WEED RESEARCH ORGANIZATION

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NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl, SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: UBI S-734, SSH-43, ARD 34/02 (= NP 55), PP 009 AND DPX 4189

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CONTENTS

NOTE

RICHARDSON, W.G., WEST, T.M. and PARKER, C. The activity and pre-emergence selectivity of some recently developed herbicides: UBI S-734, SSH-43, ARD 34/02 (=NP 55), PP 009 and DPX 4189. Technical Report Agricultural Research Council Weed Research Organization, 1981, 62, pp 59.

THE ACTIVITY AND PRE-EMERGENCE SELECTIVITY OF SOME RECENTLY DEVELOPED HERBICIDES: UBI S-734, SSH-43, ARD 34/02 (= NP 55), PP 009 and DPX 4189

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SUMMARY

In a series of pot experiments in the glasshouse, five herbicides were examined for pre-emergence selectivities as surface sprays on 64 temperate and tropical crop and weed species. In a separate set of treatments, maize and sorghum seeds were each treated with a dressing of safener to investigate possible protection from herbicide injury. The route of entry of UBI S-734 and SSH-43 was examined in another test on six selected test species. In conjunction with the pre-emergence selectivity test, persistence of the herbicides in the soil was examined. Festuca rubra was included for the first time.

UBI S-734 was active mainly pre-emergence and exhibited a broad spectrum of weed control including many grass weeds but also Cyperus species. Certain broad-leaved crops tolerated doses up to 1 kg/ha eg brassicas, cotton and legumes, including dwarf bean and groundnut.

SSH-43 was highly active pre- and post-emergence but selectivity pre-emergence was limited to large-seeded crops, especially groundnut but also cotton, maize, sorghum and some other legumes.

ARD 34/02 showed outstanding control of all grass weeds except Poa annua and Festuca rubra. All broad-leaved weeds and Cyperaceae were resistant. Onion and all broad-leaved crops were highly tolerant.

PP 009 was similarly very effective on all grass weeds, including Poa annua and Festuca rubra. Onion and most broad-leaved crops were tolerant. Broad-leaved weeds and Cyperaceae were resistant.

DPX 4189 was highly active pre-emergence on a wide range of annual and perennial broad-leaved and certain grass weeds, but not Avena fatua. The temperate cereals, especially wheat and barley, were very tolerant. Although maize, unprotected, was very sensitive to DPX 4189 it was well protected from damage by seed dressings of the safener 1,8-naphthalic anhydride. All other crops tested were very sensitive.

Persistence in the soil was relatively short for ARD 34/02 and moderate to long for the other herbicides as compared with the standard herbicides, cyanazine (short persistence) and simazine (moderate to long persistence).

INTRODUCTION

The pre- and post-emergence activities and selectivities of new herbicides are investigated at WRO on a large number of pot-grown crop and weed species at the same time obtaining experience of the type of effects produced by each compound. Persistence in the soil is also monitored and these data, in

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conjunction with crop susceptibilities, are useful in considering subsequent cropping of treated land. The limitations of these investigations are that only one crop variety or source of weed species is used, grown in one particular soil type, at only one depth of sowing and 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 from those in the field.

This report gives pre-emergence selectivity data on UBI S-734, SSH-43, ARD 34/02, PP 009 and DPX 4189. Results of activity experiments are also included for UBI S-734 and SSH-43 to provide information on levels of phytotoxicity, type and route of action. The corresponding data for ARD 34/02, PP 009 and DPX 4189 have already been published (Richardson, West and Parker, 1980).

METHODS AND MATERIALS

Activity experiments (AE 1 and AE 2) were carried out in the glasshouse on six selected species as described previously (Richardson and Dean, 1973). Four annual species were raised from seeds and two perennials from rhizome fragments. Herbicides were applied by four different methods:

i) a post-emergence spray to the foliage only, avoiding contact with the soil,

ii) post-emergence to the soil only, as a drench avoiding foliar contact,

iii) pre-emergence to the soil surface,

iv) pre-emergence with thorough incorporation before planting.

