AGRICULTURAL RESEARCH COUNCIL

WEED RESEARCH ORGANIZATION

TECHNICAL REPORT No. 36

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

BAYER 94871
TEBUTHIURON
AC 92553

NB: AC 92553 is pendimethalin
Bayer 94871 (BAY 94871) is isocarbamid

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BEGBROKE HILL, YARNTON, OXFORD

CONTENTS

NOTE

RICHARDSON, W.G. and DEAN, M.L. The activity and pre-emergence selectivity of some recently developed herbicides: BAYER 94871, tebuthiuron and AC 92553. Technical Report Agricultural Research Council Weed Research Organization, 1975, 36, pp. 33.

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THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: BAYER 94871, TEBUTHIURON AND AC 92553

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SUMMARY

Three recently developed herbicides were tested on six species for their foliar and soil activity, and subsequently on 27 temperate and 17 tropical crops and weeds for their pre-emergence selectivity following incorporation into soil. The persistence of each herbicide in the soil was also examined.

BAYER 94871 gave good potential selective annual weed control, including Avena fatua and Alopecurus myosuroides, in radish, maize, groundnut and possibly sugar beet. A moderate period of soil persistence was found.

Tebuthiuron was very active and the potential selectivities in large seeded legumes, maize, sorghum and sesamum were marginal. Treated soil caused phytotoxicity for an extremely long period.

AC 92553 controlled annual grass and certain broad-leaved weeds at rates where pea, carrot and groundnut were tolerant. Persistence in the soil was prolonged.

INTRODUCTION

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

The present report gives pre-emergence selectivity data on three new herbicides. Results of activity experiments are also included to provide information on levels of phytotoxicity, type of effect and route of action.

METHODS AND MATERIALS

These were similar to previous trials. The activity experiments (AE) were carried out on six selected species, four being raised from seeds and two perennial species from rhizome fragments. Herbicides were applied by four different methods: (i) a post-emergence foliar spray avoiding soil

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contact, (ii) a post-emergence soil drench with no foliage contact, (iii) a pre-emergence surface spray to the soil after planting, (iv) a pre-emergence soil incorporated treatment before planting, as reported by Richardson and Dean (1973). Species data are summarised in Table 1 and soil and environmental conditions in Table 2.

Table 1. Plant data for activity experiments

Species	Cultivar /Source	No. per pot at spraying		Depth of planting (cm)	Post-emergence stage of growth at spraying	Stage of growth at assessment	
		pre-	post-			pre-	post-
Dwarf bean (Phaseolus vulgaris)	The Prince	3	2	1.8	2 unifoliate leaves	1-2 trifoliate leaves	1-2 trifoliate leaves
Kale (Brassica oleracea acephala	Marrow-stem	10-15	3-5	0.6	½-2 leaves	2½-4½ leaves	3½-4½ leaves
Polygonum amphibium	WRO Clone 1	6	4-5	1.2	3½-5 leaves	5½-8½ leaves	6-9½ leaves
Perennial ryegrass (Lolium perenne)	S 23	10-15	8-10	0.6	2-2½ leaves	5-7 leaves tillering	6½ leaves tillering
Avena fatua	Boxworth 1967	8-10	5	1.2	2-2½ leaves	4-7 leaves tillering	4-7 leaves tillering
Agropyron repens	WRO Clone 31	6	4-5	1.2	2½-3 leaves	4-8 leaves tillering	5-8 leaves tillering

Techniques for the selectivity experiment were the same as reported by Richardson and Dean (1973). Herbicides were incorporated throughout the soil after spraying. Duplicate 9.0 cm pots of treated soil were planted for each species. All pots were watered from above. Soil and environmental conditions are summarised in Table 2 and plant data in Table 3. Radish (Raphanus raphanistrum) was included for ease of propagation and may be regarded as a crop or weed. To improve establishment Chenopodium album seeds were rubbed with sand paper; Chrysanthemum segetum seeds were pricked and tubers of Cyperus esculentus were stored moist at 4°C for 23 days to break dormancy. Freshly harvested bulbils of Oxalis latifolia were stored at 20°C for 4 weeks followed by heating at 45°C for 4 hours. During the experiment normal daylight was supplemented with a 14 hour photoperiod using warm white fluorescent tubes or mercury vapour lamps.

NB: AC 92553 is pendimethalin

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Table 2. Soil and environmental conditions

Experiment number, type and herbicide(s) included	AE 1 AC 92553	AE 2 BAYER 94871	AE 3 tebuthi-uron	pre-emergence selectivity experiment BAYER 94871 tebuthiuron AC 92553	
Date of spraying	14.4.72	7.6.72	6.12.73	31.10.72	
Main assessment completed	18.5.72	31.7.72	24.1.74	8.12.72	
Soil moisture at spraying (%)	13.0	10.0	12.0	13.0	
Organic matter (%)	2.8	2.8	2.8	2.8	
Clay content (%)	16.0	16.0	16.0	16.0	
pH	7.7	7.7	7.7	7.7	
John Innes Base fertiliser (g/kg)	4.0	4.0	5.0	1.0	
5% DDT dust (g/kg)	0.5	0.5	0.5	0.5	
Fritted trace elements (g/kg)	0.25	0.25	0.25	0.25	
Temperature (°C)				Temperate	Tropical
Mean	18	19	15	17	23
Maximum	27	29	23	25	29
Minimum	8	9	10	12	17
Relative humidity (%)					
Mean	60	60	70	60	60
Maximum	90	88	95	86	88
Minimum	25	30	46	38	44

In all experiments surviving plants were counted and their vigour was scored on a 0-7 scale as defined by Richardson and Dean (1973) where 0 = dead and 7 = control. Histograms were prepared from these results and a computer was used to process the selectivity experiment data as before (Richardson and Dean, 1973). For each treatment a histogram is presented which includes a pair of figures; the upper figure represents mean plant survival and the lower, mean vigour score, both calculated as percentage of untreated controls. The same information is displayed as a histogram where each 'x' represents a 5% increment except in the activity experiment results where each 'x' represents a 7% increment. A '+' indicates a value in excess of 100%; 'R' indicates a result based on one replicate only and 'M' represents a missing treatment. All doses quoted are in terms of active ingredient.

It was not possible to computerise the data for Polygonum aviculare which failed to germinate. Veronica persica germinated successfully but many plants died back from the cotyledon leaf stage because of a damping off type of syndrome. Chrysanthemum segetum, Sinapis arvensis and Solanum nigrum germinated erratically and the perennials Convolvulus arvensis and Cirsium arvense tended to turn yellow and die back due to lack of root development. However visual assessments of these species were made and are referred to in the text. Sugar beet was only assessed visually but the experiment was repeated and is referred to where necessary.

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

Soil persistence was monitored, in conjunction with the pre-emergence selectivity experiment by storing moist, treated soil at 23°C and assaying at intervals with a suitable sensitive test species (Richardson and Dean, 1973).

