvensis Chenopodium album
0.67	None listed as no weeds controlled	None

Comments on results

General

The level and pattern of activity of U-27,658 in the activity experiment was very similar to that found with U-29,722. Broad-leaved species were again more susceptible than monocotyledons but both pre and post-emergence activity was apparent.

In the post-emergence selectivity experiment U-27,658 controlled a larger number of broad-leaved weeds compared with U-29,722. Activity on grass weeds was also marginally better.

Symptoms

Epinasty on susceptible broad-leaved species and leaf trapping in sensitive grass species were evident with U-27,658. These symptoms were identical to those caused by U-29,722.

Temperate weeds and crops

Good control of the majority of the broad-leaved weeds tested was achieved. Although Tripleurospermum maritimum and Polygonum aviculare were not controlled at 6.0 kg/ha, their vigour was reduced by 36% and 57% of control respectively.

Crop tolerance was very similar to that of U-29,722 with wheat, oat and perennial ryegrass being resistant at 6.0 kg/ha. Barley was again more sensitive but was tolerant at 2.0 kg/ha.

The majority of broad-leaved weeds tested plus the two Poa spp. were selectively controlled in wheat, oat and perennial ryegrass at 6.0 kg/ha. At 2.0 kg/ha, only Sinapis arvensis and Chenopodium album were susceptible where barley and onion showed tolerance.

Tropical weeds and crops

Although severe reductions in vigour were achieved with Amaranthus retroflexus and Portulaca oleracea at 2.0 kg/ha, 6.0 kg/ha was required for control. These results were very similar to those of U-29,722, the activity of U-27,658 on grass weed species was marginally better. The perennials Cyperus rotundus and Cynodon dactylon showed little or no symptoms initially and were similar to the control 10 weeks after treatment.

Maize was the only tolerant crop at 2.0 kg/ha. Sorghum and rice were more severely affected by U-27,658, compared with U-29,722, the latter species being only marginally resistant at 2.0 kg/ha. All broad-leaved crops were susceptible. No potential selectivities were found.

Possible uses and further testing

A potential advantage of U-27,658 over U-29,722 and the phenoxy-alkanoic herbicides, was the control of Chrysanthemum segetum, Galium aparine, Spergula arvensis and Poa spp.

Further investigation of this compound for the control of annual broad-leaved weeds and Poa spp. in wheat and oat would therefore seem worthwhile. It could also prove useful for control of the same spectrum of weeds in perennial ryegrass swards.

ACTIVITY EXPERIMENT

U-27,658

		0.6 kg/ha	2.5 kg/ha	10.0 kg/ha
DWARF BEAN	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible] +	[illegible] +	[illegible]
	I	[illegible]	[illegible]	[illegible]
KALE	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible] +	[illegible]	[illegible]
POLYGONUM AMPHIBIUM	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible] +	[illegible]	[illegible]
PERENNIAL RYEGRASS	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible] +	[illegible]	[illegible]
	I	[illegible]	[illegible]	[illegible] +
AVENA FATUA	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible]	[illegible] +	[illegible]
AGROPYRON REPENS	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible] +	[illegible] +	[illegible]
	I	[illegible]	[illegible]	[illegible]

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

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-27,658 0.67 KG/HA		U-27,658 2.0 KG/HA		U-27,658 6.0 KG/HA	
WHEAT	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx
(2)	100	xxxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
OAT	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx
PER RYGR	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx
(4)	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx
(9)	43	xxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx
(10)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	36	xxxxxxx
PEA	100R	xxxxxxxxxxxxxxxxxxxxxxx	100R	xxxxxxxxxxxxxxxxxxxxxxx	OR	
(11)	71R	xxxxxxxxxxxxxx	57R	xxxxxxxxxxx	OR	
W CLOVER	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	38	xxxxxxxx
(12)	50	xxxxxxxxxx	36	xxxxxxx	29	xxxxxx
KALE	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	10	xx
(15)	57	xxxxxxxxxxx	50	xxxxxxxxxx	14	xxx
CABBAGE	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	0	
(16)	57	xxxxxxxxxxx	36	xxxxxxx	0	
SWEDE	100	xxxxxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx	20	xxxx
(17)	43	xxxxxxxxx	29	xxxxxx	7	x
CARROT	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(18)	100	xxxxxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	36	xxxxxxx
PARSNIP	100	xxxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxxx	42	xxxxxxxx
(19)	93	xxxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	36	xxxxxxx