Experiment details are summarised in Tables 1 and 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	2	2 unifoliate leaves	1½-2 trifoliate leaves	2-3 trifoliate leaves
Kale (*Brassica oleracea acephala*)	Marrowstem	10-15	3-5	0.5	1½-2½ leaves	2½-4 leaves	3-4½ leaves
Polygonum amphibium	WRO Clone 1	6	4-5	1	4-6 leaves	6-10 leaves	8-10 leaves
Perennial ryegrass (*Lolium perenne*)	S 23	10-15	10	0.5	2½-3 leaves	8-9 leaves, tillering	8-12 leaves, tillering

Table 1 cont'd

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-
Avena fatua	WRO 1976/ Bourton-on the-Water 1973	8-10	4-5	1	2½-3 leaves	6-9 leaves, tillering	6½-13 leaves, tillering
Agropyron repens	WRO Clone 1	6	4-5	1	2-3 leaves	5-8 leaves, tillering	5-10 leaves, tillering

Table 2. Soil and environment conditions

Experiment number, type and herbicide(s) included	AE 1 UBI S-734	AE 2 SSH-43	Pre-emergence selectivity test UBI S-734 PP 009 SSH-43 DPX 4189 ARD 34/02	
Date of spraying	8.6.79	15.11.79	29.1.80	
Main assessment completed	10.7.79	4. 1.80	1.4.80	
Soil moisture at spraying (%)	-	-	15.0	
Organic matter (%)	4.1	4.1	4.1	
Clay content (%)	15.0	15.0	15.0	
pH (water; 1:2 soil/water)	7.0	7.0	7.0	
Ammonium sulphate (g/kg)	-	-	0.7	
Superphosphate (g/kg)	-	-	1.7	
Potassium sulphate (g/kg)	-	-	0.7	
Vitax Q4 (g/kg)	5.0	5.0	2.5	
DDT (5% dust) (g/kg)	0.4	0.4	0.4	
Hydrated Mg SO_4 (g/kg)	1.0	1.0	0.9	
Temperature (°C)			Temperate	Tropical
Mean	21	16	15	20
Maximum	34	24	24	29
Minimum	12	9	6	14
Relative humidity (%)				
Mean	65	63	50	65
Maximum	88	88	70	88
Minimum	30	32	17	36

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

Pre-emergence selectivity experiment

Techniques for the selectivity experiment were as described by Richardson and Dean (1973), all herbicides being applied as surface pre-emergence treatments. Species were sown as detailed in Appendix 1, each being replicated twice for every treatment. Herbicides were applied using a laboratory sprayer operated at a pressure of 207 k Pa (30 lb/in^2) and moving at constant speed, 30 cm above the soil. Subsequent watering was from overhead. During the experiment, plants were raised in the glasshouse, normal daylight being supplemented by high pressure sodium lighting to provide a 14 hour photoperiod for temperate species and a 12 hour photoperiod for tropical species.

Radish (Raphanus raphanistrum) was included for ease of propagation and may be regarded as a crop or weed. To improve establishment of certain species, the following treatments were applied:- seeds of Polygonum aviculare were kept at 2°C for 12 weeks prior to planting; seeds of Chenopodium album were kept in 0.1 M potassium nitrate for 48 hours in the light; seeds of Sinapis arvensis were soaked for 30 minutes in concentrated sulphuric acid, washed for one hour in running tap water and soaked for 48 hours in aqueous gibberellic acid (250 ppm); tubers of Cyperus esculentus and bulbs of Oxalis latifolia were kept at 2°C for 12 weeks prior to planting. Dwarf bean seeds were selected by testing their electrical conductivity, after soaking for one hour in water, discarding those whose conductivity was greater than 10 mhos. Seeds of fenugreek were inoculated by pipetting an infusion of Rhizobium meliloti Dang, (Rothamsted Catalogue No 2012) directly onto seeds after sowing.

To protect from soil-borne pathogens, all seeds (except wheat, barley, oat, fenugreek, P. aviculare, B. sterilis) were pre-treated with one of the following: thiram, captan, thiram + methyl bromide (for onion only), ethylmercuric phosphate + thiram (sugar beet only), aldrin (cotton only). Maize seeds were purchased already treated with captan A + teraquinone. The seeds of kale and rape, which are particularly susceptible to disease, were treated with thiram, a 6% gum arabic solution being used prior to dressing to give better adhesion. In addition, 'Cheshunt Compound' or benomyl (for dwarf bean) fungicide solutions were applied as soil drenches to protect against fungal diseases.

A series of treatments were included for maize and sorghum in which seeds were treated with safeners to investigate possible protection from herbicide injury. Maize seeds were treated with NA (1,8-naphthalic anhydride) at 1.0% w/w of seeds (see computer No 56, abbreviation MAIZE + A) while sorghum seeds were acquired from Ciba-Geigy already dressed with cyometrinil (CGA 43089), α - (cyanomethoximino) benzacetonitrile (see computer No 58, abbreviation SORG + A). Metolachlor, which is commercially recommended for sorghum treated with cyometrinil, was included as a standard for comparison.