Table 3. Species, abbreviations, cultivars and stage of growth at assessment

	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Stage of growth at assessment (untreated control leaf number exclusive of cotyledons)
Temperate species					
Wheat (Triticum aestivum)	WHEAT (1)	Kolibri	8	1.2	3½-4 leaves
Barley (Hordeum vulgare)	BARLEY (2)	Sultan	8	1.2	4½ leaves
Oat (Avena sativa)	OAT (3)	Condor	8	1.2	4½ leaves
Perennial ryegrass (Lolium perenne)	PER RYGR (4)	S 23	15	0.6	4-5 leaves, tillering
Onion (Allium cepa)	ONION (8)	Robusta	15	0.6	2 leaves
Dwarf bean (Phaseolus vulgaris)	DWF BEAN (9)	The Prince	3	1.8	1 trifoliate leaf
Field bean (Vicia faba)	FLD BEAN (10)	Maris Bead	4	1.8	5½ leaves
Pea (Pisum sativum)	PEA (11)	Dark Skinned Perfection	4	1.2	7-9 leaves
White clover (Trifolium repens)	W CLOVER (12)	S 100	20	0.6	2 trifoliate leaves

Table 3 (continued)

	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Stage of growth at assessment (untreated control leaf number exclusive of cotyledons)
Tomato (*Lycopersicon esculentum*)	TOMATO (14)	Ailsa Craig	10	0.6	3½-4 leaves
Kale (*Brassica oleracea acephala*)	KALE (15)	Marrowstem	15	0.6	3½ leaves
Swede (*Brassica napus*)	SWEDE (17)	Lord Derby	15	0.6	3½ leaves
Carrot (*Daucus carota*)	CARROT (18)	Chantenay Red Core	10	0.6	2-2½ leaves
Lettuce (*Lactuca sativa*)	LETTUCE (20)	Borough Wonder	15	0.6	5½ leaves
Sugar beet (*Beta vulgaris*)	SUG BEET (21)	Klein monogerm	15	1.2	not recorded
Avena fatua	AVE FATU (26)	Chipping Norton 1968	8	1.2	3½-4 leaves
Alopecurus myosuroides	ALO MYOS (27)	Rothamsted 1968	30	0.6	6 leaves, tillering
Poa annua	POA ANN (28)	WRO 1966	25	0.2	5 leaves
Sinapis arvensis	SIN ARV (30)	WRO 1965	15	0.6	erratic germination
Raphanus raphanistrum	RAPH RAP (31)	Long Black Spanish	12	0.6	3 leaves
Chrysanthemum segetum	CHRY SEG (32)	WRO 1972	50	Surface	erratic germination
Tripleurospermum maritimum	TRIP MAR (33)	WRO 1971	25	Surface	8 leaves
Senecio vulgaris	SEN VULG (34)	WRO 1970	35	0.3	5 leaves
Polygonum lapathifolium	POL LAPA (35)	WRO 1971	15	0.6	2½ leaves
Polygonum aviculare	POL AVIC (36)	Rothamsted 1968 and WRO 1972	100	0.6	nil germination

Table 3 (continued)

	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Stage of growth at assessment (untreated control leaf number exclusive of cotyledons)
Galium aparine	GAL APAR (38)	WRO 1970	12	0.6	2½-4 whorls
Chenopodium album	CHEN ALB (39)	WRO 1967	40	0.6	4-8 leaves
Stellaria media	STEL MED (40)	WRO 1970	20	0.6	8-10 leaves
Veronica persica	VER PERS (42)	WRO 1972	25	0.6	diseased
Solanum nigrum	SOL NIG (43)	Asmer Seeds 1972	12	0.6	erratic germination
Agropyron repens	AG REPEN (47)	WRO Clone 31	6†	1.2	4½-5 leaves, tillering
Allium vineale	ALL VIN (49)	WRO 1971	6*	1.2	2½-3 leaves
Cirsium arvense	CIRS ARV (50)	WRO Clone 1	4††	1.2	premature die-back
Tussilago farfara	TUS FARF (51)	WRO Clone 1	4†	1.8	3½ leaves
Convolvulus arvensis	CONV ARV (52)	WRO Clone 1	4††	1.2	premature die-back
Tropical species (grown under higher of temperature regimes)					
Maize (Zea mays)	MAIZE (58)	Inra 200	6	1.8	4½-5 leaves
Sorghum (Sorghum bicolor)	SORGHUM (59)	Eli Lilly, U.S.A., 1972	8	1.2	5 leaves
Rice (Oryza sativa)	RICE (60)	IR 5	10	1.2	3-3½ leaves
Groundnut (Arachis hypogea)	GRNDNUT (64)	Argentine	4	1.8	4½-5 trifoliate leaves
Soyabean (Glycine max)	SOYABEAN (65)	Wayne	6	1.2	2-2½ trifoliate leaves

Table 3 (continued)

	Designation and computer serial number	Cultivar or source	No. per pot	Depth of planting (cm)	Stage of growth at assessment (untreated control leaf number exclusive of cotyledons)
Cotton (Gossypium hirsutum)	COTTON (66)	26J	6	1.8	1½-2 leaves
Jute (Corchorus olitorius)	JUTE (67)	Egypt 1971	20	0.6	3-3½ leaves
Kenaf (Hibiscus cannabinus)	KENAF (68)	Thai Native	10	0.6	2-2½ leaves
Sesamum (Sesamum indicum)	SESAMUM (70)	Addis Ababa 1970	10	0.6	2-4 leaves
Eleusine indica	ELEU IND (74)	WRO 1964	15	0.6	4-5 leaves
Echinochloa crus-galli	ECH CRUS (75)	WRO 1968	15	0.6	5 leaves
Rottboellia exaltata	ROTT EXA (76)	Rhodesia 1971	30	0.6	3½-4 leaves
Digitaria sanguinalis	DIG SANG (77)	WRO 1968	20	0.2	4½-5 leaves
Amaranthus retroflexus	AMAR RET (78)	WRO 1966	15	0.3	4-7 leaves
Cyperus esculentus	CYP ESCU (85)	WRO Clone 2 (ex South Africa)	5**	1.8	5-7 leaves/ shoot
Cyperus rotundus	CYP ROTU (86)	WRO Clone 1 (ex Rhodesia)	5**	1.8	7½-8½ leaves/ shoot
Oxalis latifolia	OXAL LAT (87)	WRO Clone 2 (ex Cornwall)	15 bulbs	1.2	1-3 leaves

/ one node rhizome fragments
// 4 cm root fragments
* aerial bulbils
** tubers

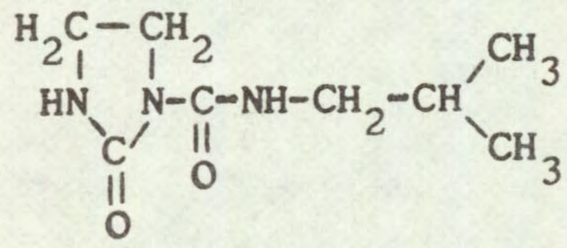
NB: Bayer 94871 (BAY 94871) is isocarbamid

BAYER 94871

Code number BAYER 94871, MZ 166 **Trade name** -

Chemical name N-isobutyl-2-oxo-imidazolidine-1-carboxamide

Structure



Source

Bayer Agrochemicals Ltd
Eastern Way
Bury St Edmunds
Suffolk

This compound has also been referred to as imizolamid, azolamid, izolamid and isocarbamid.

Information available and suggested uses

Eue *et al* (1970) and the manufacturer's information from 1973 report good selective broad-leaved and grass weed control in sugar beet following pre-emergence surface application at 4.6-6.8 kg/ha. Hack and Schmidt (1972) have reported an improved weed control spectrum in sugar beet using BAY 6339H, a mixture of BAYER 94871 and lenacil.

Formulations used 80% w/w a.i. wettable powder (BAY 6199H)

Spray volume for activity experiment 352 l/ha (31.3 gal/ac)
for selectivity experiment 413 l/ha (36.8 gal/ac)

RESULTS

Full histogram results are presented on pages 11 to 15 and potential selectivities are summarised in the following Table.

