AGRICULTURAL RESEARCH COUNCIL

WEED RESEARCH ORGANIZATION

TECHNICAL REPORT No. 25

THE PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES:

LENACIL
RU 12068
METRIBUZIN
CYPRAZINE
EMD-IT 5914
BENTHIOCARB

W.G. Richardson and M.L. Dean

EMD-IT 5914 is difunon, RU 12068 is 3-(2-tetrahydropyranyl)-5,6-trimethyleneuracil (Procida)

August 1973

Price

U.K. and overseas surface mail - £1.75

Overseas airmail - £2.20

BEGBROKE HILL, YARNTON, OXFORD

IGER

INSTITUTE OF GRASSLAND & ENVIRONMENTAL RESEARCH

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9/11/05

Many thanks for the loan of this item

Jenny

With Compliments

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NOTE

Richardson, W.G. and Dean, M.L. The pre-emergence selectivity of some recently developed herbicides: lenacil, RU 12068, metribuzin, cyprazine, EMD-IT 5914 and benthiocarb. Tech. Rep. agric. Res. Coun. Weed Res. Orgn, 1973, (25), pp 57.

THE PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: LENACIL, RU 12068, METRIBUZIN, CYPRAZINE, EMD-IT 5914 and BENTHIOCARB

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SUMMARY

Five newly developed herbicides were tested on six species for their soil and foliar activity and on a range of 32 temperate and 17 tropical crop and weed species for their pre-emergence selectivity following incorporation into soil at three doses. The persistence of biological activity in the soil was also examined. The established compound, lenacil, was included for comparison with the related RU 12068.

RU 12068 exhibited a similar type of activity to lenacil but the levels of activity were greater. At higher doses lenacil showed some selectivity in sorghum and groundnut in addition to sugar beet while selectivities with RU 12068 were only apparent at 0.30 kg/ha when white clover was the only tolerant temperate crop. However, selective weed control by RU 12068 showed no advantages over present treatments and no tropical weeds were controlled in tolerant crops.

Metribuzin was found to be a highly active compound similar to other triazines. Good control of annual grass and broad-leaved species was achieved at levels up to 0.30 kg/ha. Crops were not outstandingly tolerant and selectivities tended to be marginal. Tussilago farfara, Convolvulus arvensis were particularly resistant as were both Cyperus spp to a lesser degree. Soil persistence at 1.20 kg/ha was detectable up to 40 weeks.

The activity of cyprazine resembled atrazine and simazine very closely. Maize exhibited outstanding tolerance of this compound and many of the larger seeded crops showed useful tolerance. Slight to severe effects were apparent on perennial species. Persistence of the compound in the soil was not so long as with atrazine and simazine.

EMD-IT 5914 proved to be an active compound. Control of a range of broad-leaved and monocotyledonous weed species was achieved including some perennials. Selectivities were few and tended to be marginal but cotton achieved outstanding tolerance.

Good control of grass weeds was obtained with benthiocarb while broad-leaved and perennial species were highly resistant. The majority of crop species showed good tolerance but selectivities were not outstanding. The distinct lack of activity on broad-leaved weed species was a disadvantage of this compound.

INTRODUCTION

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

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* Herbicide Evaluation Section
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are in the process of commercial development by industry. This involves application, both pre-emergence and post-emergence, to a wide range of crop and weed species grown in pots, as a preliminary stage of this process. The objectives are to discover selectivities additional to those 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 provide a source of information on the relative susceptibility of plant species. The latter may subsequently prove useful in considering problems such as the cropping of land contaminated with the herbicide. Essentially the main value of this experimentation is as a guide in the planning of further experiments both in pots and in the field.

Attention is drawn particularly to the fact that the experiment described here is only a preliminary guide to the relative resistance or susceptibility of the species included. Pot experiments of this sort are not a reliable guide to the dose levels needed to produce the same effects in the field. 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 experiments are conducted on one soil type only. All these important variables can have a profound effect on response and for this reason it must be emphasised that the data reported should be regarded primarily as a source of ideas for further work.

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

The present report gives data on five new compounds plus lenacil, which was included for comparison with RU 12068. We have also included data from Initial Activity Tests, another form of preliminary experiment, which provides some indication of the mode, type and levels of activity of these compounds.

METHODS AND MATERIALS

a) Initial Activity Tests (IAT 1, 2 and 3)

This is the first routine test when a new herbicide is received. This provides information on levels of phytotoxicity, mode and type of action and whether the activity is associated with uptake by the roots or foliage of the plant. Herbicides are applied by four different methods to six selected species, four being raised from seeds and perennial species from one node rhizome fragments (see Table 1 for species data).

i) foliar spray, post-emergence

Plants were raised in 8.9 cm plastic disposable pots and thinned to constant number before treatment. The herbicide was

applied from a Teejet fan nozzle moving at constant speed 30 cm above level of maximum foliage. The stage of growth at spraying is given in Table 1. The soil surface was protected from herbicideal spray with a layer of perlite to intercept any spray which might reach the soil surface. After careful removal of the perlite, following spraying, the plants were transferred to fibre-glass beds in the glasshouse and sub-irrigated until assessment. The foliage was not washed-off after 24 hours.

ii) soil drench, post-emergence

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

iii) surface spray, pre-emergence

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

iv) soil incorporated, pre-emergence

The method for this portion of the test follows the main pre-emergence experiment identically.