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-27,658 0.67 KG/HA		U-27,658 2.0 KG/HA		U-27,658 6.0 KG/HA	
LETTUCE	100	xxxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(20)	57	xxxxxxxxxxx	50	xxxxxxxxxx	43	xxxxxxxxx
SUG BEET	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	30	xxxxxx
(21)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxx	36	xxxxxxx
AVE FATU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(26)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
ALO MYOS	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(27)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx
POA ANN	100R	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx
(28)	100R	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
POA TRIV	100	xxxxxxxxxxxxxxxxxxxx	69	xxxxxxxxxxxxxx	6	x
(29)	93	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	21	xxxx
SIN ARV	100	xxxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx	8	xx
(30)	57	xxxxxxxxxxx	29	xxxxxx	14	xxx
RAPH RAP	100	xxxxxxxxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxx	0	
(31)	64	xxxxxxxxxxxxx	43	xxxxxxxxx	0	
CHRY SEG	100	xxxxxxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxx	0	
(32)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	
TRIP MAR	133	xxxxxxxxxxxxxxxxxxxx +	133	xxxxxxxxxxxxxxxxxxxx +	133	xxxxxxxxxxxxxxxxxxxx +
(33)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
SEN VULG	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	19	xxxx
(34)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	21	xxxx
POL LAPA	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	6	x
(35)	93	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	14	xxx
POL AVIC	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(36)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxx	43	xxxxxxxxx

NB:AC 50-NB:AC 50-191 is confidential (Cyanamid), AC 84777 is difenzoquat metilsulfate, U-27,658 is 2-(3,4,5-tribromopyrazol-1-yl)acetic acid (Upjohn), U-29,722 is 3,4,5-tribromo-@-methyl-pyrazole-1-acetic acid (Upjoh3,4,5-tribromo-@-methylpyrazole-1-acetic acid (Upjohn)

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-27,658 0.67 KG/HA		U-27,658 2.0 KG/HA		U-27,658 6.0 KG/HA	
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(38)	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx
CHEN ALB	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
(39)	57	xxxxxxxxxxx	29	xxxxxx	0	
STEL MED	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	6	x
(40)	57	xxxxxxxxxxx	43	xxxxxxxxx	14	xxx
SPER ARV	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	6	x
(41)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	21	xxxx
AG REPEN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
AG STOLO	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(48)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
MAIZE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(58)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
SORGHUM	100	xxxxxxxxxxxxxxxxxxxx	25	xxxxx	0	
(59)	86	xxxxxxxxxxxxxxxx	29	xxxxxx	0	
RICE	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(60)	86	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(64)	57	xxxxxxxxxxx	50	xxxxxxxxxx	36	xxxxxxx
SOYABEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(65)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	43	xxxxxxxxx
COTTON	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(66)	57	xxxxxxxxxxx	29	xxxxxx	14	xxx
JUTE	143	xxxxxxxxxxxxxxxxxxxx +	57	xxxxxxxxxxx	0	
(67)	50	xxxxxxxxxx	14	xxx	0	

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	U-27,658 0.67 KG/HA		U-27,658 2.0 KG/HA		U-27,658 6.0 KG/HA	
KENAF	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	25	xxxxx
(68)	43	xxxxxxxxxx	36	xxxxxxx	29	xxxxxx
TOBACCO	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	0	
(69)	43	xxxxxxxxxx	43	xxxxxxxxxx	0	
ELEU IND	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx
(74)	100	xxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
ECH CRUS	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxxx
(75)	100	xxxxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
ROT EXAL	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(76)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	50	xxxxxxxxx
AMAR RET	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	0	
(78)	64	xxxxxxxxxxxxx	50	xxxxxxxxxx	0	
PORT OLE	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	17	xxx
(79)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
CYN DACT	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(82)	100	xxxxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
CYP ROTU	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
(86)	100	xxxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx

METFLURAZONE

Code numbers SAN 6706, HER 6706 Trade name -

Chemical name 4-chloro-5-(dimethylamino)-2-(3-trifluoromethylphenyl)pyridazin-3(2H)-one

Source
Sandoz Ltd
3090 Agro Research
CH-4002 Basle
Switzerland

Information available and suggested uses

Technical information received from the manufacturer during 1969 and 1970 reports good pre-emergence activity against a range of weed species, especially grasses. Cotton is reported as being tolerant. Weed control is long lasting and use in orchards, grapevines and industrial situations is suggested.

Formulation used 80% w/w a.i. wettable powder

Spray volume 338 l/ha (30.1 gal/ac) in both experiments

RESULTS

Full histogram results are given on pages 36-40 and potential selectivities are summarised in the following Table.

Rate (kg ai/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
4.5	carrot	Alopecurus myosuroides Raphanus raphanistrum Senecio vulgaris Galium aparine Amaranthus retroflexus + species below
1.5	species above + parsnip	Chenopodium album + species below
0.5	species above + wheat barley oat soyabean kenaf	Poa trivialis Sinapis arvensis Stellaria media Spergula arvensis

Comments on results

General

Activity experiment results showed metflurazone to be a particularly active compound when applied to the soil. Foliar activity was much reduced compared with soil treatments and was limited to certain broad-leaved species. Pre-emergence applications appeared more damaging at assessment

than comparable soil drench treatment of established plants. Later observations revealed both to have more or less equivalent activity. Pre-emergence surface application and incorporation usually produced comparable degrees of phytotoxicity although perennial ryegrass showed greater susceptibility to surface application.

In the selectivity experiment, a number of annual broad-leaved and grass species were controlled, but mostly at the higher doses. Several crops showed tolerance, particularly carrot, but selectivities tended to be marginal.

Symptoms

Susceptible species exhibited a pronounced chlorosis particularly of newly developing foliage. In broad-leaved plants initial symptoms appeared in the petioles and veins. These later developed in the leaf lamina in some cases producing a variegated effect. Grasses also showed total chlorosis at higher rates while at lower doses, alternate green and white stripes occurred, possibly due to a diurnal effect. Necrosis was slow to develop in all species, plants often surviving and remaining turgid for a considerable time before dying, despite the lack of chlorophyll. Agropyron repens and Brassica spp. exhibited a red pigmentation of the foliage due to an unmasking of the natural pigments by the lack of chlorophyll. According to Hilton et al (1969) these effects are largely due to an inhibition of carotenoid synthesis and it may be significant that carrot, a plant producing relatively large quantities of these pigments was the most resistant species tested. Pre-emergence applications had little effect on germination and symptoms were identical to those reported here (Richardson and Dean, 1972). Symptoms were reminiscent of those caused by aminotriazole and pyriclor.

Temperate weeds and crops

Nine grass and broad-leaved weeds were controlled at 4.5 kg/ha, at the main assessment, including such difficult species as Galium aparine. Later observations revealed however, that due to the slow action of metflurazone, this species was eventually controlled at only 1.5 kg/ha and Senecio vulgaris at 0.5 kg/ha. Furthermore, 4.5 kg/ha subsequently controlled Avena fatua and the composites, Chrysanthemum segetum and Tripleurospermum maritimum. The perennials Agropyron repens and Agrostis stolonifera were also completely killed at this rate at the later assessment but Polygonum lapathifolium and P. aviculare were resistant.

Although a mild chlorosis was observed on carrot at 1.5 and 4.5 kg/ha, these symptoms were not evident five weeks later when fresh weights of shoots at both doses were similar to the untreated control. Parsnip exhibited tolerance at 1.5 kg/ha while the cereals wheat, barley and oat were resistant at 0.5 kg/ha.

