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NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

TECHNICAL REPORT No. 22

THE PRE-EMERGENCE SELECTIVITY OF SOME NEWLY DEVELOPED HERBICIDES:

BENTAZON
BAS 3730H
METFLURAZONE
SAN 9789
HER 52.123
U 27,267

W.G. Richardson and M.L. Dean

December 1972

Price

U.K. and overseas surface mail - £0.25

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BEGBROKE HILL, YARNTON, OXFORD

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RICHARDSON, W.G. and DEAN, M.L. The pre-emergence selectivity of some newly developed herbicides: bentazon, BAS 3730H, metflurazone, SAN 9789, HER 52.123 and U 27,267. Tech. Rep. agric. Res. Coun. Weed Res. Orgn, 1972, 22, pp. 51.

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THE PRE-EMERGENCE SELECTIVITY OF SOME NEWLY DEVELOPED HERBICIDES: BENTAZON, BAS 3730 H, METFLURAZONE, SAN 9789, HER 52.123, U 27,267

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SUMMARY

Six newly developed herbicides were tested on a range of 33 temperate and 17 tropical weed and crop species for their pre-emergence selectivity, following incorporation into soil at three doses.

The pre-emergence activity of bentazon and BAS 3730H was confirmed, paralleling results from our previous tests. Cereals and large seeded legumes were especially tolerant of bentazon while representative Compositae were particularly susceptible.

BAS 3730H also exhibited selectivity in large-seeded legumes but cereal susceptibility was greater than with bentazon. The spectrum of weed control was greater, however, and soil persistence longer for BAS 3730H than for bentazon.

SAN 9789 was found to be more active than the related metflurazone but both compounds exhibited characteristic chlorotic symptoms and particularly long soil persistence. Tolerance of groundnut, cotton, carrot and kenaf was observed with metflurazone, but only kenaf and carrot showed adequate resistance to SAN 9789. Selectivities were achieved against a range of mono- and dicotyledonous weed species.

HER 52.123 exhibited a broad spectrum of weed control in temperate species and selectivities were observed in large-seeded leguminous crops, tropical cereals and kenaf. Persistence of this compound in the soil was found to be adequate for weed control without the risk of residue damage to following crops.

U 27,267 achieved control or useful suppression of many grass and broad-leaved weeds. Certain large-seeded legumes and tropical cereals showed tolerance as did sugar beet and kenaf. Selectivities tended to be marginal however, and soil persistence was prolonged at the highest rate.

INTRODUCTION

The Herbicide Evaluation and Overseas Sections 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 have been to discover selectivities additional to those pinpointed 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

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provide a source of information on the relative susceptibility of the 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. Further, 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 pre-emergence experiments are conducted only on one soil type and the post-emergence experiments at one growth stage. These important variables can have a profound effect on response. For the above reasons it must be emphasized 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 six new herbicides drawn from two separate experiments, presenting data on those compounds tested which are undergoing active development or are of special interest.

METHODS AND MATERIALS

The techniques used resembled those in previous pre-emergence selectivity experiments (Richardson et al. 1971). Six herbicides were tested in two separate experiments, each compound being applied at three doses and incorporated into the soil before planting. Incorporation was not necessarily required to secure the maximum effect from the herbicide, but the intention was to assess the inherent selectivity when the herbicide was distributed throughout the growing medium.

Tin plate containers 19.0 x 13.7 x 7.6 cm deep were filled to a depth of 6.5 cm with a sandy loam topsoil from a field at Begbroke Hill. Soil conditions are summarised in Table 1. The herbicides were used in the formulation supplied by the manufacturer for field experimentation. These were sprayed on to the soil surface using a laboratory sprayer embodying a 'Teejet' fan nozzle moving at constant speed over a spray bench. Shortly after spraying, the soil was passed six times through a large polythene funnel to incorporate the herbicide evenly through the soil. The treated soil was then used to fill a series of 8.9 cm diameter disposable plastic pots to a depth of 6.5 cm in which the plants were subsequently grown.

Table 1. Soil and environmental conditions

	Experiment 1 Bentazon Metflurazone SAN 9789 U 27,267		Experiment 2 BAS 3730 H HER 52.123	
Date of spraying	14 December 1970		17 March 1971	
Organic matter	2.0 %		2.8 %	
Clay content	13.0 %		15.0 %	
Soil moisture at spraying	11.0 %		16.0 %	
John Innes base fertiliser	1.0 g/kg		1.0 g/kg	
DDT, (5% dust)	0.6 g/kg		0.6 g/kg	
	Temperate	Tropical	Temperate	Tropical
Temperature, °C				
Mean	18	23	18	24
Maximum	21	26	23	29
Minimum	14	19	15	21
Relative humidity (%)				
Mean	52	55	55	60
Maximum	70	80	80	85
Minimum	40	35	30	30

Pots were allocated to individual species and a specified number of seeds sown at the appropriate depth (see Table 2). For the perennial weed species small portions of underground system were planted as indicated in Table 2 and all pots were replicated twice.

With five species, plant material was pre-treated to improve establishment. Chenopodium album seeds were soaked in 0.1M potassium nitrate solution and kept in the light for three days prior to planting. Polygonum aviculare seeds were kept moist at 2°C for a period of at least six weeks before planting as were seeds of Veronica persica prior to experiment 2. Tubers of Cyperus esculentus were stored moist at 4°C for 14 days prior to planting to break dormancy in experiment 2, but this was omitted in experiment 1 and resulted in the erratic germination. Rottboellia exaltata seeds were soaked for 48-72 hours in water and those which sank were lightly crushed before planting.