Pre-emergence treatments were assessed some 4-5 weeks after planting and post-emergence treatments about two weeks following treatment (see Table 1). Assessments for number of survivors and plant vigour were made as in the pre-emergence selectivity experiments and are subsequently presented in the same manner (see page 10). Spraying dates, assessment dates and soil and environmental conditions are given in Table 2 for all the tests.

b) <u>Pre-emergence selectivity test</u>

The techniques used for the pre-emergence experiment resembled those in previous pre-emergence selectivity experiments (Richardson and Dean 1972). Six herbicides were tested, each compound being applied at three doses and fully 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 2. 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.

Table 1. Plant data for Initial Activity Tests

	Cultivar /Source	No. per pot at spraying pre-	post-	Depth of planting (cm)	Stage of growth at spraying	Stage of growth at assessment
Dwarf bean (Phaseolus vulgaris)	The Prince	3	2	1.8	10–15 cm 2 unifoliates	1½–2 trifoliates
Kale (Brassica oleracea acephala)	Green Marrow-stem	12	5	0.6	1½–2 true leaves	3–5 true leaves
Avena fatua	Boxworth 1967	8	8	1.2	2–3 leaves	6½–10½ leaves
Polygonum amphibium	WRO Clone 1	6	6	1.2	3½–5½ leaves	4–6 leaves tillering
Perennial ryegrass (Lolium perenne)	S 23	10	10	0.6	1½–2 leaves	3½–7 leaves tillering
Agropyron repens	WRO Clone 31	6	6	1.2	2–3 leaves	4–6 leaves tillering

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.

Pots were allocated to individual species and a specified number of seeds sown at the appropriate depth (see Table 3). For the perennial weed species small portions of underground systems were planted, as indicated in Table 3, and all pots were replicated twice.

With certain species, plant material was pre-treated to improve establishment. Chenopodium album seeds were rubbed with sandpaper until the seed coat was pierced. 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. Tubers of Cyperus esculentus were stored moist at 4°C for 23 days prior to planting to break dormancy. Rottboellia exaltata seeds were soaked for 48–72 hours in water and those which sank were lightly crushed before planting.

Table 2. Soil and Environmental Conditions

Experiment number, type and herbicide	IAT 1 RU 12068 cyprazine	IAT 2 metribuzin	IAT 3 EMD-IT 5914 benthiocarb	pre-emergence lenacil metribuzin RU 12068 EMD-IT 5914 cyprazine benthiocarb	
Date of spraying	23.6.71	17.8.71	8.10.71	24.11.71	
Date of main assessment post-em. pre-em.	13.7.71 18.7.71	1.9.71 13.9.71	27.10.71 11.11.71	22.2.72	
Soil moisture at spraying (%)	-	-	-	13	
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	
J.I. Base Fertiliser	4.0 g/kg	4.0 g/kg	2.0 g/kg	1.0 g/kg	
DDT (5% dust)	-	0.5 g/kg	-	0.5 g/kg	
Fritted Trace Elements	-	-	-	0.3 g/kg	
Temperature (°C)				Temperate	Tropical
Mean	23	20	17	18	24
Maximum	32	28	26	24	31
Minimum	14	13	10	11	10
Relative Humidity (%) Mean	50-55	45-55	50-55	55-60	55-65
Maximum	80	78	78	78	95
Minimum	27	18	22	30	28

The spraying of the soil, its subsequent transfer to pots and planting of the various species commenced on 24th November 1971. 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. 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 2 and normal daylight was supplemented with a 14 hour photoperiod using warm white fluorescent tubes or mercury vapour lamps. During the experimental

period an interrupted electrical supply was experienced and this led to lower temperatures than normal on several occasions. These were for only short periods (not more than 2-3 hours) however. Supplementary lighting was also reduced and completely lost for 2 weeks during which time some of the tropical species especially did suffer a loss of vigour.