The selective control of a range of weeds in carrot is interesting and parallels the results found in a recent pre-emergence selectivity experiment, (Richardson and Dean, 1972), although Polygonum aviculare proved more resistant to post-emergence treatments. A number of broad-leaved weeds plus Poa trivialis were also selectively controlled in parsnip and the cereals.

Tropical weeds and crops

Only Amaranthus retroflexus was controlled at the initial assessment at 4.5 kg/ha. However, all weed species, with the exception of Cynodon dactylon, were reduced in vigour by 50% or more at 1.5 kg/ha and the majority were severely affected at the lower rates. Later assessments (4 weeks after treatment) showed that all species were controlled at 4.5 kg/ha. At this time the annual grasses Eleusine indica and Echinochloa crus-galli, plus Amaranthus retroflexus, were also controlled at 1.5 kg/ha, while the remaining annual and perennial weeds were severely affected. Root and rhizome production of the perennial species, Cyperus rotundus and Cynodon dactylon were correspondingly reduced. At 0.5 kg/ha however, most species were recovering.

Only soyabean and kenaf exhibited tolerance at 0.5 kg/ha but margins of resistance would suggest that these crops would not tolerate rates much higher than this. Cotton showed no resistance in this test but rice exhibited some marginal tolerance at the lowest dose. Small seeded crop species were particularly susceptible and no selectivities were found in this trial.

Possible uses and further testing

Although a large range of species were found to be susceptible in this trial, it would appear that the majority of the herbicidal effects were caused by uptake from the soil as exemplified in the activity experiment.

A broad-spectrum of weeds were controlled at doses where carrots were resistant but advantages over existing herbicides used in this crop are not obvious. The particularly long period of soil persistence of metflurazone reported previously (Richardson and Dean, 1972) could limit its use in this crop.

The reported tolerance of cotton to pre-emergence treatment was not paralleled in this post-emergence trial and the resistance of soyabean and kenaf was not outstanding.

Tropical weed control was not so good in this present experiment compared with the pre-emergence application (Richardson and Dean, 1972). The activity shown in this test against both annual and perennial species would appear to offer some use in the non-crop and industrial situations, especially in view of the extended soil persistence. The lack of quick 'knock-down' effect could be a disadvantage in this situation however.

ACTIVITY EXPERIMENT

METFLURAZONE

		0.3 kg/ha	1.3 kg/ha	5.1 kg/ha
DWARF BEAN	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible]	[illegible]	[illegible]
KALE	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible]	[illegible]	[illegible]
POLYGONUM AMPHIBIUM	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible] +	[illegible] +	[illegible] +
	I	[illegible]	[illegible]	[illegible]
PERENNIAL RYEGRASS	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible] +	[illegible]	[illegible]
AVENA FATUA	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible] +	[illegible]	[illegible]
	I	[illegible]	[illegible]	[illegible]
AGROPYRON REPENS	F	[illegible]	[illegible]	[illegible]
	S	[illegible]	[illegible]	[illegible]
	P	[illegible]	[illegible]	[illegible]
	I	[illegible]	[illegible]	[illegible]

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

POST-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	METFLURAZONE 0.50 KG/HA	METFLURAZONE 1.5 KG/HA	METFLURAZONE 4.5 KG/HA
WHEAT (1)	100 100	100 64	100 29
BARLEY (2)	100 100	100 64	100 50
OAT (3)	100 86	100 57	100 43
PER RYGR (4)	100 79	100 43	38 29
DWF BEAN (9)	100 79	100 57	100 43
FLD BEAN (10)	100 64	100 43	100 29
PEA (11)	100R 71R	100R 57R	100R 57R
W CLOVER (12)	100 57	69 36	38 29
KALE (15)	100 71	100 50	100 43
CABBAGE (16)	100 71	100 57	100 43
SWEDE (17)	100 57	90 29	0 0
CARROT (18)	100 100	100 86	100 86
PARSNIP (19)	100 86	100 86	100 71

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