The spraying of the soil, its subsequent transfer to pots and planting of the various species commenced on 14 December 1970 in experiment 1. The pots were then placed in aluminium foil dishes in the glasshouses at 15°C until completion of spraying, the whole procedure taking 1½ days. For experiment 2, spraying commenced 17 March 1971 and was completed early on 18 March. The temperatures were then raised to the desired values for the temperate and tropical species respectively. Initial watering until emergence was from overhead using a boom with fan nozzles to give uniform treatment to all pots. After emergence of the majority of the species pots were watered individually from overhead according to need, using a small rose and avoiding contact with the plants as far as possible. Conditions during the experimental periods are summarised in Table 1 and normal daylight was supplemented in both experiments with a 14 hour photoperiod using warm white fluorescent tubes.

Table 2. Species abbreviations, varieties and stage of growth at assessment

	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Expt No.	Stage of growth at assessment (untreated controls)
Temperate species						
Wheat (*Triticum aestivum*)	WHEAT (1)	Joss Cambier	8	1.2	1	4½-5 leaves, tillering
					2	3½-4 leaves
Barley (*Hordeum vulgare*)	BARLEY (2)	Sultan	8	1.2	1	5½ leaves
					2	3-3½ leaves
Oat (*Avena sativa*)	OAT (3)	Condor	8	1.2	1	4½ leaves
					2	3-3½ leaves
Perennial ryegrass (*Lolium perenne*)	PER RYGR (4)	S 23	15	0.6	1	4½-5 leaves, tillering
					2	4-5 leaves, tillering
Onion (*Allium cepa*)	ONION (8)	Rijnsburger	15	0.6	1	2-3 leaves
					2	2 leaves
Dwarf bean (*Phaseolus vulgaris*)	DWF BEAN (9)	The Prince	3	1.8	1	1½ trifoliates
					2	1½ trifoliates
Field bean (*Vicia faba*)	FLD BEAN (10)	Maris Bead	4	1.8	1	5½ leaves
					2	3½-4 leaves
Pea (*Pisum sativum*)	PEA (11)	Dark skinned perfection	4	1.8	1	6 leaves
					2	5½-6½ leaves
White clover (*Trifolium repens*)	W CLOVER (12)	S 100	20	0.6	1	1½-2 trifoliates
					2	1 trifoliate
Kale (*Brassica oleracea acephala*)	KALE (15)	Marrowstem	10	0.6	1	3½ true leaves
					2	2½ true leaves
Swede (*Brassica napus*)	SWEDE (17)	Lord Derby	10	0.6	1	3½ true leaves
					2	2½ true leaves
Carrot (*Daucus carota*)	CARROT (18)	Chantenay Red Core	10	0.6	1	3½ true leaves
					2	2½ true leaves
Lettuce (*Lactuca sativa*)	LETTUCE (20)	Borough Wonder	14	0.6	1	4½-5 true leaves
					2	4½ true leaves
Sugar beet (*Beta vulgaris*)	SUG BEET (21)	'Klein E' monogerm	15	1.2	1	4½-5 true leaves
					2	2½-3 true leaves
Avena fatua	AVE FATU (26)	Boxworth	8	1.2	1	4½ leaves
					2	4 leaves

Species	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Expt No.	Stage of growth at assessment
Alopecurus myosuroides	ALO MYOS (27)	Rothamsted	30	0.6	1 2	5 leaves, tillering 5 leaves, tillering
Poa annua	POA ANN (28)	WRO 1966	25	0.6	1 2	5 leaves, tillering 5 leaves, tillering
Sinapis arvensis	SIN ARV (30)	WRO 1964	15	0.6	1 2	not included $2\frac{1}{2}$-3 true leaves
Raphanus raphanistrum	RAPH RAP (31)	Black Spanish	12	0.6	1 2	not included $2\frac{1}{2}$-3 true leaves
Tripleurospermum maritimum	TRIP MAR (33)	WRO 1967	20	0.3	1 2	not included $6\frac{1}{2}$-$7\frac{1}{2}$ true leaves
Senecio vulgaris	SEN VULG (34)	WRO 1967	20	0.6	1 2	$5\frac{1}{2}$ true leaves $2\frac{1}{2}$-3 true leaves
Polygonum lapathifolium	POL LAPA (35)	WRO 1965	15	0.6	1 2	no germination $2\frac{1}{2}$ true leaves
Polygonum aviculare	POL AVIC (36)	WRO 1968	20	0.6	1 2	5-6 true leaves 4 true leaves
Galium aparine	GAL APAR (38)	WRO 1970	12	0.6	1 2	7 rosettes 3-4 rosettes
Chenopodium album	CHEN ALB (39)	Kidlington 1967	25	0.6	1 2	6-8 true leaves 2-4 true leaves
Stellaria media	STEL MED (40)	WRO 1970	20	0.6	1 2	6 pairs true leaves 4 pairs true leaves
Veronica persica	VER PERS (42)	WRO 1969	25	0.6	1 2	not included 4 leaves
Agropyron repens	AG REPEN (47)	WRO Clone 31	6†	1.2	1 2	$4\frac{1}{2}$ leaves 4-$4\frac{1}{2}$ leaves
Allium vineale	ALL VIN (49)	WRO 1969	6*	1.2	1 2	2-3 leaves $2\frac{1}{2}$ leaves
Cirsium arvense	CIRS ARV (50)	WRO Clone 1	4††	1.2	1 2	4-5 leaves 8 leaves
Tussilago farfara	TUS FARF (51)	WRO Clone 1	4†	1.8	1 2	5 leaves 3-4 leaves
Convolvulus arvensis	CONV ARV (52)	WRO Clone 1	4††	1.2	1 2	12 leaves 10 leaves