Table 3. Species, abbreviations, varieties 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 controls)
Temperate species					
Wheat (*Triticum aestivum*)	WHEAT (1)	Kolibri	8	1.2	3½ leaves
Barley (*Hordeum vulgare*)	BARLEY (2)	Sultan	8	1.2	3½-4 leaves
Oat (*Avena sativa*)	OAT (3)	Condor	8	1.2	3½ leaves
Perennial ryegrass (*Lolium perenne*)	PER RYGR (4)	S23	15	0.6	5 leaves, tillering
Onion (*Allium cepa*)	ONION (8)	Rijnsburger	15	0.6	2-3 leaves
Dwarf bean (*Phaseolus vulgaris*)	DWF BEAN (9)	The Prince	3	1.8	1-1½ trifoliates
Field bean (*Vicia faba*)	FLD BEAN (10)	Maris Bead	4	1.8	5½ pairs leaves
Pea (*Pisum sativum*)	PEA (11)	Dark skinned perfection	4	1.8	7 pairs leaves
White clover (*Trifolium repens*)	W CLOVER (12)	S100	20	0.6	3 trifoliates
Kale (*Brassica oleracea acephala*)	KALE (15)	Marrowstem	10	0.6	3½-4 true leaves
Swede (*Brassica napus*)	SWEDE (17)	Lord Derby	10	0.6	3½ true leaves
Carrot (*Daucus carota*)	CARROT (18)	Chantenay Red Core	10	0.6	2½ true leaves
Lettuce (*Lactuca sativa*)	LETTUCE (20)	Borough Wonder	15	0.6	5 true leaves
Sugar beet (*Beta vulgaris*)	SUG BEET (21)	'Klein E' monogerm	15	1.2	2-2½ true 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 controls)
Avena fatua	AVE FATU (26)	Boxworth	8	1.2	3–3½ leaves
Alopecurus myosuroides	ALO MYOS (27)	Rothamsted	30	0.6	4–5 leaves, tillering
Poa annua	POA ANN (28)	WRO 1966	25	0.6	4½–5 leaves
Sinapis arvensis	SIN ARV (30)	WRO 1967	15	0.6	2 true leaves
Raphanus raphanistrum	RAPH RAP (31)	Red White Tipped	10	0.6	2 true leaves
Tripleurospermum maritimum	TRIP MAR (33)	WRO 1967	25	Surface	no germination
Senecio vulgaris	SEN VULG (34)	WRO 1967	25	0.6	no germination
Polygonum lapathifolium	POL LAPA (35)	WRO 1966	15	0.6	no germination
Polygonum aviculare	POL AVIC (36)	WRO 1968	30	0.6	no germination
Galium aparine	GAL APAR (38)	WRO 1970	12	0.6	3½ rosettes
Chenopodium album	CHEN ALB (39)	Wytham 1971	25	0.6	3 true leaves
Stellaria media	STEL MED (40)	WRO 1970	20	0.6	6 pairs true leaves
Veronica persica	VER PERS (42)	WRO 1970	25	0.6	Diseased
Agropyron repens	AG REPEN (47)	WRO Clone 31	6†	1.2	4½ leaves
Allium vineale	ALL VIN (49)	WRO 1971	6*	1.2	1–1½ leaves
Cirsium arvense	CIRS ARV (50)	WRO Clone 1	4††	1.2	5–6 leaves
Tussilago farfara	TUS FARF (51)	WRO Clone 1	4†	1.8	4–5 leaves
Convolvulus arvensis	CONV ARV (52)	WRO Clone 1	4††	1.2	10 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 controls)
"Tropical" species (grown under higher of temperature regimes)					
Maize (Zea mays)	MAIZE (58)	Inra 200	6	1.8	4½-5 leaves
Sorghum (Sorghum vulgare)	SORGHUM (59)	Fetereita	8	1.2	4½ leaves
Rice (Oryza sativa)	RICE (60)	Kogbandi	10	1.2	2-2½ leaves
Groundnut (Arachis hypogea)	GRNDNUT (64)	Natal Common	4	1.8	4½-5 trifoliates
Soyabean (Glycine max)	SOYABEAN (65)	Merit	6	1.2	2 trifoliates
Cotton (Gossypium hirsutum)	COTTON (66)	Samaru 26J	6	1.8	2-3 true leaves
Jute (Corchorus olitorius)	JUTE (67)	Egypt 1971	20	0.6	2-3½ true leaves
Kenaf (Hibiscus cannabinus)	KENAF (68)	Thai Native	10	0.6	1-2½ true leaves
Sesamum (Sesamum indicum)	SESAMUM (70)	Addis Ababa 1970	10	0.6	2-4 true leaves
Eleusine indica	ELEU IND (74)	WRO 1964	15	0.6	3½-4½ leaves
Echinochloa crus-galli	ECH CRUS (75)	WRO 1969	15	0.6	4-4½ leaves
Rottboellia exaltata	ROTT EXA (76)	Rhodesia 1971	30	0.6	3½-4 leaves
Digitaria sanguinalis	DIG SANG (77)	WRO 1968	20	0.6	4½-5½ leaves
Amaranthus retroflexus	AMAR RET (78)	WRO 1968	15	0.3	4-7 true leaves
Cyperus esculentus	CYP ESCU (85)	WRO Clone 2 (South Africa)	5**	1.8	3-4 leaves
Cyperus rotundus	CYP ROTU (86)	WRO Clone 1 (Rhodesia)	5**	1.8	4-6½ leaves
Oxalis latifolia	OXAL LAT (87)	WRO Clone 2 (ex Cornwall)	12 bulbs	1.2	2-4½ leaves

≠ one node rhizome
// 4 cm root fragments

* aerial bulbils
** tubers

c) Assessment and processing of results (pre-emergence experiment)

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 3. 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. A '+' indicates a value in excess of 100%; an 'r' indicates a result based on one replicate only and an 'M' represents a missing treatment.

For a variety of reasons it was not possible to record the final assessment on to punch cards with certain species. Both Polygonum lapathifolium and Polygonum aviculare failed to germinate as did Senecio vulgaris and Tripleurospermum maritimum. Veronica persica germinated successfully but nearly all the plants died back from the cotyledon leaf stage because of a "damping off" type of disease. Rottboellia exaltata and Oxalis latifolia both exhibited erratic development but some indications of susceptibility or resistance were observed and are 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 or vigour reduction of 70% or more as compared with control in respect of weeds have been taken as the criteria of selectivity. A summary table of observed selectivities and a series of individual comments have been made on the results to highlight salient points for each herbicide.