RATE (kg ai/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
9.0	None	None listed as no crops tolerant
3.0	radish maize groundnut	*Avena fatua* *Alopecurus myosuroides* *Poa annua* *Tripleurospermum maritimum* *Senecio vulgaris* *Polygonum lapathifolium* *Chenopodium album* *Stellaria media* *Amaranthus retroflexus*
1.0	None listed as no weeds controlled	None

Comments on results

General

The activity experiment foliar spray caused mild symptoms on broad-leaved species. Most activity was found following soil applications, particularly pre-emergence where surface and incorporated treatments were equally effective.

In the selectivity experiment, a range of annual weeds were controlled. Potential selectivities were limited. No crops tolerated 9.0 kg/ha and no weeds were controlled at 1.0 kg/ha.

Symptoms

Symptoms were characteristic of a photosynthetic inhibitor. Foliar treatment caused wilting and scorch of broad-leaved species a few days after treatment. Following soil applications, chlorosis preceded die-back in all species. In broad-leaved species this chlorosis was often more intense at leaf margins or immediately adjacent to midribs and veins. Germination was not affected following pre-emergence application.

Temperate weeds and crops

All annual grass and most broad-leaved weeds were controlled at 3.0 kg/ha. The susceptibility of Avena fatua and Alopecurus myosuroides is very interesting. Galium aparine, Raphanus raphanistrum and all the perennials were resistant. [A subsequent experiment has shown that Polygonum aviculare and Veronica persica are susceptible at 3.0 kg/ha.]

Although results for sugar beet are not presented observations suggested that it would be tolerant at 3.0 kg/ha. [In a subsequent experiment this result was not confirmed, although marginal resistance was noted at 3.0 kg/ha and complete tolerance was observed at 1.0 kg/ha]. Radish was the only other crop tolerant at 3.0 kg/ha.

Potential selective control of a range of annual grass and broad-leaved weeds was noted in radish and possibly in sugar beet.

Tropical weeds and crops

Amaranthus retroflexus was the only weed controlled at 3.0 kg/ha. With the exception of Rottboellia exaltata all annual grass weeds were severely reduced at this dose, but were likely to recover. The perennials Oxalis latifolia, Cyperus rotundus and Cyperus esculentus eventually recovered from minor symptoms.

Only maize and groundnut were tolerant at 3.0 kg/ha. The latter also showed some marginal resistance at 9.0 kg/ha, from which it had almost recovered at a later assessment. Sorghum exhibited marginal tolerance at 3.0 kg/ha. Cotton and jute were particularly sensitive.

Only A. retroflexus was controlled at potentially selective rates in maize and groundnut.

Soil persistence

A moderate period of soil persistence was found using turnip as the test species. No plants showed symptoms 7 weeks after treatment at 1.0 kg/ha, while 3.0 kg/ha gradually disappeared from the soil over 47 weeks.

Fifty weeks after application 9.0 kg/ha was still causing 85% reduction of shoot fresh weight.

Possible uses and further testing

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The possible selective control of annual weeds in sugar beet is of interest, but the fact that crop tolerance was not confirmed in a second experiment suggests that selectivities may be marginal. However under our conditions the herbicide was thoroughly incorporated before sowing. Eue et al have reported sugar beet tolerance in the field at 6.0-8.0 kg product/ha following surface pre-emergence application. This method may well improve the level of crop tolerance. Although BAYER 94871 lacks activity against certain weeds (eg G. aparine, R. raphanistrum and perennials) the control of A. fatua and A. myosuroides gives it an advantage over other sugar beet herbicides. Hack and Schmidt (1972) have reported that combinations of BAYER 94871 and lenacil improve the spectrum of activity and are less dependant on the amount of rainfall than other soil-acting herbicides. Mixtures with other herbicides may also be worth investigating. The moderate period of soil persistence could prove advantageous in controlling late germinating weeds with little risk to the subsequent crop.

Selective weed control in radish may be worth some further experimentation.

There would not appear to be any obvious use for BAYER 94871 in the tropical situation owing to the high dose required and lack of outstanding selectivities in the crops tested.

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ACTIVITY EXPERIMENT

BAYER 94871

		1.0 kg/ha	3.0 kg/ha	9.0 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxx xxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxx xx
	P	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxx	xxxxx xxxxx
	I	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxx xxxxxxxxx	xx xx
KALE	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xxx xxx
	P	xxxxxxxxx xxxxxxxxx	xxx xxxxx	o o
	I	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxx xxxx	o o
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx
	S	xxxxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxxxxxxxx + xxxxxxxx	xxxxxxxxxxxxxxx + xxxx
	P	xxxxxxxxx xxxxxxxxx	xxxxxxxx xxxxxx	xxxxxx xx
	I	xxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx	xxxxxxx xx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxx xxxx
	P	xxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxx xxxxx	xx xxxx
	I	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxx xxxxxxx	o o
AVENA FATUA	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx + xxxxxxxxxxxxx	xxxxxxxxxxxxxxx + xxxx	xx xx
	P	xxxxxxxxxxxxxxx xxxxx	xxxx xxxx	o o
	I	xxxxxxxxxxxxxxx xxxxxxx	xx xx	o o
AGROPYRON REPENS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx + xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx + xxxxxxxxxxx	xxxxxxxxxxxxxxx + xxxx
	P	xxxxxxxxxxxxxxx xxxxxxxxxxx	xxxxxxxxxxxxxxx + xxxxxx	xxxx xxxx
	I	xxxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx + xxxxxxx	xxxxxxx xxxx

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

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PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	BAYER 94871 1.00 KG/HA		BAYER 94871 3.00 KG/HA		BAYER 94871 9.00 KG/HA	
WHEAT	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx
(1)	71	xxxxxxxxxxxxxx	36	xxxxxxx	21	xxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx	12	xx
(2)	71	xxxxxxxxxxxxxx	36	xxxxxxx	36	xxxxxxx
OAT	93	xxxxxxxxxxxxxxxxxxx	107	xxxxxxxxxxxxxxxxxxxx +	0	
(3)	71	xxxxxxxxxxxxxx	36	xxxxxxx	0	
PER RYGR	91	xxxxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxx +	38	xxxxxxxx
(4)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
ONION	129	xxxxxxxxxxxxxxxxxxx +	98	xxxxxxxxxxxxxxxxxxx	24	xxxxx
(8)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	36	xxxxxxx
DWF BEAN	95	xxxxxxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxx	109	xxxxxxxxxxxxxxxxxxx +
(9)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	43	xxxxxxxxx
FLD BEAN	91	xxxxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxxx	91	xxxxxxxxxxxxxxxxxx
(10)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
PEA	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	43	xxxxxxxxx
W CLOVER	21	xxxx	0		0	
(12)	43	xxxxxxxxx	0		0	
TOMATO	68	xxxxxxxxxxxxxx	0		0	
(14)	64	xxxxxxxxxxxxx	0		0	
KALE	127	xxxxxxxxxxxxxxxxxxx +	58	xxxxxxxxxxxx	0	
(15)	86	xxxxxxxxxxxxxxxxx	29	xxxxxx	0	
SWEDE	67	xxxxxxxxxxxxx	3	x	0	
(17)	57	xxxxxxxxxxx	7	x	0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	BAYER 94871 1.00 KG/HA		BAYER 94871 3.00 KG/HA		BAYER 94871 9.00 KG/HA	
CARROT	94	xxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx	44	xxxxxxxxx
(18)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
LETTUCE	72	xxxxxxxxxxxxxx	36	xxxxxxx	4	x
(20)	57	xxxxxxxxxxx	29	xxxxxx	14	xxx
AVE FATU	64	xxxxxxxxxxxxx	59	xxxxxxxxxxxx	21	xxxx
(26)	71	xxxxxxxxxxxxxx	29	xxxxxx	14	xxx
ALO MYOS	133	xxxxxxxxxxxxxxxxxxx +	80	xxxxxxxxxxxxxxxx	20	xxxx
(27)	64	xxxxxxxxxxxxx	29	xxxxxx	29	xxxxxx
POA ANN	79	xxxxxxxxxxxxxxxx	55	xxxxxxxxxxx	9	xx
(28)	71	xxxxxxxxxxxxxx	29	xxxxxx	29	xxxxxx
RAPH RAP	95	xxxxxxxxxxxxxxxxxx	110	xxxxxxxxxxxxxxxxxxx +	45	xxxxxxxxx
(31)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	36	xxxxxxx
TRIF MAR	91	xxxxxxxxxxxxxxxxx	26	xxxxx	9	xx
(33)	71	xxxxxxxxxxxxxx	29	xxxxxx	14	xxx
SEN VULG	106	xxxxxxxxxxxxxxxxxxx +	14	xxx	0	
(34)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	
POL LAPA	109	xxxxxxxxxxxxxxxxxxx +	69	xxxxxxxxxxxxxx	4	x
(35)	71	xxxxxxxxxxxxxx	29	xxxxxx	14	xxx
GAL APAR	102	xxxxxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx	130	xxxxxxxxxxxxxxxxxxx +
(38)	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	43	xxxxxxxxx
CHEN ALB	125	xxxxxxxxxxxxxxxxxxx +	55	xxxxxxxxxx	0	
(39)	100	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
STEL MED	72	xxxxxxxxxxxxx	0		0	
(40)	86	xxxxxxxxxxxxxxxx			0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