Species	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Expt No.	Stage of growth at assessment
Rumex acetosella	RUM ACET (50)	WRO Clone 1	4††	1.2	1 2	6 leaves not included
"Tropical" species (grown under higher of temperature regimes)						
Maize (Zea mays)	MAIZE (58)	Inra 200	6	1.2	1 2	4-4½ leaves 4-5 leaves
Sorghum (Sorghum vulgare)	SORGHUM (59)	Serena (1) Fetereita(2)	10 8	1.2	1 2	4½-5½ leaves 4-5 leaves
Rice (Oryza sativa)	RICE (60)	Kogbandi	10	1.2	1 2	2½-3 leaves 2½-3 leaves
Groundnut (Arachis hypogea)	GRNDNUT (64)	Nigeria 1968	4	1.8	1 2	4-5 trifoliates 5 trifoliates
Soyabean (Glycine max)	SOYABEAN (65)	Merit	(1)4 (2)6	1.8	1 2	2-3 trifoliates 2-2½ trifoliates
Cotton (Gossypium hirsutum)	COTTON (66)	Samaru 26J	6	1.8	1 2	2-4 true leaves 2-3 true leaves
Jute (Corchorus olitorius)	JUTE (67)	Trinidad 1970	(1)12 (2)20	0.6	1 2	4-5 true leaves 4-5 true leaves
Kenaf (Hibiscus cannabinus)	KENAF (68)	Thai Native	10	1.2	1 2	2-3 true leaves 2-3 true leaves
Sesamum (Sesamum indicum)	SESAMUM (70)	Addis Ababa 1970	10	0.6	1 2	poor germination 4 true leaves
Eleusine indica	ELEU IND (74)	WRO 1964	15	0.6	1 2	5-5½ leaves 4-5 leaves
Echinochloa crus-galli	ECH CRUS (75)	WRO 1966	15	0.6	1 2	4½-5 leaves 4-5 leaves
Rottboellia exaltata	ROTT EXA (76)	Mozambique 1970	(1)20 (2)30	1.2	1 2	4-6 leaves 3-4 leaves, tillering
Digitaria sanguinalis	DIG SANG (77)	Shell Research 1965	20	0.6	1 2	3-5 leaves 2-4 leaves, tillering
Amaranthus retroflexus	AMAR RET (78)	WRO 1968	15	0.6	1 2	5-7 true leaves 5-6 true leaves

Species	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Expt No.	Stage of growth at assessment
Cyperus esculentus	CYP ESCU (85)	WRO Clone 2 (South Africa)	5**	1.2	1 2	3-4 leaves 7-9 leaves
Cyperus rotundus	CYP ROTU (86)	WRO Clone 1 (Rhodesia)	5**	1.2	1 2	6-9 leaves 9-11 leaves
Oxalis latifolia	OXAL LAT (87)	WRO Clone 2 (ex Cornwall)	10 bulbs	1.2	1 2	7 leaves 2-12 leaves

† one node rhizome fragments

†† 4 cm root fragments

* aerial bulbils

** tubers

Assessment and processing of results

The main assessment was made directly on to punch cards 4-6 weeks after spraying. The numbers of survivors and their vigour, expressed on a 0-7 subjective 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 2. 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 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. An 'r' indicates a result based on one replicate only and an 'M' represents a missing treatment.

In experiment 1 with certain species it was not possible to record the final assessment on to punch cards for a variety of reasons. *Polygonum lapathifolium* failed to germinate and pea, sesamum, jute, soyabean and *Cyperus esculentus* exhibited poor or erratic germination. However, some indications of their resistance or susceptibility was apparent and is referred to where relevant. Several species, notably the perennials, were kept for a period of several months to observe later effects or 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 of 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 to highlight salient points for each herbicide.

Persistence of herbicides in soil

An extra identical batch of soil was sprayed and mixed for each treatment. This soil was used to obtain preliminary information on the rate of disappearance, or persistence of the herbicides. The moist soil was stored in screw-top glass jars in the dark at a constant temperature of 23°C, together with jars containing samples of the same untreated control soil as used in the experiments. Moisture levels were determined at the start of the experiment and were checked periodically. Adjustments were made to keep the levels constant. At six week intervals the soil was remixed, a subsample drawn and a sensitive test species sown into it. Plants were raised under normal temperate glasshouse conditions. When control plants had reached a defined growth stage (3-4 leaves) the number of plants per pot and their freshweight was recorded. The initial bioassay was run in the same week as the setting up of the experiments and tests were repeated for up to one year if necessary.

BENTAZON
(Experiment 1)

Code number BAS 3510 H Trade name Basagran

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

Source BASF United Kingdom Ltd, Agricultural Division, St Francis Tower, Greyfriars, Ipswich, Suffolk IP1 1LE

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 compound. It has been effective, as a post-emergence treatment, in cereals, maize and rice against a range of species and has also been suggested for use against *Cyperus* spp. A further development has been in combination with dichlorprop for post-emergence control of *Matricaria* spp. and *Chrysanthemum segetum* in cereals. No previous reports have been noted regarding the soil action of this compound.