Persistence of herbicides in soil

When the herbicides were applied in the pre-emergence selectivity test 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 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. An air space was left above the soil in the jar which was ventilated every 3-4 weeks. The moisture level of the soil was determined at the start of the experiment and checked periodically. Adjustments were made to keep the level 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 where necessary.

LENACIL

Code number: Du Pont 634

Trade name: Venzar

Chemical name: 3-cyclohexyl-6,7-dihydro-1H-cyclopentapyrimidine-2, 4-(3H,5H)dione

Source:
Du Pont Co (UK) Ltd
Du Pont House
18 Bream's Buildings
Fetter Lane
London EC4

Information available and suggested uses:

Well-established herbicide for pre-emergence weed control in sugar beet at 0.90 to 2.24 kg/ha depending on soil type. It is also useful in high organic matter soils e.g. fen soils, when incorporated. Weed control in strawberries and bulbs post planting and in herbaceous and hardwood nursery stock.

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

Spray volume: for selectivity experiment 352 l/ha (31.3 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE (kg/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
1.20	sorghum groundnut	Avena fatua Alopecurus myosuroides Poa annua Raphanus raphanistrum Galium aparine Eleusine indica Digitaria sanguinalis + species below
0.30	species above + onion dwarf bean field bean pea white clover carrot sugar beet maize soyabean cotton kenaf sesamum	Sinapis arvensis Chenopodium album Stellaria media
0.075	None listed as no weeds controlled	None

Comments on results

Lenacil was included in this experiment as a standard for comparison with the chemically related RU 12068 and both herbicides are referred to in greater detail in the section on RU 12068.

Only three broad-leaved weeds were controlled at 0.30 kg/ha, while a further seven broad-leaved and grass weeds were controlled at 1.20 kg/ha. Only the tropical crops, sorghum and groundnut were completely tolerant at this dose, but sugar beet and cotton showed some resistance also. Many further crops were tolerant at 0.30 kg/ha.

No initial activity test results are available for this compound.

PRE-EMERGENCE TEST

LENACIL

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
WHEAT	98	xxxxxxxxxxxxxxxxxxx	91	xxxxxxxxxxxxxxxxxx	46	xxxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	7	x
BARLEY	79	xxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxx	0	
(2)	100	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
OAT	87	xxxxxxxxxxxxxxxx	107	xxxxxxxxxxxxxxxxxxx+	0	
(3)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	0	
PER RYGR	98	xxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxx	0	
(4)	100	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	0	
ONION	104	xxxxxxxxxxxxxxxxxxx+	81	xxxxxxxxxxxxxxx	40	xxxxxxxx
(8)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	21	xxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx
(9)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	14	xxx
FLD BEAN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	29	xxxxxx
(10)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	7	x
PEA	100	xxxxxxxxxxxxxxxxxxx	117	xxxxxxxxxxxxxxxxxxx+	83	xxxxxxxxxxxxxxxx
(11)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx
W CLOVER	112	xxxxxxxxxxxxxxxxxxx+	66	xxxxxxxxxxxx	7	x
(12)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	14	xxx
KALE	83	xxxxxxxxxxxxxxxx	30	xxxxxx	0	
(15)	86	xxxxxxxxxxxxxxxx	21	xxxx	0	
SWEDE	91	xxxxxxxxxxxxxxxxx	13	xxx	13	xxx
(17)	100	xxxxxxxxxxxxxxxxxxx	14	xxx	7	x
CARROT	104	xxxxxxxxxxxxxxxxxxx+	98	xxxxxxxxxxxxxxxxxxx	0	
(18)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	0	
LETTUCE	94	xxxxxxxxxxxxxxxxxx	22	xxxx	0	
(20)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	

PRE-EMERGENCE TEST

LENACIL

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
SUG BEET	95	xxxxxxxxxxxxxxxxxxx	118	xxxxxxxxxxxxxxxxxxxx+	99	xxxxxxxxxxxxxxxxxxx
(21)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
AVE FATU	105	xxxxxxxxxxxxxxxxxxx+	91	xxxxxxxxxxxxxxxxx	35	xxxxxxx
(26)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	14	xxx
ALO MYOS	113	xxxxxxxxxxxxxxxxxxx+	113	xxxxxxxxxxxxxxxxxxx+	17	xxx
(27)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	21	xxxx
POA ANN	118	xxxxxxxxxxxxxxxxxxx+	93	xxxxxxxxxxxxxxxxxx	32	xxxxxx
(28)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	14	xxx
SIN ARV	126	xxxxxxxxxxxxxxxxxxx+	0		0	
(30)	100	xxxxxxxxxxxxxxxxxxx	0		0	
RAPH RAP	78	xxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxxx+	0	
(31)	100	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0	
GAL APAR	96	xxxxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxxx	72	xxxxxxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	21	xxxx
CHEN ALB	68	xxxxxxxxxxxxxx	15	xxx	0	
(39)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	
STEL MED	60	xxxxxxxxxxxx	7	x	0	
(40)	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	
AG REPEN	92	xxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	36	xxxxxxx
ALL VIN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(49)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
CIRS ARV	106	xxxxxxxxxxxxxxxxxxx+	106	xxxxxxxxxxxxxxxxxxx+	106	xxxxxxxxxxxxxxxxxxx+
(50)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
TUS FARF	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx

PRE-EMERGENCE TEST

LENACIL

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
CONV ARV	126	xxxxxxxxxxxxxxxxxxxx+	111	xxxxxxxxxxxxxxxxxxx+	126	xxxxxxxxxxxxxxxxxx+
(52)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx
MAIZE	93	xxxxxxxxxxxxxxxxxx	114	xxxxxxxxxxxxxxxxxx+	114	xxxxxxxxxxxxxxxxxx+
(58)	79	xxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
SORGHUM	102	xxxxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxx
(59)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
RICE	102	xxxxxxxxxxxxxxxxxxx	108	xxxxxxxxxxxxxxxxxxx+	6	x
(60)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	36	xxxxxxx
GRNDNUT	104	xxxxxxxxxxxxxxxxxxx+	91	xxxxxxxxxxxxxxxxx	91	xxxxxxxxxxxxxxxxx
(64)	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
SOYABEAN	70	xxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx
(65)	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	14	xxx
COTTON	48	xxxxxxxxxx	72	xxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxx
(66)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
JUTE	89	xxxxxxxxxxxxxxxxx	7	x	0	
(67)	100	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
KENAF	100	xxxxxxxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxx	10	xx
(68)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	14	xxx
SESAMUM	80	xxxxxxxxxxxxxxxx	110	xxxxxxxxxxxxxxxxxxx+	88	xxxxxxxxxxxxxxxxx
(70)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
ELEU IND	114	xxxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxxx+	21	xxxx
(74)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	36	xxxxxxx
ECH CRUS	105	xxxxxxxxxxxxxxxxxxx+	82	xxxxxxxxxxxxxxxx	35	xxxxxxx
(75)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
DIG SANG	120	xxxxxxxxxxxxxxxxxxx+	70	xxxxxxxxxxxxxx	10	xx
(77)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	14	xxx

PRE-EMERGENCE TEST

LENACIL

SPECIES		0.075 KG/HA		0.30 KG/HA		1.20 KG/HA
AMAR RET	81	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
(78)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
CYP ESCU	84	xxxxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxxx
(85)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
CYP ROTU	113	xxxxxxxxxxxxxxxxxxx+	122	xxxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxxx+
(86)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx

RU 12068

Code number: RU 12068 **Trade name:**

Chemical name: 3-(2-tetrahydropyranyl)-6,7-dihydro-1H-cyclopenta-pyrimidine-2,4-(3H,5H)dione

Source: Procida
Department de Biologie Appliquee
5 Rue Bellini
99 Puteaux
France

Information available and suggested uses:

Manufacturer's data received in 1970 details pre- and post-emergence activity on a wide range of weed species. Small seeded annuals are controlled at 2.0 kg/ha but higher rates are required for control of less susceptible and perennial species. No selectivity in cereals was reported then but the possibility for use as a total herbicide was suggested: later Bertin et al (1972) reported promising results in cereals from pre- and post-emergence applications of 0.5 kg/ha with tolerance at higher doses in groundnut, potatoes, woody and plantation species pre-emergence and cotton post-emergence.

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

Spray volume: for selectivity experiment 352 l/ha (31.3 gal/ac)
for initial activity test 392 l/ha (34.9 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE (kg/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
1.20	None	None listed as no crops tolerant
0.30	white clover maize sorghum groundnut cotton	Sinapis arvensis Raphanus raphanistrum Chenopodium album Stellaria media
0.075	None listed as no weeds controlled	None

Comments on results

General

The Initial Activity Test showed that the level and type of phytotoxicity of RU 12068 was similar to other uracils such as bromacil and terbacil. Broad-leaved species were susceptible to the foliar spray but most phytotoxicity occurred following soil treatments. Post-emergence soil drenches usually were as effective as pre-emergence applications. In the latter, no differences were found between surface and incorporated treatments. In a leaching study, RU 12068 was found to be very mobile, comparable to bromacil and terbacil, while lenacil and pyrazone were of much lower mobility.

The pre-emergence selectivity test was carried out at much lower doses than the initial activity test. The activity of RU 12068 was found to be greater than that of lenacil but selectivity was reduced. The pattern of activity of both compounds was similar.

Symptoms

Both RU 12068 and lenacil caused similar symptoms and these were typical of photosynthetic inhibitors. Germination was unaffected, but seedlings died back from an early growth stage, preceded by a severe chlorosis. Symptoms developed slightly more rapidly with RU 12068 than with lenacil.

Temperate weeds and crops

In addition to the three broad-leaved weeds controlled at 0.30 kg/ha by lenacil, i.e. Stellaria media, Chenopodium album and Sinapis arvensis. RU 12068 also controlled Raphanus raphanistrum. A higher rate of both herbicides was required for control of grass weeds. Perennial weeds, notably Convolvulus arvensis, were resistant to both compounds.

White clover was the only crop tolerant to RU 12068 at 0.30 kg/ha. With lenacil at the same dose, onion, dwarf bean, field bean, pea, carrot and sugar beet were tolerant. There was no tolerance of cereals or brassica crops to either herbicide.