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SPECIES	BAYER 94871 1.00 KG/HA		BAYER 94871 3.00 KG/HA		BAYER 94871 9.00 KG/HA	
AG REPEN	103	xxxxxxxxxxxxxxxxxxxxx +	94	xxxxxxxxxxxxxxxxxxxx	103	xxxxxxxxxxxxxxxxxxxx +
(47)	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
ALL VIN	114	xxxxxxxxxxxxxxxxxxxx +	114	xxxxxxxxxxxxxxxxxxxx +	103	xxxxxxxxxxxxxxxxxxxx +
(49)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
TUS FARF	120	xxxxxxxxxxxxxxxxxxxx +	90	xxxxxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxxx +
(51)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
MAIZE	132	xxxxxxxxxxxxxxxxxxxx +	96	xxxxxxxxxxxxxxxxxxx	108	xxxxxxxxxxxxxxxxxxxx +
(58)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
SORGHUM	83	xxxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxxx +
(59)	93	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
RICE	108	xxxxxxxxxxxxxxxxxxxx +	96	xxxxxxxxxxxxxxxxxxx	60	xxxxxxxxxxxx
(60)	79	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(64)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
SOYABEAN	86	xxxxxxxxxxxxxxxxx	118	xxxxxxxxxxxxxxxxxxxx +	86	xxxxxxxxxxxxxxxxx
(65)	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	29	xxxxxx
COTTON	65	xxxxxxxxxxxxx	41	xxxxxxxx	0	
(66)	71	xxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
JUTE	43	xxxxxxxxx	0		0	
(67)	14	xxx	0		0	
KENAF	98	xxxxxxxxxxxxxxxxxxx	109	xxxxxxxxxxxxxxxxxxxx +	22	xxxx
(68)	100	xxxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	7	x
SESAMUM	208	xxxxxxxxxxxxxxxxxxxx +	138	xxxxxxxxxxxxxxxxxxxx +	0	
(70)	100	xxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	

NB: Bayer 94871 (BAY 94871) is isocarbamid

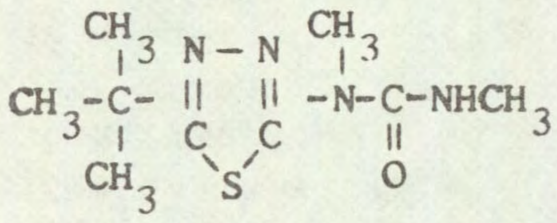
SPECIES		BAYER 94871 1.00 KG/HA		BAYER 94871 3.00 KG/HA		BAYER 94871 9.00 KG/HA
ELEU IND	89	xxxxxxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxxx +	75	xxxxxxxxxxxxxxx
(74)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	36	xxxxxxx
ECH CRUS	104	xxxxxxxxxxxxxxxxxxxx +	95	xxxxxxxxxxxxxxxxxxx	63	xxxxxxxxxxxxx
(75)	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	43	xxxxxxxxx
ROTT EXA	137	xxxxxxxxxxxxxxxxxxxx +	137	xxxxxxxxxxxxxxxxxxxx +	107	xxxxxxxxxxxxxxxxxxxx +
(76)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
DIG SANG	84	xxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	0	
(77)	57	xxxxxxxxxxx	43	xxxxxxxxx	0	
AMAR RET	130	xxxxxxxxxxxxxxxxxxx +	27	xxxxx	0	
(78)	71	xxxxxxxxxxxxx	43	xxxxxxxxx	0	
CYP ESCU	82	xxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxx
(85)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	64	xxxxxxxxxxx
CYP ROTU	95	xxxxxxxxxxxxxxxxxx	118	xxxxxxxxxxxxxxxxxxx +	87	xxxxxxxxxxxxxxxx
(86)	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
OXAL LAT	171	xxxxxxxxxxxxxxxxxxxx +	75	xxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
(87)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx

TEBUTHIURON

Code number EL 103, AP 2591 **Trade name** Spike, Perflan

Chemical name 1,3-dimethyl-1-(5-t-butyl-1,3,4-thiadiazol-2-yl) urea

Structure



Source

Eli Lilly
Lilly Research Centre Ltd
Erl Wood Manor
Windlesham
Surrey

Information available and suggested uses

Manufacturer's information received in 1974 reports potential non-selective control in non-crop areas; control of bush and trees in pasture and rangeland and selective control of certain tree species in re-afforestation programmes. Grass and broad-leaved weed control in sugar cane is reported at 0.5-1.25 kg/ha depending on season and soil type. Convolvulus spp, Sorghum halepense and Cyperus esculentus show considerable resistance to this herbicide.

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

Spray volume for activity experiment 305 l/ha (27.1 gal/ac)
for selectivity experiment 413 l/ha (36.8 gal/ac)

RESULTS

Full histogram results are presented on pages 19 to 23 and potential selectivities are summarised in the following Table.

RATE (kg ai/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
1.6 and 0.4	None	None listed as no crops tolerant
0.1	pea maize sorghum groundnut soyabean sesamum	Avena fatua Alopecurus myosuroides Poa annua Raphanus raphanistrum Tripleurospermum maritimum Senecio vulgaris Polygonum lapathifolium Chenopodium album Stellaria media Amaranthus retroflexus

Comments on results

General

The activity experiment foliar spray caused considerable damage, especially on the broad-leaved species. However greater activity was found following soil application, particularly on the grasses. Post-emergence soil drenches were as effective as pre-emergence treatments. Similar levels of activity were found with either surface application or incorporation.

Tebuthiuron was very active in the selectivity experiment and no crop tolerated more than 0.1 kg/ha. A range of annual weeds was controlled at this dose but potential selectivities were limited. Galium aparine and all perennial weeds were resistant at lower doses.