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

Doses 0.66, 2.00 and 6.00 kg a.i./ha
(0.59, 1.79 and 5.36 lb a.i./ac)

Spray volume 338 l/ha (30.1 gal/ac)

RESULTS

Table of selectivities

DOSE kg/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
6.00	wheat barley oat dwarf bean field bean maize sorghum rice groundnut	*Galium aparine* *Chenopodium album* + species below
2.00	species above + perennial rye grass lettuce cotton kenaf soyabean	*Stellaria media* *Cirsium arvense* + species below
0.66	species above + onion white clover kale swede sugar beet	*Senecio vulgaris*

Comments on results

General This experiment confirms the soil activity of this compound observed in previous tests (Richardson, W.G. unpublished data) and patterns of activity generally followed post-emergence activity.

This compound showed marked specificity for certain broad-leaved species, notably some Compositae, but the grasses were generally highly tolerant. This compound was not so highly active as BAS 3730H.

Symptoms These were typical of a photosynthetic inhibitor type of compound. No adverse effects were observed on the germination ability of the species but symptoms developed with the growth of the plant. Slight yellowing of the foliage was observed at lower rates with marginal stunting and retardation. At higher rates the foliage became much paler or chlorotic followed by necrosis coupled with moderate to severe stunting or death.

Temperate weeds and crops

Although *Tripleurospermum maritimum* and *Chrysanthemum segetum* were not included in this test, other representative Compositae namely *Senecio vulgaris* and *Cirsium arvense*, were found to be highly susceptible being controlled at 0.66 and 2.00 kg/ha respectively. *Tussilago farfara* exhibited a higher resistance. *Galium aparine* also showed susceptibility being reduced in vigour by 50% at 2.00 kg/ha and controlled at 6.00 kg/ha. All grass weed species were outstandingly tolerant even at 6.00 kg/ha.

All temperate crops tested, with the exception of carrot, exhibited some tolerance to this compound. The cereals, wheat, barley and oat and the large seeded legumes, dwarf bean and field bean were all outstandingly tolerant at 6.00 kg/ha. Although pea does not appear in the histograms, due to erratic germination, an occasional plant emerged at all rates and showed no symptoms. Small seeded white clover, however, was only tolerant to 0.66 kg/ha. Perennial rye grass and surprisingly lettuce, in view of the susceptibility of other Compositae, both showed resistance up to 2.00 kg/ha with the former only being marginally affected at 6.00 kg/ha. Both kale and swede tolerated 0.66 kg/ha, but were severely affected at higher doses, especially swede. Sugar beet and onion were also resistant at 0.66 kg/ha with the latter showing marginal tolerance at 2.00 kg/ha. Carrot was very sensitive to this compound even at 0.66 kg/ha.

Pre-emergence selectivity in cereal crops and large-seeded legumes has been demonstrated, and parallels the post-emergence activity of this compound. The susceptibility of members of the Compositae and their selective control in these crops and in perennial rye grass and lettuce is of considerable interest. The results obtained with carrot suggest that various other weed members of the Umbelliferae might show similar sensitivity and the low tolerance of kale and particularly swede suggest that cruciferous weeds could also prove susceptible.

Tropical weeds and crops

No tropical weed species were controlled even at 6.00 kg/ha. *Amaranthus retroflexus* was the most susceptible species but was not satisfactorily controlled at this rate and all grass weed species showed a high degree of tolerance. Vigour of *Cyperus esculentus* was reduced at 2.00 kg/ha but no results were obtained at the higher rate due to erratic germination. Little

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significant effect was observed on Cyperus rotundus or Oxalis latifolia at 6.00 kg/ha at the initial assessment and recovery was complete after six months.

Maize, rice and sorghum were all tolerant at 6.00 kg/ha although there was some variation in plant number of sorghum due to erratic germination. Groundnut was also resistant to this rate while cotton, kenaf and soyabean which is absent from the histograms due to poor germination, all tolerated 2.00 kg/ha. Jute showed no resistance even at 0.66 kg/ha.

Soil persistence

Using carrot as a sensitive test species bentazon, applied at 6.00 kg/ha, had disappeared 39 weeks after application although relatively little had been detected since week 19. Applications of 0.66 and 2.00 kg/ha had both disappeared after 13 weeks. At six weeks symptoms were not observed at the lower dose but were still apparent at 2.00 kg/ha.

Possible uses and further testing

This herbicide appears to fill a gap in weed control in cereals. Some Compositae have shown considerable resistance to phenoxyalkanoic herbicides and also to several of the newer urea herbicides, while bentazon has exhibited a high specificity for these species both pre- and post-emergence. A mixture of bentazon with phenoxyalkanoic acids has already been developed in the form of BAS 3580H to give a more complete post-emergence spectrum of control. Similar mixtures of bentazon with certain substituted ureas for pre-emergence treatment of large-seeded legumes and perhaps cereals could lead to a greater weed control spectrum in these crops.

Indications with representative species suggest that Umbelliferae and Cruciferae may also be susceptible target species and further testing of this compound in the field as a pre-emergence treatment appear well justified.