Assessment and processing of results

Results were processed as described by Richardson and Dean (1973). Survivors were counted and scored for vigour on a 0-7 scale as previously, where 0 = dead and 7 = as in untreated control. It was not possible to analyse the data for Eleusine indica or Amaranthus retroflexus because of variable germination/emergence and growth, but some observations were made and are referred to in the text where appropriate. To improve growth, dwarf bean was germinated under tropical conditions and then transferred to the temperate glasshouse. Conversely, Phalaris minor was raised under temperate conditions until emergence, then transferred to the tropical glasshouse.

Pairs of histograms are presented for each treatment, the upper representing mean plant survival and the lower, mean vigour score, both calculated as percentages of untreated controls. Each 'x' represents a 5% increment but in the activity experiments 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.

A table of observed selectivities, using the criteria specified, is presented for each herbicide along with comments to highlight salient points.

Maize and sorghum, each with and without safeners, were harvested for shoot fresh weights six weeks after sowing. These results are presented in subsidiary tables for each compound.

Persistence in the soil

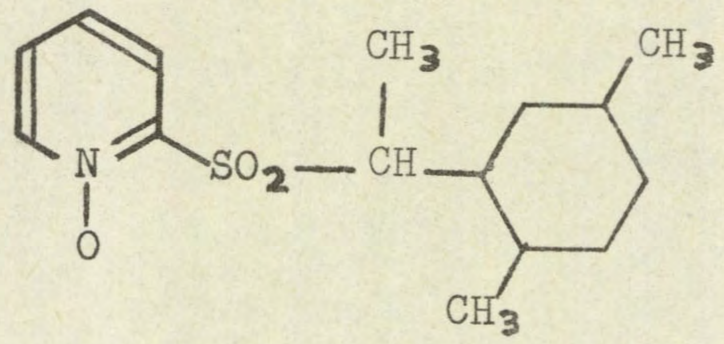
This was monitored, in conjunction with the pre-emergence selectivity experiment, both as surface and incorporated treatments. For the surface treatments, tins containing soil were sprayed directly with the herbicides. For incorporated treatments, tins containing soil were emptied immediately after spraying and the soil passed six times through a large polyethylene funnel before refilling the tins. All treatments were then transferred to the temperate glasshouse together with tins containing untreated soil as controls and watered as necessary, from overhead. Soil moisture before watering was 15%. For the surface treatments, the soil in the tins was divided into six equal compartments by aluminium plates. Susceptible species were periodically sown shallowly, disturbing the soil as little as possible. For incorporated treatments, the soil was emptied into a polythene bag, shaken vigorously and sampled into 6.5 cm diameter plastic pots and the same species sown and covered with soil to the same depth as in the surface treatments. Plants were harvested three to four weeks after sowing, when they had reached a predetermined growth stage, the number and fresh weight of shoots being recorded. Periodical bioassays were carried out at six to eight week intervals for up to a year, unless the herbicides had disappeared before then. Herbicides are considered to have disappeared when shoot fresh weights of the test plants are 80% or more as compared with the controls. Results are presented in graphical form for each herbicide and comments are made in the text. Standard treatments of cyanazine (short persistence) and simazine (moderate to long persistence) were included for comparison. Average temperature during this period was 16°C (minimum 3°C, maximum 33°C) and relative humidity 60% (minimum 22%, maximum 90%). It can be seen from the graphs with certain of the herbicides that the rate of degradation appeared to decrease at the sixth bioassay, 46 weeks after treatment. This may have been due to a temporary lack of soil moisture. However, the degradation rate was only slightly affected at this time for the standard herbicide, simazine (see page 53).

UBI S-734

Code number UBI S-734

Chemical name 2-[1-(2,5-dimethylphenyl)ethylsulphonyl]pyridine-N-oxide

Structure



Source

Uniroyal Ltd
Brooklands Farm
Cheltenham Road
Evesham
Worcs WR11 6LM
UK

Information available and suggested uses

Suggested for control of Cyperus spp., perennial and annual grass weeds in dicotyledonous crops at 0.5-2.0 kg/ha.