Symptoms

These were similar to those reported for BAYER 94871 and were typical of other photosynthetic inhibitors.

Temperate weeds and crops

With the exception of Galium aparine all annual weeds were controlled at 0.1 kg/ha. Grass weeds were somewhat more resistant than broad-leaved species however. Perennial weeds showed resistance at this dose but were reduced in vigour by over 50% at 0.4 kg/ha. G. aparine was also controlled at 0.4 kg/ha. [Polygonum aviculare and Veronica persica were killed at 0.1 kg/ha in a subsequent experiment].

Pea was the only tolerant crop at 0.1 kg/ha. Dwarf and field bean were reduced by only 21% at this dose thus showing marginal tolerance. Other crops were reduced by more than 50% at 0.1 kg/ha, with most smaller seeded species being killed.

All annual weeds tested, excluding G. aparine, were controlled at 0.1 kg/ha where pea was tolerant.

Tropical weeds and crops

Amaranthus retroflexus was the only weed controlled at 0.1 kg/ha. Annual grasses were controlled or killed at 0.4 kg/ha with the exception of Rottboellia exaltata which was reduced by only 50%. Only minor symptoms were observed on the perennial weeds. Oxalis latifolia was still stunted and weak 11 weeks after treatment at 1.6 kg/ha while Cyperus rotundus was more severely affected and unlikely to recover. Certain tubers retrieved were rotting. Cyperus esculentus was more sensitive and was eventually killed at 1.6 kg/ha. Severely reduced plants were recovering from 0.4 kg/ha 11 weeks after treatment.

No crops tolerated 0.4 kg/ha although maize showed some degree of resistance. At 0.1 kg/ha maize, groundnut and soyabean were completely tolerant while sorghum and sesamum showed only minor symptoms. The latter germinated erratically and some plants died, probably due to damping-off, but those surviving were healthy. Jute and kenaf were particularly sensitive.

A.retroflexus was the only weed controlled at rates where any crops were tolerant.

Soil persistence

A very long period of soil persistence was found using turnip as the test plant. Symptoms were still detectable 50 weeks after treatment at 0.1 kg/ha (45% reduction of shoot fresh weight). Doses of 0.4 and 1.6 kg/ha were causing complete kill of plants at this time. This soil persistence was much longer than for most other urea herbicides.

Possible uses and further testing

Because of the high level of activity, the limited selectivity and the very long soil persistence of tebuthiuron, it is doubtful if it could find any use in arable situations. However these characteristics would seem to give it great potential as a total herbicide provided the doses used were sufficient to also control perennial weeds.

The tolerance of the larger seeded tropical cereals and legumes is interesting but of little value due to the limited weed control at 0.1 kg/ha. Further investigations in sesamum, a crop which tolerates few herbicides, may be worthwhile.

ACTIVITY EXPERIMENT.

TEBUTHIURON

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

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

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES		TEBUTHIURON 0.10 KG/HA	TEBUTHIURON 0.40 KG/HA		TEBUTHIURON 1.60 KG/HA	
WHEAT	93	xxxxxxxxxxxxxxxxxxxx	0		0	
(1)	29	xxxxxx	0		0	
BARLEY	25	xxxxx	0		0	
(2)	36	xxxxxxx	0		0	
OAT	14	xxx	0		0	
(3)	14	xxx	0		0	
PER RYGR	52	xxxxxxxxxx	0		0	
(4)	29	xxxxxx	0		0	
ONION	55	xxxxxxxxxxx	0		0	
(8)	43	xxxxxxxxx	0		0	
DWF BEAN	109	xxxxxxxxxxxxxxxxxxxx +	14	xxx	0	
(9)	79	xxxxxxxxxxxxxxxx	7	x	0	
FLD BEAN	104	xxxxxxxxxxxxxxxxxxxx +	13	xxx	13	xxx
(10)	79	xxxxxxxxxxxxxxxx	14	xxx	7	x
PEA	114	xxxxxxxxxxxxxxxxxxxx +	0		0	
(11)	86	xxxxxxxxxxxxxxxx	0		0	
W CLOVER	0		0		0	
(12)	0		0		0	
TOMATO	0		0		0	
(14)	0		0		0	
KALE	0		6	x	0	
(15)	0		14	xxx	0	
SWEDE	0		0		0	
(17)	0		0		0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	TEBUTHIURON 0.10 KG/HA		TEBUTHIURON 0.40 KG/HA		TEBUTHIURON 1.60 KG/HA	
CARROT	75	xxxxxxxxxxxxxxx	0		0	
(18)	43	xxxxxxxxx	0		0	
LETTUCE	4	x	0		0	
(20)	14	xxx	0		0	
AVE FATU	54	xxxxxxxxxx	0		0	
(26)	21	xxxx	0		0	
ALO MYOS	73	xxxxxxxxxxxxxxx	0		0	
(27)	29	xxxxxx	0		0	
POA ANN	73	xxxxxxxxxxxxxxx	6	x	0	
(28)	29	xxxxxx	7	x	0	
RAPH RAP	0		0		0	
(31)	0		0		0	
TRIP MAR	9	xx	0		0	
(33)	14	xxx	0		0	
SEN VULG	0		0		0	
(34)	0		0		0	
POL LAPA	0		0		0	
(35)	0		0		0	
GAL APAR	136	xxxxxxxxxxxxxxxxxxxx +	89	xxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxx +
(38)	93	xxxxxxxxxxxxxxxxxx	21	xxxx	14	xxx
CHEN ALB	27	xxxxx	0		0	
(39)	29	xxxxxx	0		0	
STEL MED	0		0		0	
(40)	0		0		0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES		TEBUTHIURON 0.10 KG/HA		TEBUTHIURON 0.40 KG/HA		TEBUTHIURON 1.60 KG/HA	
AG REPEN	86	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	77	xxxxxxxxxxxxxxx	
(47)	57	xxxxxxxxxxx	36	xxxxxxx	29	xxxxxx	
ALL VIN	103	xxxxxxxxxxxxxxxxxxxxx	+	41	xxxxxxxx	72	xxxxxxxxxxxxx
(49)	93	xxxxxxxxxxxxxxxxxxxx		29	xxxxxx	29	xxxxxx
TUS FARF	120	xxxxxxxxxxxxxxxxxxxxx	+	90	xxxxxxxxxxxxxxxxxxx	120	xxxxxxxxxxxxxxxxxxxx +
(51)	71	xxxxxxxxxxxxxx		50	xxxxxxxxxx	43	xxxxxxxxx
MAIZE	96	xxxxxxxxxxxxxxxxxx		84	xxxxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxxx
(58)	100	xxxxxxxxxxxxxxxxxxxx		71	xxxxxxxxxxxxxx	50	xxxxxxxxxx
SORGHUM	89	xxxxxxxxxxxxxxxxxx		89	xxxxxxxxxxxxxxxxxxx	0	
(59)	93	xxxxxxxxxxxxxxxxxxx		36	xxxxxxx	0	
RICE	84	xxxxxxxxxxxxxxxxx		36	xxxxxxx	30	xxxxxx
(60)	50	xxxxxxxxxx		21	xxxx	21	xxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx		50	xxxxxxxxxx	37	xxxxxxx
(64)	100	xxxxxxxxxxxxxxxxxxxx		21	xxxx	14	xxx
SOYABEAN	96	xxxxxxxxxxxxxxxxxx		32	xxxxxx	11	xx
(65)	100	xxxxxxxxxxxxxxxxxxxx		14	xxx	7	x
COTTON	41	xxxxxxxx		0		0	
(66)	14	xxx		0		0	
JUTE	0			0		0	
(67)	0			0		0	
KENAF	0			0		0	
(68)	0			0		0	
SESAMUM	69	xxxxxxxxxxxxx		69	xxxxxxxxxxxxx	0	
(70)	93	xxxxxxxxxxxxxxxxxxx		21	xxxx	0	