SPECIES	BENTAZON 0.66 kg/ha	BENTAZON 2.00 kg/ha	BENTAZON 6.00 kg/ha
WHEAT	102	102	102
(1)	100	100	100
BARLEY	102	102	89
(2)	100	100	100
OAT	87	103	103
(3)	100	100	100
PER RYGR	101	109	79
(4)	100	86	71
ONION	200	167	67
(8)	100	79	64
DWF BEAN	106	106	88
(9)	100	100	100
FLD BEAN	109	109	109
(10)	100	100	100
W CLOVER	122	102	46
(12)	93	64	57
KALE	100	75	13
(15)	93	64	7
SWEDE	93	13	0
(17)	100	29	0
CARROT	7	0	0
(18)	21	0	0
LETTUCE	106	118	29
(20)	100	86	50
SUG BEET	71	24	0
(21)	100	57	0

SPECIES	BENTAZON 0.66 kg/ha		BENTAZON 2.00 kg/ha		BENTAZON 6.00 kg/ha	
AVE FATU	73	xxxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxxx	110	xxxxxxxxxxxxxxxxxxxx+
(26)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
ALO MYOS	73	xxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxxx
(27)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
POA ANN	90	xxxxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(28)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
SEN VULG	12	xx	12	xx	0	
(34)	50	xxxxxxxxxx	36	xxxxxxx	0	
POL AVIC	92	xxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxxx	69	xxxxxxxxxxxxxx
(36)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
GAL APAR	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	14	xxx
(38)	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
CHEN ALB	150	xxxxxxxxxxxxxxxxxxxx+	68	xxxxxxxxxxxxxx	0	
(39)	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	
STEL MED	59	xxxxxxxxxxxx	6	x	0	
(40)	93	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
AG REPEN	103	xxxxxxxxxxxxxxxxxxxx+	113	xxxxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxxxx+
(47)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
ALL VIN	150	xxxxxxxxxxxxxxxxxxxx+	150	xxxxxxxxxxxxxxxxxxxx+	129	xxxxxxxxxxxxxxxxxxxx+
(49)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	36	xxxxxxx
CIRS ARV	45	xxxxxxxxx	0		0	
(50)	36	xxxxxxx	0		0	
TUS FARF	114	xxxxxxxxxxxxxxxxxxxx+	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	36	xxxxxxx
CONV ARV	104	xxxxxxxxxxxxxxxxxxxx+	104	xxxxxxxxxxxxxxxxxxxx+	78	xxxxxxxxxxxxxxxx
(52)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx

SPECIES	BENTAZON 0.66 kg/ha	BENTAZON 2.00 kg/ha	BENTAZON 6.00 kg/ha
RUM ACET	118	64	129
(53)	100	100	100
MAIZE	100	83	100
(58)	100	100	93
SORGHUM	64	96	64
(59)	93	93	93
RICE	104	98	87
(60)	86	79	86
GRNDNUT	60	100	80
(64)	100	100	86
COTTON	92	138	92
(66)	79	93	71
KENAF	75	100	25
(68)	93	86	64
ELEU IND	101	84	93
(74)	100	93	93
ECH CRUS	94	103	107
(75)	100	93	79
ROT EXAL	97	49	74r
(76)	93	93	85r
DIG SANG	43	43	100
(77)	93	93	93
AMAR RET	67	67	42
(78)	86	79	64
CYP ROTU	115	97	97
(86)	100	100	71

SPECIES	BENTAZON 0.66 kg/ha		BENTAZON 2.00 kg/ha		BENTAZON 6.00 kg/ha	
OXAL LAT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	108	xxxxxxxxxxxxxxxxxxxxx+
(87)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx

BAS 373OH
(Experiment 2)

Code number BAS 373OH **Trade name** -

Chemical name 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione

Source BASF United Kingdom Ltd, Agricultural Division, St Francis Tower, Greyfriars, Ipswich, Suffolk IP1 1LE

Information available and suggested uses

Fischer (1968, 1969) suggests good activity from this and related compounds against *Matricaria* spp., Cyperaceae and a range of broadleaved weeds. All the action is reported as being through the foliage.

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

Doses 0.42, 1.66 and 6.66 kg a.i./ha (0.38, 1.48 and 5.95 lb a.i./ac)

Spray volume 384 l/ha (34.2 gal/ac)

RESULTS

Table of selectivities

DOSE kg/ha	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
6.66	none	none listed as no crops tolerant
1.66	dwarf bean field bean pea maize groundnut cotton	*Poa annua* *Tripleurospermum maritimum* *Senecio vulgaris* *Polygonum lapathifolium* *Polygonum aviculare* *Chenopodium album* *Stellaria media* *Veronica persica* *Amaranthus retroflexus* + species below
0.42	species above + wheat barley oat onion kale carrot sorghum rice soyabean	*Sinapis arvensis*

NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

Comments on results

General This experiment confirms the results of a previous test when the action of this compound through the soil was observed (Richardson, W.G. unpublished data).

A broad spectrum of weed control was observed, monocotyledons being more susceptible to this compound than to bentazon.

Symptoms Susceptible species exhibited lightening or chlorosis of foliage after germination. At higher doses development may not have been further than the cotyledon stage but at lower rates development was more advanced before the foliage became lighter and plants became stunted followed by loss of turgidity and necrosis of the tissue.

Temperate weeds and crops

Although activity on composite species was not so great as with bentazon, *Senecio vulgaris* and *Tripleurospermum maritimum* were controlled at 1.66 kg/ha. The perennials *Tussilago farfara* and *Cirsium arvense*, however, required 6.66 kg/ha for control to be achieved. Control of *Polygonum aviculare* at 1.66 kg/ha was most impressive with *Polygonum lapathifolium* and *Poa annua* also being controlled at this rate. Severe effects were observed on other grass weed species with the vigour of *Avena fatua* and *Alopecurus myosuroides* being reduced by 50% or more at this dose. *Sinapis arvensis* was the only weed controlled at 0.42 kg/ha. *Agropyron repens* completely recovered from 6.66 kg/ha after six months.