Although RU 12068 selectively controlled four broad-leaved weeds in white clover, there are no apparent advantages over herbicides currently used for weed control in this crop. Sugar beet was reduced in vigour by only 29% with 0.30 kg/ha of RU 12068, but the margin of selectivity is very much less than with lenacil (vigour reduction of only 21% at 1.20 kg/ha). [In a recent post-emergence selectivity test, white clover and sugar beet were tolerant to 0.29 kg/ha while six weeds, including some grasses, were controlled. As with lenacil, a serious disadvantage in the weed control spectrum of RU 12068 was found to be the resistance of Veronica persica.]

Tropical weeds and crops

Tropical annual weed species were only controlled at 1.20 kg/ha although some reduction of Echinochloa crus-galli and Digitaria sanguinalis was achieved at 0.30 kg/ha. These results were slightly superior to comparable rates of lenacil. The greatest difference between the two compounds was the increased susceptibility of Amaranthus retroflexus to RU 12068 at 1.20 kg/ha. Neither herbicide was effective against Cyperus rotundus or

Cyperus esculentus; both species recovered three months after treatment. At 1.20 kg/ha RU 12068 reduced the vigour of Rottboellia exaltata to 43% compared with 64% with lenacil. Oxalis latifolia suffered from variable germination and development but eight weeks after treatment minor symptoms were visible at 0.30 kg/ha of lenacil and severe stunting and/or death at 1.20 kg/ha was apparent. Symptoms were more severe at comparable rates of RU 12068 where complete foliage kill and death of bulbs followed emergence at 1.20 kg/ha.

Large differences in crop tolerance were noted between RU 12068 and lenacil but the tendency was for large seeded species to exhibit the greater tolerance to both compounds.

No tropical weeds were selectively controlled in the associated crops with RU 12068. [This was also the case in a recent post-emergence experiment where crops appeared more susceptible to this compound while weed susceptibility was similar]. RU 12068 and lenacil, which only selectively controlled two annual grass species in sorghum and groundnut, exhibited no distinct advantage in these crops.

Soil persistence

Using turnip as the sensitive test species (susceptibility similar to that of swede in the selectivity experiment), 0.075 kg/ha was not detected 6 weeks after application. 0.30 kg/ha of both RU 12068 and lenacil exhibited no phytotoxicity 27 weeks after treatment. RU 12068 proved to be more persistent at 1.20 kg/ha, however, still being detectable 50 weeks after treatment whereas the same concentration of lenacil produced no symptoms at 46 weeks.

Possible uses and further testing

RU 12068 has more in common with terbacil and bromacil of the uracil group than the more selective lenacil and pyrazone. Consequently it may be worth testing in situations where terbacil and bromacil are in use. Its long period of persistence at higher rates could prove advantageous in these and in total weed control situations.

INITIAL ACTIVITY TEST

RU 12068

		0.76 kg/ha (S 0.67 kg/ha)	2.28 kg/ha (S 2.00 kg/ha)	6.84 kg/ha (S 6.00 kg/ha)
DWARF BEAN	F	xxxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxxx xxxx
	S	xxxxxxx x	xxxxxxx x	o o
	P	o o	o o	o o
	I	o o	o o	xx xx
KALE	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxxxx xxxxx
	S	o o	o o	o o
	P	o o	o o	o o
	I	o o	o o	o o
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxxxx
	S	xxxxxxxxxxxxxxx xxx	o o	o o
	P	xxxxxxxxxxxxx xxxx	xxxxxxxxx xxxx	xxxxxxxxxxx xxxx
	I	xxxxxxxxxxxxx xxxxxx	xxxxxxxxxxx xxxx	xxxxxxxx xxxx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxx
	S	o o	o o	o o
	P	x xx	o o	o o
	I	xx xxxxxxx	o o	o o
AVENA FATUA	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx
	S	o o	o o	o o
	P	x xxxxx	o o	o o
	I	o o	o o	o o
AGROPYRON REPENS	F	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxxxxx
	S	xxxxxxxxxxxxxxx xxxx	xxxx xx	o o
	P	xxxxxxxx xxxx	xxxxxxx xxxx	xxxxx xxx
	I	xxxxxxx xxxx	xxx xx	xx xx

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

PRE-EMERGENCE TEST

RU 12068

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
WHEAT	91	xxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxx	39	xxxxxxxx
(1)	100	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	14	xxx
BARLEY	74	xxxxxxxxxxxxxxx	58	xxxxxxxxxxxx	0	
(2)	100	xxxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
OAT	93	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	40	xxxxxxxx
(3)	100	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx
PER RYGR	101	xxxxxxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxxx	17	xxx
(4)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
ONION	104	xxxxxxxxxxxxxxxxxxx+	81	xxxxxxxxxxxxxxxx	35	xxxxxxx
(8)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(9)	71	xxxxxxxxxxxxxx	36	xxxxxxx	7	x
FLD BEAN	100	xxxxxxxxxxxxxxxxxxx	114	xxxxxxxxxxxxxxxxxxx+	14	xxx
(10)	93	xxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	7	x
PEA	133	xxxxxxxxxxxxxxxxxxx+	133	xxxxxxxxxxxxxxxxxxx+	133	xxxxxxxxxxxxxxxxxxx+
(11)	79	xxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	29	xxxxxx
W CLOVER	91	xxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxx	0	
(12)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	0	
KALE	90	xxxxxxxxxxxxxxxxx	53	xxxxxxxxxxx	0	
(15)	71	xxxxxxxxxxxxxx	21	xxxx	0	
SWEDE	104	xxxxxxxxxxxxxxxxxxx+	20	xxxx	7	x
(17)	36	xxxxxxx	14	xxx	7	x
CARROT	92	xxxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxxx+	0	
(18)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	
LETTUCE	101	xxxxxxxxxxxxxxxxxxx	7	x	0	
(20)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	