PRE-EMERGENCE SELECTIVITY EXPERIMENT

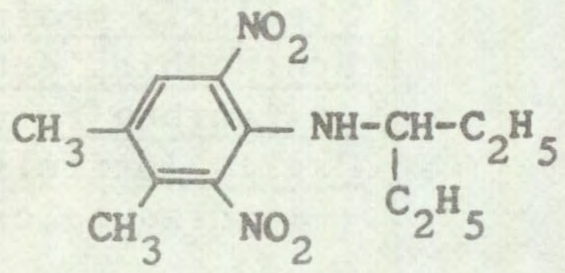
SPECIES		TEBUTHIURON 0.10 KG/HA		TEBUTHIURON 0.40 KG/HA		TEBUTHIURON 1.60 KG/HA	
ELEU IND	139	xxxxxxxxxxxxxxxxxxxxxx +	6	x	0		
(74)	79	xxxxxxxxxxxxxxxxx	14	xxx	0		
ECH CRUS	111	xxxxxxxxxxxxxxxxxxxxxx +	3	x	0		
(75)	57	xxxxxxxxxxx	7	x	0		
ROTT EXA	112	xxxxxxxxxxxxxxxxxxxxxx +	39	xxxxxxxx	3	x	
(76)	86	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	7	x	
DIG SANG	84	xxxxxxxxxxxxxxxxx	0		0		
(77)	57	xxxxxxxxxxx	0		0		
AMAR RET	7	x	0		0		
(78)	7	x	0		0		
CYP ESCU	109	xxxxxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxxxxx +	68	xxxxxxxxxxxxxx	
(85)	100	xxxxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	57	xxxxxxxxxxx	
CYP ROTU	71	xxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxxx	
(86)	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	
OXAL LAT	118	xxxxxxxxxxxxxxxxxxxx +	75	xxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	
(87)	79	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	

AC 92553

Code number AC 92553 **Trade name** Stomp, Prowl

Chemical name N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine

Structure



Source Cyanamid International Ltd
Fareham Road
Gosport
Hants
PO13 OAS

Information available and suggested uses

Pre-emergence control of annual grass and certain broad-leaved weeds is reported by the manufacturer at 0.5 to 2.0 kg/ha depending on soil type. Generally incorporation provides better weed control in cotton, soyabeans, peanuts and beans where soil temperatures are higher at planting. In areas where weather at planting is normally cool and wet, pre-emergence surface application is suggested. Comparison of pre-emergence surface application and incorporation is recommended. Mixtures with atrazine or cyanazine are reported to give excellent weed control in maize.

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

Spray volume for activity experiment 352 l/ha (31.3 gal/ac)
for selectivity experiment 413 l/ha (36.8 gal/ac)

RESULTS

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

RATE (kg ai/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
4.0	pea carrot groundnut	Avena fatua Poa annua Polygonum lapathifolium Rottboellia exaltata Digitaria sanguinalis Cyperus esculentus + species below

(Table continued overleaf)

RATE (kg ai/ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
1.0	species above + barley onion field bean kale swede lettuce radish maize soyabean cotton	Alopecurus myosuroides Chenopodium album Stellaria media Echinochloa crus-galli Amaranthus retroflexus Oxalis latifolia + species below
0.25	species above + wheat oat perennial ryegrass dwarf bean white clover sorghum	Eleusine indica

Comments on results

General

The activity experiment foliar spray caused minor symptoms on the foliage of broad-leaved species only. Soil applications were generally more active, especially pre-emergence treatments. Dwarf bean and the perennials were resistant to post-emergence soil drenches. Perennial ryegrass and kale were more sensitive to pre-emergence surface applications while incorporated treatments were generally more active against the other species tested. This possibility of greater activity following surface application should be borne in mind when considering the results of the selectivity experiment in which the herbicide was thoroughly incorporated before sowing.

A wide range of annual and perennial weeds were controlled in the selectivity experiment. Eleusine indica was particularly sensitive. A large number of crops were tolerant and many potential selectivities were noted. Certain large seeded legumes and carrot were particularly tolerant.

Symptoms

Mild scorch resulted from the foliar spray on dwarf bean and kale. Post-emergence soil drenches caused inhibition of growth and leaves became darker green and tended to stick together.

Annual grasses often failed to emerge from the coleoptile following pre-emergence application at higher rates while at lower doses plants were stunted and foliage was dark green. Broad-leaved species were also stunted with twisted darker green leaves. Certain species, notably brassicas, exhibited a purple/red colouration. In some annuals chlorosis was observed prior to necrosis. Root systems of susceptible species were generally poorly developed. These symptoms are similar to those of other dinitro-aniline herbicides.

NB: AC 92553 is pendimethalin

Temperate weeds and crops

Although Alopecurus myosuroides was the only annual grass weed to be controlled at 1.0 kg/ha, both Poa annua and Avena fatua were severely reduced at this dose. Of the broad-leaved species, Stellaria media and Chenopodium album were controlled at 1.0 kg/ha and Polygonum lapathifolium at 4.0 kg/ha. However the other broad-leaved weeds, Galium aparine, Raphanus raphanistrum, Senecio vulgaris and Tripleurospermum maritimum were resistant. The perennials were also resistant with the exception of Convolvulus arvensis which did not emerge, root fragments eventually rotting at 1.0 and 4.0 kg/ha. [In a subsequent test, Polygonum aviculare was controlled at 0.25 kg/ha and Veronica persica at 1.0 kg/ha].

Pea and carrot were tolerant at 4.0 kg/ha while barley was only reduced by 29%. At 1.0 kg/ha several other broad-leaved crops were tolerant including field bean, lettuce and the brassicas. The tolerance of onion at this dose is of considerable interest. [Sugar beet proved to be sensitive at 0.25 kg/ha in a subsequent experiment].

Certain annual grass and broad-leaved weeds were controlled at selective rates in pea and carrot. Some potential selectivities were also noted in barley, onion, lettuce and the brassica crops at 1.0 kg/ha.

Tropical weeds and crops

Eleusine indica was particularly sensitive to AC 92553 and did not emerge at 0.25 kg/ha. Echinochloa crus-galli was controlled at 1.0 kg/ha. Digitaria sanguinalis was killed at 4.0 kg/ha and although severely affected at 1.0 kg/ha showed signs of recovery. Rottboellia exaltata was also controlled at 4.0 kg/ha but was recovering from 1.0 kg/ha despite severe effects initially. Although Amaranthus retroflexus was severely reduced at 0.25 kg/ha and controlled at 1.0 kg/ha, plants that were not killed produced inflorescences at both doses. Cyperus rotundus was particularly resistant and eventually recovered completely from minor symptoms. Cyperus esculentus had failed to emerge 11 weeks after treatment at 4.0 kg/ha and tubers were still sound with unemerged sprouts. Plants recovered from 1.0 kg/ha. Oxalis latifolia was susceptible at 1.0 kg/ha and had not emerged from 4.0 kg/ha four weeks after treatment. Some recovery was observed at both doses during a later assessment however.