All the large-seeded legumes tested, pea, dwarf bean and field bean exhibited tolerance up to 1.66 kg/ha. Pea showed most tolerance being only reduced in vigour by 29% at 6.66 kg/ha, while the small seeded white clover exhibited no tolerance. The temperate cereals, wheat, oat and barley along with carrot, kale and onions all exhibited tolerance to 0.42 kg/ha. The vigour of carrot was only reduced by 29% at 1.66 kg/ha in marked contrast to its high susceptibility to bentazon.

Most interesting among the selectivities observed was the control of *Sinapis arvensis* in kale at 0.42 kg/ha showing the differing responses of related species. The selective control of Polygonaceae in legume crops, notably *Polygonum aviculare* in pea is also of considerable interest.

Tropical weeds and crops

Amaranthus retroflexus was the only tropical annual weed controlled and this required 1.66 kg/ha. At this rate the grass weeds were slightly to moderately affected, though not so severely as the temperate grasses. This compound showed relatively little effect on the *Cyperus* spp. tested and three months after treatment recovery was nearly complete. *Oxalis latifolia*, however, was just controlled at 6.66 kg/ha at the initial assessment and after three months one replicate was completely dead, the other being severely weakened and stunted. 1.66 kg/ha was still having some adverse effect at this stage.

The larger-seeded crop species, maize, groundnut and cotton were all tolerant up to 1.66 kg/ha with maize being reduced by only 21% in vigour at 6.66 kg/ha. The reduced number of plants for cotton at both 0.42 and 1.66 kg/ha is believed due to erratic germination of this species rather than direct herbicide effect. Tolerance in kenaf was only marginal at 0.42 kg/ha.

Selective control of Amaranthus retroflexus was achieved in maize, groundnut and cotton at 1.66 kg/ha.

Soil persistence

Using turnip as the sensitive test species residues of this compound were detected at the 6.66 kg/ha rate 54 weeks after application. At this time turnip fresh weight was only 28% of control but this had been steadily increasing from 0% at week 26. Disappearance of the compound at lower rates of application was more rapid, there being no detectable symptoms 6 and 26 weeks after treatment at the 0.42 and 1.66 kg/ha doses respectively.

Possible uses and further testing

The control or suppression of many grass weed species would appear to give this compound some advantage over the related bentazon for pre-emergence weed control in dicotyledonous crops. Thus it may be worth field testing of these two compounds, in comparison, in temperate large-seeded legumes as pre-emergence treatments. Unfortunately the margin of selectivity of BAS 3730H in cereals is not so great as that of bentazon and hence, pre-emergence treatments with mixtures of substituted ureas may not be so practicable.

NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

SPECIES	BAS 373OH 0.42 kg/ha		BAS 373OH 1.66 kg/ha		BAS 373OH 6.66 kg/ha	
WHEAT	98	xxxxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	36	xxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(2)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	36	xxxxxxx
OAT	91	xxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxxx	72	xxxxxxxxxxxxxx
(3)	93	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
PER RYGR	97	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	23	xxxxx
(4)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
ONION	115	xxxxxxxxxxxxxxxxxxxx+	54	xxxxxxxxxxx	8	xx
(8)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	21	xxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
FLD BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(10)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
PEA	100	xxxxxxxxxxxxxxxxxxxx	114	xxxxxxxxxxxxxxxxxxxx+	114	xxxxxxxxxxxxxxxxxxxx+
(11)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
W CLOVER	76	xxxxxxxxxxxxxxx	0		0	
(12)	64	xxxxxxxxxxxxx	0		0	
KALE	113	xxxxxxxxxxxxxxxxxxxx+	113	xxxxxxxxxxxxxxxxxxxx+	7	x
(15)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
SWEDE	83	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	
(17)	71	xxxxxxxxxxxxxx	21	xxxx	0	
CARROT	106	xxxxxxxxxxxxxxxxxxxx+	94	xxxxxxxxxxxxxxxxxxx	12	xx
(18)	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	21	xxxx
LETTUCE	93	xxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx	0	
(20)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	

NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

SPECIES	BAS 3730H 0.42 kg/ha		BAS 3730H 1.66 kg/ha		BAS 3730H 6.66 kg/ha	
SUG BEET	90	xxxxxxxxxxxxxxxxxx	30	xxxxxx	0	
(21)	43	xxxxxxxxx	50	xxxxxxxxxx	0	
AVE FATU	140	xxxxxxxxxxxxxxxxxxxx+	110	xxxxxxxxxxxxxxxxxxxx+	60	xxxxxxxxxxxx
(26)	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
ALO MYOS	106	xxxxxxxxxxxxxxxxxxxx+	81	xxxxxxxxxxxxxxxx	25	xxxxx
(27)	86	xxxxxxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
POA ANN	110	xxxxxxxxxxxxxxxxxxxx+	83	xxxxxxxxxxxxxxxxx	14	xxx
(28)	57	xxxxxxxxxxx	29	xxxxxx	29	xxxxxx
SIN ARV	24	xxxxx	0		0	
(30)	29	xxxxxx	0		0	
RAPH RAP	121	xxxxxxxxxxxxxxxxxxxx+	81	xxxxxxxxxxxxxxxx	0	
(31)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	
TRIP MAR	85	xxxxxxxxxxxxxxxxx	14	xxx	0	
(33)	64	xxxxxxxxxxxxx	14	xxx	0	
SEN VULG	60	xxxxxxxxxxxx	13	xxx	0	
(34)	100	xxxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
POL LAPA	54	xxxxxxxxxxx	38	xxxxxxxx	0	
(5)	93	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
POL AVIC	68	xxxxxxxxxxxxxx	20	xxxx	0	
(36)	43	xxxxxxxxx	29	xxxxxx	0	
GAL APAR	55	xxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	39	xxxxxxxx
(38)	93	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
CHEN ALB	131	xxxxxxxxxxxxxxxxxxxx+	19	xxxx	0	
(39)	57	xxxxxxxxxxx	21	xxxx	0	
STEL MED	105	xxxxxxxxxxxxxxxxxxxx+	38	xxxxxxxx	0	
(40)	71	xxxxxxxxxxxxxx	21	xxxx	0	

NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

SPECIES	BAS 3730H 0.42 kg/ha	BAS 3730H 1.66 kg/ha	BAS 3730H 6.66 kg/ha
VER PERS	41 xxxxxxxx	0	0
(42)	79 xxxxxxxxxxxxxxxx	0	0
AG REPEN	103 xxxxxxxxxxxxxxxxxxxx+	103 xxxxxxxxxxxxxxxxxxxx+	103 xxxxxxxxxxxxxxxxxxxx+
(47)	86 xxxxxxxxxxxxxxxxx	64 xxxxxxxxxxxxx	43 xxxxxxxxx
ALL VIN	103 xxxxxxxxxxxxxxxxxxxx+	111 xxxxxxxxxxxxxxxxxxxx+	103 xxxxxxxxxxxxxxxxxxxx+
(49)	93 xxxxxxxxxxxxxxxxxxx	79 xxxxxxxxxxxxxxxx	64 xxxxxxxxxxxxx
CIRS ARV	97 xxxxxxxxxxxxxxxxxxx	116 xxxxxxxxxxxxxxxxxxxx+	19 xxxx
(50)	79 xxxxxxxxxxxxxxxx	50 xxxxxxxxxx	14 xxx
TUS FARF	100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx	50 xxxxxxxxxx
(51)	100 xxxxxxxxxxxxxxxxxxxx	64 xxxxxxxxxxxxx	14 xxx
CONV ARV	100 xxxxxxxxxxxxxxxxxxxx	75 xxxxxxxxxxxxxxx	38 xxxxxxxx
(52)	100 xxxxxxxxxxxxxxxxxxxx	64 xxxxxxxxxxxxx	7 x
MAIZE	92 xxxxxxxxxxxxxxxxxx	92 xxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx
(58)	100 xxxxxxxxxxxxxxxxxxxx	86 xxxxxxxxxxxxxxxxx	79 xxxxxxxxxxxxxxxx
SORGHUM	94 xxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx
(59)	93 xxxxxxxxxxxxxxxxxxx	71 xxxxxxxxxxxxxx	57 xxxxxxxxxxx
RICE	102 xxxxxxxxxxxxxxxxxxxx	96 xxxxxxxxxxxxxxxxxxx	64 xxxxxxxxxxxxx
(60)	86 xxxxxxxxxxxxxxxxx	64 xxxxxxxxxxxxx	43 xxxxxxxxx
GRNDNUT	100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx	100 xxxxxxxxxxxxxxxxxxxx
(64)	100 xxxxxxxxxxxxxxxxxxxx	86 xxxxxxxxxxxxxxxxx	43 xxxxxxxxx
SOYABEAN	122 xxxxxxxxxxxxxxxxxxxx+	122 xxxxxxxxxxxxxxxxxxxx+	56 xxxxxxxxxxx
(65)	100 xxxxxxxxxxxxxxxxxxxx	71 xxxxxxxxxxxxxx	7 x
COTTON	75 xxxxxxxxxxxxxxx	75 xxxxxxxxxxxxxxx	66 xxxxxxxxxxxxx
(66)	93 xxxxxxxxxxxxxxxxxxx	93 xxxxxxxxxxxxxxxxxxx	50 xxxxxxxxxx
JUTE	92 xxxxxxxxxxxxxxxxxx	0	0
(67)	57 xxxxxxxxxxx	0	0

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NB: BAS 373OH is 4-(4'-fluorophenyl)-2-methyltetrahydro-1,2,4-oxadiazin-3,5-dione (BASF)
HER 52.112 is 2-amino-4-isopropylamino-6-chloro-pyrimidine (Sandoz), SAN 9789 is norflurazon,
U 27.267 is N,N-dimethyl-2-(3,4,5-tribromopyrazol-1-yl)propionamide (Upjohn)

SPECIES	BAS 3730H 0.42 kg/ha		BAS 3730H 1.66 kg/ha		BAS 3730H 6.66 kg/ha	
KENAF	114	xxxxxxxxxxxxxxxxxxxx+	30	xxxxxx	0	
(68)	79	xxxxxxxxxxxxxxxx	29	xxxxxx	0	
SESAMUM	53	xxxxxxxxxxx	38	xxxxxxxx	0	
(70)	71	xxxxxxxxxxxxxx	21	xxxx	0	
ELEU IND	101	xxxxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx
(74)	93	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
ECH CRUS	103	xxxxxxxxxxxxxxxxxxxx+	74	xxxxxxxxxxxxxxx	0	
(75)	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	0	
ROT EXAL	157	xxxxxxxxxxxxxxxxxxxx+	114	xxxxxxxxxxxxxxxxxxxx+	107	xxxxxxxxxxxxxxxxxxxx+
(76)	93	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
DIG SANG	90	xxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxxx	16	xxx
(77)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
AMAR RET	81	xxxxxxxxxxxxxxxx	26	xxxxx	0	
(73)	71	xxxxxxxxxxxxxx	14	xxx	0	
CYP ESCU	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(85)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
CYP ROTU	93	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
(86)	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
OXAL LAT	119	xxxxxxxxxxxxxxxxxxxx+	88	xxxxxxxxxxxxxxxxxx	56	xxxxxxxxxxx
(87)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx

METFLURAZONE
(Experiment 1)

Code number 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 data sheets received from the manufacturer during 1969 and 1970 report good pre-emergence activity against a range of weed species, especially grasses. Cotton is reported as being the most tolerant crop species and weed control is long lasting.