PRE-EMERGENCE TEST

RU 12068

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
SUG BEET	76	xxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxx	4	x
(21)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	14	xxx
AVE FATU	91	xxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxxx	7	x
(26)	93	xxxxxxxxxxxxxxxxxx	36	xxxxxxx	14	xxx
ALO MYOS	148	xxxxxxxxxxxxxxxxxxx+	18	xxxxxxxxxx	4	x
(27)	86	xxxxxxxxxxxxxxxx	36	xxxxxxx	7	x
POA ANN	174	xxxxxxxxxxxxxxxxxxx+	65	xxxxxxxxxxxxx	12	xx
(28)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
SIN ARV	63	xxxxxxxxxxxxx	0		0	
(30)	57	xxxxxxxxxxx	0		0	
RAPH RAP	98	xxxxxxxxxxxxxxxxxxx	20	xxxx	0	
(31)	79	xxxxxxxxxxxxxxxx	14	xxx	0	
GAL APAR	84	xxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	21	xxxx
CHEN ALB	75	xxxxxxxxxxxxxx	23	xxxxx	0	
(39)	93	xxxxxxxxxxxxxxxxxx	14	xxx	0	
STEL MED	93	xxxxxxxxxxxxxxxxxx	27	xxxxx	0	
(40)	100	xxxxxxxxxxxxxxxxxx	29	xxxxxx	0	
AG REPEN	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	92	xxxxxxxxxxxxxxxx
(47)	100	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	43	xxxxxxxxx
ALL VIN	100	xxxxxxxxxxxxxxxxxx	83	xxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
(49)	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
CIRS ARV	71	xxxxxxxxxxxx	141	xxxxxxxxxxxxxxxxxx+	106	xxxxxxxxxxxxxxxxxx+
(50)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx
TUS FARF	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
(51)	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	36	xxxxxxx

PRE-EMERGENCE TEST

RU 12068

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
CONV ARV	111	xxxxxxxxxxxxxxxxxxx+	111	xxxxxxxxxxxxxxxxxxx+	111	xxxxxxxxxxxxxxxxxxx+
(52)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx
MAIZE	103	xxxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxxx+	103	xxxxxxxxxxxxxxxxxxx+
(58)	86	xxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	57	xxxxxxxxxx
SORGHUM	102	xxxxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxx	38	xxxxxxxx
(59)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx	36	xxxxxxx
RICE	108	xxxxxxxxxxxxxxxxxxx+	90	xxxxxxxxxxxxxxxxx	18	xxxx
(60)	100	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	7	x
GRNDNUT	104	xxxxxxxxxxxxxxxxxxx+	91	xxxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxxx+
(64)	79	xxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
SOYABEAN	98	xxxxxxxxxxxxxxxxxxx	70	xxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxx
(65)	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	21	xxxx
COTTON	96	xxxxxxxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx	132	xxxxxxxxxxxxxxxxxxx+
(66)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
JUTE	27	xxxxx	0		0	
(67)	43	xxxxxxxxx	0		0	
KENAF	95	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx
(68)	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	21	xxxx
SESAMUM	95r	xxxxxxxxxxxxxxxxxx	15	xxx	0	
(70)	85r	xxxxxxxxxxxxxxxx	7	x	0	
ELEU IND	97	xxxxxxxxxxxxxxxxxx	107	xxxxxxxxxxxxxxxxxxx+	21	xxxx
(74)	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx	29	xxxxxx
ECH CRUS	90	xxxxxxxxxxxxxxxxx	82	xxxxxxxxxxxxxxx	4	x
(75)	100	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	14	xxx
DIG SANG	115	xxxxxxxxxxxxxxxxxxx+	80	xxxxxxxxxxxxxxx	5	x
(77)	100	xxxxxxxxxxxxxxxxxxx	50	xxxxxxxxx	14	xxx

PRE-EMERGENCE TEST

RU 12068

SPECIES	0.075 KG/HA		0.30 KG/HA		1.20 KG/HA	
AMAR RET	51	xxxxxxxxxx	92	xxxxxxxxxxxxxxxxx	0	
(78)	100	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx	0	
CYP ESCU	108	xxxxxxxxxxxxxxxxxxx+	72	xxxxxxxxxxxxx	96	xxxxxxxxxxxxxxxxxx
(85)	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
CYP ROTU	103	xxxxxxxxxxxxxxxxxxx+	94	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxx
(86)	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxx

METRIBUZIN

Code number: BAY 94337

Trade name: Sencor, Sencorex

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

Source:
Bayer Agrochemicals
Eastern Way
Bury St Edmunds
Suffolk

Information available and suggested uses:

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

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

Spray volume:
for selectivity experiment 352 l/ha (31.3 gal/ac)
for initial activity test 395 l/ha (35.2 gal/ac)