Groundnut was particularly tolerant at 4.0 kg/ha and showed no symptoms subsequently. Soyabean and cotton also showed some marginal resistance at this dose. All large seeded crops were tolerant at 1.0 kg/ha. Sorghum was tolerant at 0.25 kg/ha.

Potential selective control of all annual grass weeds plus A. retroflexus and the perennials O. latifolia and C. esculentus was noted in groundnut. E. indica, E. crus-galli, O. latifolia and A. retroflexus could also be controlled in maize, soyabean and cotton. Only E. indica was controlled at a rate at which sorghum was tolerant.

Soil persistence

Using perennial ryegrass as the test species, a long period of soil persistence was found. Six weeks after application 0.25 kg/ha caused no symptoms and the partial disappearance of 1.0 kg/ha during the first 14 weeks after treatment resulted in shoot fresh weights increasing from 5 to 37%. However, from 14 to 50 weeks the degree of phytotoxicity from the 1 kg/ha application remained almost the same (shoot fresh weight reductions of 60 to 80%). Plants were still killed 50 weeks after treatment at 4.0 kg/ha.

NB: AC 92553 is pendimethalin

Possible uses and further testing

The pattern of activity of AC 92553 is similar to that of other dinitro-aniline herbicides, with control of annual grass and certain broad-leaved weeds, and the tolerance of carrot and other broad-leaved crops e.g. brassicas and legumes. However the resistance of onion, and to a lesser extent barley, differs from these other compounds. Further trials of AC 92553 could well prove beneficial in view of the increasing importance of grass weeds in onions and the shortage of herbicides to combat them.

Some differences are apparent between the range of weeds controlled reported by the manufacturer and those found in the present test e.g. the claim that composite weeds are controlled was not substantiated. In view of the very low solubility of AC 92553 (0.3 ppm in water - much less than that of most other herbicides), this discrepancy is not surprising and perhaps this factor alone can explain why the activity of pre-plant incorporated and surface pre-emergence treatments vary so much with climate and soil type. The long period of soil persistence will also have to be considered in relation to following crops in any rotation.

Crop tolerances were largely as reported by the manufacturer. The potential selective control of a wide range of both annual and perennial weeds in groundnut would suggest that further testing in this crop would be worthwhile. Improved weed control and/or selectivity may however be achieved by surface application compared to the incorporated treatment used in this experiment. This former method of application may be of particular benefit in increasing the selectivity against annual grass weeds and especially R. exaltata in maize. Further testing in soyabean and cotton for controlling annual grass weeds may also be worthwhile.

NB: AC 92553 is pendimethalin

ACTIVITY EXPERIMENT

AC 92553

		0.125 kg/ha	0.75 kg/ha	4.5 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	P	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx +	xxxxxxxxxxxxxxx xxxxxxxxxxxx +	xxxxxxxxxxxxxxx xxxxxxxxxx
	I	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx
KALE	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx
	P	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx +	xxxxxxxxxxxxxxx xxxxxxxxx +	xxxxxxx x
	I	xxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxx xxxxxxxxx
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	P	xxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxx xxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx +
	I	xxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx +	xxxxxxxxxxx xxxxxxxxxxxxxxx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx
	P	xxxxxxxxxx xxxxxxxxxxxxxxx	x xxxx	o o
	I	xxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxx xxxxxxxxxx	o o
AVENA FATUA	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx
	P	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx +	xxxxxxxxxx xxxxxxxx
	I	xxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxx xxxxxx	x xxx
AGROPYRON REPENS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxx
	P	xxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx
	I	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx +	xxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxx xxxxxxx

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

NB: AC 92553 is pendimethalin

SPECIES	AC 92553 0.25 KG/HA		AC 92553 1.00 KG/HA		AC 92553 4.00 KG/HA	
WHEAT	93	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx
(1)	93	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx
BARLEY	100	xxxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxx
(2)	100	xxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
OAT	107	xxxxxxxxxxxxxxxxxxxxx +	107	xxxxxxxxxxxxxxxxxxxxx +	71	xxxxxxxxxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	29	xxxxxx
PER RYGR	84	xxxxxxxxxxxxxxxxx	31	xxxxxx	3	x
(4)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
ONION	73	xxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxx	67	xxxxxxxxxxxxx
(8)	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	29	xxxxxx
DWF BEAN	109	xxxxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxxxx +
(9)	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
FID BEAN	104	xxxxxxxxxxxxxxxxxxxx +	104	xxxxxxxxxxxxxxxxxxxx +	104	xxxxxxxxxxxxxxxxxxxx +
(10)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
PEA	114	xxxxxxxxxxxxxxxxxxxx +	86	xxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
W CLOVER	103	xxxxxxxxxxxxxxxxxxxx +	79	xxxxxxxxxxxxxxxx	39	xxxxxxxx
(12)	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
TOMATO	74	xxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx	85	xxxxxxxxxxxxxxxxx
(14)	79	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	43	xxxxxxxxx
KALE	110	xxxxxxxxxxxxxxxxxxxx +	127	xxxxxxxxxxxxxxxxxxxx +	121	xxxxxxxxxxxxxxxxxxxx +
(15)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx
SWEDE	88	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(17)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx

NB: AC 92553 is pendimethalin

PRE-EMERGENCE SELECTIVITY EXPERIMENT

SPECIES	AC 92553 0.25 KG/HA		AC 92553 1.00 KG/HA		AC 92553 4.00 KG/HA	
CARROT	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	112	xxxxxxxxxxxxxxxxxxxxxx +
(18)	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxxx
LETTUCE	98	xxxxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxxxx
(20)	93	xxxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxxxxx	29	xxxxxx
AVE FATU	91	xxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxxxx	5	x
(26)	86	xxxxxxxxxxxxxxxxxxx	36	xxxxxxx	14	xxx
ALO MYOS	147	xxxxxxxxxxxxxxxxxxxxxx +	53	xxxxxxxxxxx	0	
(27)	71	xxxxxxxxxxxxxx	21	xxxx	0	
POA ANN	96	xxxxxxxxxxxxxxxxxxxx	41	xxxxxxxx	0	
(28)	79	xxxxxxxxxxxxxxxxx	36	xxxxxxx	0	
RAPH RAP	95	xxxxxxxxxxxxxxxxxxx	115	xxxxxxxxxxxxxxxxxxxxx +	100	xxxxxxxxxxxxxxxxxxxx
(31)	100	xxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
TRIP MAR	112	xxxxxxxxxxxxxxxxxxxxx +	121	xxxxxxxxxxxxxxxxxxxxx +	88	xxxxxxxxxxxxxxxxxx
(33)	100	xxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	43	xxxxxxxxx
SEN VULG	116	xxxxxxxxxxxxxxxxxxxxx +	102	xxxxxxxxxxxxxxxxxxxxx +	49	xxxxxxxxxx
(34)	100	xxxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx
POL LAPA	109	xxxxxxxxxxxxxxxxxxxxx +	97	xxxxxxxxxxxxxxxxxxx	101	xxxxxxxxxxxxxxxxxxxx +
(35)	100	xxxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx
GAL APAR	116	xxxxxxxxxxxxxxxxxxxxx +	123	xxxxxxxxxxxxxxxxxxxxx +	123	xxxxxxxxxxxxxxxxxxxx +
(38)	93	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
CHEN ALB	118	xxxxxxxxxxxxxxxxxxxx +	36	xxxxxxx	7	x
(39)	86	xxxxxxxxxxxxxxxxx	29	xxxxxx	14	xxx
STEL MED	83	xxxxxxxxxxxxxxxxx	65	xxxxxxxxxxxxx	18	xxxx
(40)	79	xxxxxxxxxxxxxxxxx	29	xxxxxx	29	xxxxxx