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

Doses 0.33, 1.00 and 3.00 kg a.i./ha (0.30, 0.89 and 2.68 lb a.i./ac)

Spray volume 338 l/ha (30.1 gal/ac)

RESULTS

Table of selectivities

DOSE kg/ha	CROP: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
3.00	none	none listed as no crops tolerant
1.00	carrot	Avena fatua Alopecurus myosuroides Senecio vulgaris Polygonum aviculare Galium aparine Chenopodium album Stellaria media Agropyron repens Allium vineale Echinochloa crus-galli + species below
0.33	species above + groundnut cotton kenaf	Poa annua Eleusine indica Digitaria sanguinalis Amaranthus retroflexus

Comments on results

General The activity of this compound was found to be intermediate between the two related compounds, SAN 9789 and HER 52.144.

Symptoms The most striking feature of this compound and SAN 9789 was the chlorotic symptoms produced in susceptible species. Germination was apparently unaffected but subsequent development was marked by slight yellowing or chlorosis of the foliage at lower rates and complete chlorosis at the higher doses. This is believed to be due to the prevention or retardation of chloroplast development and symptoms are similar to those produced by amitrole and pyriclor. Plants remained in this state for some considerable time before collapse and death of affected tissue. Certain species such as Agropyron repens and some Brassica spp. exhibited red or purple pigmentation of affected foliage due to an 'unmasking' of the naturally occurring pigments by the lack of production of chlorophyll. According to Hilton et al. (1969) these effects are largely due to an inhibition of carotenoid synthesis. Perhaps it is significant that carrot, a species producing relatively large quantities of these pigments, was the most resistant of the species tested.

Temperate weeds and crops

Ten weed species were controlled at 1.00 kg/ha most important of which, relating to weed control in carrot, were Galium aparine, Polygonum aviculare, Chenopodium album, Senecio vulgaris and Stellaria media. Agropyron repens was completely killed at this rate but did recover from the 0.33 kg/ha dose where symptoms were evident for a considerable time.

Carrot was the only crop tested to exhibit tolerance at 1.00 kg/ha. Mild chlorosis was observed at the base of the petioles six weeks after treatment at this rate, but these symptoms were not visible four weeks later. Vigour was only reduced by 29% at 3.00 kg/ha but chlorosis was still visible at the base of the petioles ten weeks after treatment although the leaves appeared normal. No other crops were tolerant even at 0.33 kg/ha and there appeared to be no additional tolerance due to increased seed size. Swede and kale were particularly sensitive.

Tropical weeds and crops

Amaranthus retroflexus was particularly sensitive to this compound being completely killed at 0.33 kg/ha. The two annual grass weeds, Eleusine indica and Digitaria sanguinalis were also controlled at this rate, while 1.00 kg/ha was necessary to control Echinochloa crus-galli. Rottboellia exaltata was severely suppressed at this dose but required higher rates for control. The response of Cyperus esculentus was somewhat variable but total chlorosis was observed at the initial assessment from 3.00 kg/ha. Cyperus rotundus was controlled at 1.00 kg/ha five months after treatment when there was a 99% reduction in fresh weight compared with 50% vigour at the first assessment. One or two shoots were beginning to recover at this latter time, but root and rhizome development was negligible. 3.00 kg/ha had completely killed the system by this time with pink/red or rotting tubers, while the 0.33 kg/ha treatment had completely recovered. Oxalis latifolia was variable in response but 3.00 kg/ha still showed some symptoms five months after treatment with some bulbs rotting and others showing signs of recovery.

Broadleaved crops showed a greater degree of tolerance than the cereals. Groundnut, kenaf and cotton were all unaffected at 0.33 kg/ha and the latter was only reduced in vigour by 21% at 1.00 kg/ha. Neither jute or soyabean exhibited any tolerance.

Selective pre-emergence control of Eleusine indica, Digitaria sanguinalis and Amaranthus retroflexus was achieved in cotton, kenaf and groundnut at 0.33 kg/ha. Although levels of selectivity were marginal, there would also appear to be some dose at which selective control of C. rotundus in cotton could be achieved.

Soil persistence

Using turnip as the sensitive test species, results showed an extremely long persistence of this compound in the soil. One year after treatment at 3.00 kg/ha plants emerged but all died while at 0.33 and 1.00 kg/ha the recovery on a fresh weight basis was 36% and 5% of control respectively.

Possible uses and further testing

Further pre-emergence testing of this compound in cotton and possibly kenaf and groundnut would seem appropriate especially against Cyperus spp. The extreme length of soil persistence may be a disadvantage in this situation but it would, conversely, be a distinct advantage if the compound is used as a total herbicide. This would perhaps be a suitable use for this herbicide in view of the fact that 90% of the species used in this test were controlled at 3.00 kg/ha.

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