RESULTS

TABLE OF SELECTIVITIES

RATE (kg/ha)	CROPS: vigour reduced by less than 15%	WEEDS: number or vigour reduced by more than 70%
1.20	None	None listed as no crops tolerant
0.30	field bean pea maize	Avena fatua Alopecurus myosuroides Poa annua Eleusine indica Echinochloa crus-galli Digitaria sanguinalis + species below
0.075	species above + wheat barley onion dwarf bean carrot sorghum rice groundnut soyabean	Sinapis arvensis Raphanus raphanistrum Chenopodium album Stellaria media Amaranthus retroflexus

Comments on results

General

The type and level of activity found in the Initial Activity Test with metribuzin was similar to other triazines. More effects were found with the foliar spray than would be expected from simazine or atrazine, possibly due to the higher water solubility of this herbicide. Most activity occurred with the soil treatments, there being little difference in the degree of activity between post-emergence soil drench and pre-emergence surface of incorporated treatments. A leaching study showed that metribuzin had a high mobility in the soil as compared with simazine and atrazine.

In the pre-emergence selectivity test, metribuzin exhibited good activity at only 0.075 kg/ha and only certain resistant weeds tolerated 1.20 kg/ha. Crop tolerance was somewhat limited however.

Symptoms

Symptoms were typical of those caused by other photosynthetic inhibitors. Germination was normal but seedlings developed a severe chlorosis after reaching the cotyledon stage, before die-back occurred.

Temperate weeds and crops

With the notable exception of Galium aparine, which was resistant at 1.20 kg/ha, all annual broad-leaved weeds were controlled at 0.075 kg/ha. 0.30 kg/ha achieved control of annual grass weeds. Of the perennial weeds, Cirsium arvense, Allium vineale and Agropyron repens showed some sensitivity, the latter eventually being killed at 1.20 kg/ha. Tussilago farfara and Convolvulus arvensis were extremely resistant. [Unfortunately no information on polygonaceous and composite weeds is available from this test due to bad germination. However, in a post-emergence test representative weeds of these two families were controlled at 0.29 kg/ha i.e. Polygonum aviculare, Polygonum lapathifolium, Tripleurospermum maritimum and Senecio vulgaris. In fact, Galium aparine was the only resistant species of eighteen weeds tested at 0.29 kg/ha.]

The cereals, wheat and barley were tolerant at 0.075 kg/ha. Of the small seeded species, onion and carrot were also tolerant at this dose. The large seeded leguminous crops, field bean and more notably pea, were tolerant to 0.30 kg/ha while dwarf bean was tolerant at 0.075 kg/ha only. [Field bean was sensitive to 0.29 kg/ha post-emergence while pea was tolerant.]

The selective control in peas, at 0.30 kg/ha of all annual weeds, with the exception of Galium aparine was most interesting. Of the crops tolerant at 0.075 kg/ha the most interesting selectivities were with carrots and onions. [Carrot proved even more tolerant in the post-emergence test.]

Tropical weeds and crops

Excellent control of small seeded annual weeds was achieved at 0.30 kg/ha and plant number of Amaranthus retroflexus was reduced to 15% of untreated at 0.075 kg/ha. Little significant effect was observed on Rottboellia exaltata and vigour was reduced to only 57% of untreated at 1.20 kg/ha. Oxalis latifolia showed some adverse symptoms at the initial assessment especially at higher doses. One month later at 1.20 kg/ha all

plant material was dead and bulbs were rotting. Severe symptoms were apparent at lower doses and bulbs from these treatments were also rotting. Both Cyperus spp. showed minor adverse effects at 1.20 kg/ha at the initial assessment. After one month C. rotundus was recovering and, although still showing symptoms, recovery of C. esculentus was a possibility. This was verified after a further month.

Metribuzin severely affected all tropical crops at 0.30 kg/ha with the exception of maize which was tolerant at this dose. The larger seeded species including rice, but with the exception of cotton, all tolerated 0.075 kg/ha. Surprisingly sesamum also exhibited some resistance at this dose where vigour was reduced by only 21% of untreated.

Good selective control of the annual grass weeds Echinochloa crus-galli, Digitaria sanguinalis and Eleusine indica was achieved in maize at 0.30 kg/ha. It may be that levels of selectivity could be increased by achieving control at a slightly reduced dose. Amaranthus retroflexus was selectively controlled in sorghum, rice, groundnut and soyabean but this was not outstanding and would not offer any advantages over established practices.

Soil persistence

Using turnip as the sensitive test species (susceptibility similar to that of swede in the selectivity experiment), doses of 0.075, 0.30 and 1.20 kg/ha were not detected at 5, 10 and 40 weeks respectively. These time periods are slightly shorter than would be expected for simazine and atrazine.

Possible uses and further testing

The results obtained in this test have shown that this herbicide has potential use as a selective herbicide in certain crops such as peas, beans and possibly carrots. Maize would seem to be another possible situation for metribuzin although from other data it would appear that rate, method of application and planting depth would play an important part in degree of selectivity (Dean and Parker 1973). Although solanaceous crops were not represented in this test good weed control has been reported elsewhere in potatoes and tomatoes. The period of persistence in the soil is not likely to cause damage to a succeeding crop, but it may be sufficiently long for control of late germinating weeds.

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