NB: AC 92553 is pendimethalin

SPECIES	AC 92553 0.25 KG/HA		AC 92553 1.00 KG/HA		AC 92553 4.00 KG/HA	
AG REPEN	94	xxxxxxxxxxxxxxxxxxxx	103	xxxxxxxxxxxxxxxxxxxxx +	103	xxxxxxxxxxxxxxxxxxxxx +
(47)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxx
ALL VIN	93	xxxxxxxxxxxxxxxxxxx	103	xxxxxxxxxxxxxxxxxxxxx +	62	xxxxxxxxxxx
(49)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
TUS FARF	105	xxxxxxxxxxxxxxxxxxxx +	75	xxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxxx +
(51)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
MAIZE	84	xxxxxxxxxxxxxxxxx	108	xxxxxxxxxxxxxxxxxxxx +	84	xxxxxxxxxxxxxxxxx
(58)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx
SORGHUM	96	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	6	x
(59)	93	xxxxxxxxxxxxxxxxxxx	36	xxxxxxx	14	xxx
RICE	90	xxxxxxxxxxxxxxxxxx	108	xxxxxxxxxxxxxxxxxxxx +	24	xxxxx
(60)	57	xxxxxxxxxxx	50	xxxxxxxxxx	29	xxxxxx
GRNDNUT	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(64)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
SOYABEAN	107	xxxxxxxxxxxxxxxxxxxx +	86	xxxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxxx
(65)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
COTTON	73	xxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxxx
(66)	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx
JUTE	94	xxxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(67)	79	xxxxxxxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
KENAF	82	xxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
(68)	64	xxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
SESAMUM	185	xxxxxxxxxxxxxxxxxxx +	138	xxxxxxxxxxxxxxxxxxx +	46	xxxxxxxxx
(70)	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	14	xxx

PRE-EMERGENCE SELECTIVITY EXPERIMENT

NB: AC 92553 is pendimethalin

SPECIES	AC 92553 0.25 KG/HA		AC 92553 1.00 KG/HA		AC 92553 4.00 KG/HA	
ELEU IND	0		0		0	
(74)	0		0		0	
ECH CRUS	76	xxxxxxxxxxxxxxxx	6	x	0	
(75)	71	xxxxxxxxxxxxxxx	21	xxxx	0	
ROTT EXA	73	xxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxxxx	45	xxxxxxxxx
(76)	79	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
DIG SANG	96	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
(77)	43	xxxxxxxxx	36	xxxxxxx	0	
AMAR RET	82	xxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxxxx	0	
(78)	43	xxxxxxxxx	29	xxxxxx	0	
CYP ESCU	109	xxxxxxxxxxxxxxxxxxxx +	123	xxxxxxxxxxxxxxxxxxxx +	0	
(85)	100	xxxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxxx	0	
CYP ROTU	79	xxxxxxxxxxxxxxxx	103	xxxxxxxxxxxxxxxxxxxx +	79	xxxxxxxxxxxxxxxx
(86)	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
OXAL LAT	139	xxxxxxxxxxxxxxxxxxx +	21	xxxx	0	
(87)	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	

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ABBREVIATIONS

ångström	Å	freezing point	f.p.
Abstract	Abs.	from summary	F.s.
acid equivalent*	a.e.	gallon	gal
acre	ac	gallons per hour	gal/h
active ingredient*	a.i.	gallons per acre	gal/ac
approximately equal to*	≃	gas liquid chromatography	GLC
aqueous concentrate	a.c.	gramme	g
bibliography	bibl.	hectare	ha
boiling point	b.p.	hectokilogram	hkg
bushel	bu	high volume	HV
centigrade	C	horse power	hp
centimetre*	cm	hour	h
concentrated	concd	hundredweight*	cwt
concentration	concn	hydrogen ion concentration*	pH
concentration × time product	ct	inch	in.
concentration required to kill 50% test animals	LC_{50}	infra red	i.r.
		kilogramme	kg
cubic centimetre*	cm^3	kilo ($\times 10^3$)	k
cubic foot*	ft^3	less than	<
cubic inch*	in^3	litre	l.
cubic metre*	m^3	low volume	LV
cubic yard*	yd^3	maximum	max.
cultivar(s)	cv.	median lethal dose	LD_{50}
curie*	Ci	medium volume	MV
degree Celsius*	^oC	melting point	m.p.
degree centigrade*	^oC	metre	m
degree Fahrenheit*	^oF	micro ($\times 10^{-6}$)	µ
diameter	diam.	microgramme*	µg
diameter at breast height	d.b.h.	micromicro (pico: $\times 10^{-12}$)*	µµ
divided by*	÷ or /	micrometre (micron)*	µm (or µ)
dry matter	d.m.	micron (micrometre)*[x]	µm (or µ)
emulsifiable concentrate	e.c.	miles per hour*	mile/h
equal to*	=	milli ($\times 10^{-3}$)	m
fluid	fl.	milliequivalent*	m.equiv.
foot	ft	milligramme*	mg
		millilitre	ml

* The name micrometre is preferred to micron and µm is preferred to µ.

millimetre*	mm
millimicro* (nano: $\times 10^{-9}$)	n or mμ
minimum	min.
minus	-
minute	min
molar concentration*	M (small cap)
molecule, molecular	mol.
more than	>
multiplied by*	×
normal concentration*	N (small cap)
not dated	n.d.
oil miscible concentrate	o.m.c. (tables only)
organic matter	o.m.
ounce	oz
ounces per gallon	oz/gal
page	p.
pages	pp.
parts per million*	ppm
parts per million by volume*	ppmv
parts per million by weight*	ppmw
percent(age)*	%
pico (micromicro: $\times 10^{-12}$)	p or μμ
pint	pint
pints per acre	pints/ac
plus or minus*	±
post-emergence	post-em.
pound	lb
pound per acre*	lb/ac
pounds per minute	lb/min
pound per square inch*	lb/in^2
powder for dry application	p. (tables only)
power take off	p.t.o.
precipitate (noun)	ppt.
pre-emergence	pre-em.
quart	quart
relative humidity	r.h.
revolution per minute*	rev/min
second	s
soluble concentrate	s.c.
soluble powder	s.p.
solution	soln
species (singular)	sp.
species (plural)	spp.
specific gravity	sp. gr.
square foot*	ft^2
square inch*	in^2
square metre*	m^2
square root of*	$\sqrt{}$
sub-species*	ssp.
summary	s.
temperature	temp.
ton	ton
tonne	t
ultra-low volume	ULV
ultra violet	u.v.
vapour density	v.d.
vapour pressure	v.p.
varietas	var.
volt	V
volume	vol.
volume per volume	v/v
water soluble powder	w.s.p. (tables only)
watt	W
weight	wt
weight per volume*	w/v
weight per weight*	w/w
wettable powder	w.p.
yard	yd
yards per minute	yd/min

* Those marked * should normally be used in the text as well as in tables, etc.

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16. Report on a joint survey of the presence of wild oat seeds in cereal seed drills in the United Kingdom during Spring 1970. November, 1970. J.G. Elliott and P.J. Attwood. Price - £0.25.

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21. An automatic punching counter. November 1972. R.C. Simmons. Price - U.K. and overseas surface mail - £0.30; overseas airmail - £0.50.

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NB: AC 92553 is pendimethalin

NB: Bayer 94871 (BAY 94871) is isocarbamid

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