Formulation used 75% w/w a.i. wettable powder

Spray volume for activity experiment 370 l/ha
for pre-emergence selectivity experiment 370 l/ha

RESULTS

Full results are given in the histograms on pages 9-14 and potential selectivities are summarised in the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
4.0	none	none listed as no crops tolerant
1.0	dwarf bean radish groundnut cotton	Sinapis arvensis Chrysanthemum segetum Tripleurospermum maritimum Senecio vulgaris Polygonum lapathifolium Chenopodium album Stellaria media Rumex obtusifolius Allium vineale Cyperus rotundus Oxalis latifolia + species below

(Table continued overleaf)

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.25	species above + field bean pea rape kale maize + antidote cowpea chickpea soyabean kenaf	Bromus sterilis Festuca rubra Avena fatua Alopecurus myosuroides Poa annua Poa trivialis Veronica persica Holcus lanatus Agropyron repens Echinochloa crus-galli Rottboellia exaltata Digitaria sanguinalis Solanum nigrum Snowdenia polystachya Phalaris minor Cyperus esculentus Bromus pectinatus

Comments on results

Activity experiment

Grasses were more susceptible than broad-leaved species. The foliar spray caused minor symptoms on dwarf bean, kale and perennial ryegrass, but only at the higher doses. Much greater activity resulted post-emergence from the soil drench applications. However, pre-emergence treatments were the most effective means of application (except on dwarf bean) with lethal effects on all the grasses. Surface pre-emergence treatments were more toxic than when the herbicide was incorporated into the soil on four of the species, but not with dwarf bean and A. repens. This is important when considering the results of the pre-emergence selectivity test, where application was to the surface only.

Symptoms

The foliar spray caused some slight stunting at the higher doses on kale and dwarf bean with the unifoliate leaves of the latter also scorched. New leaves produced by both species were slightly deformed. The main symptom from soil drench and pre-emergence treatments was a powerful inhibition of growth. Grasses often failed to emerge either from the soil or from the coleoptile or died back soon after emergence, while broad-leaved species were often stopped at the cotyledon stage. At lower doses, where plants developed further than this, leaves were often darker green in colour and trapped or stuck together, consequently giving plants and leaves a deformed appearance. Some species had shinier leaves which suggests an effect on wax development. An additional symptom with broad-leaved species, was that newly developing leaves were sometimes twisted, lanceolate or even strap shaped similar to symptoms caused by growth regulator herbicides. Cotyledon leaves were often cupped with inrolled, necrotic margins.

Persistence in the soil

A long period of persistence is evident from the graph on page 15. Perennial ryegrass, the test species was still severely affected by residues from both surface and incorporated treatments of 0.25 kg/ha 53 weeks after spraying.

Pre-emergence selectivity among temperate species

All weeds were controlled at 4.0 kg/ha. At 1.0 kg/ha, all were controlled except three annuals (Raphanus raphanistrum, Polygonum aviculare and Galium aparine) and two perennials (Cirsium arvense and Tussilago farfara). The lowest dose of 0.25 kg/ha controlled all grass weeds, Veronica persica and Solanum nigrum.

No crop tolerated the highest dose while only dwarf bean and radish tolerated 1.0 kg/ha. Field bean, pea and the other brassicae (rape and kale) were the only other crops tolerant to the lowest dose of 0.25 kg/ha. Most small-seeded crops were sensitive (perennial ryegrass, onion, white clover, carrot and lettuce.

Although weed control was of a high order, crop tolerance was limited to only the large seeded legumes and brassica crops. Volunteer cereals (wheat and barley) were not controlled selectively, however, and it is difficult to see advantages of UBI S-734 over any other herbicides already approved for use in legume and brassica crops. While the rather long period of soil persistence may be useful in giving control of late germinating weeds, it may be a danger to other crops following in the rotation. The susceptibility of Agropyron repens was interesting and possibly worth further investigation.

Selectivity among tropical species

This compound showed excellent activity at 0.25 kg/ha against all the annual grass weeds, including Rottboellia. No annual broad-leaved weeds were represented but small seeded crops such as jute and sesamum were "controlled" at this dose, together with Cyperus esculentus. Cyperus rotundus was suppressed at 1 kg/ha. Both Cyperus species eventually showed signs of recovery from these two doses and there was no kill in any treatments but the higher doses (1 kg/ha for C. esculentus and 4 kg/ha for C. rotundus) showed complete suppression up to five months from spraying.

Clear selectivity was shown in cotton and groundnut at 1 kg/ha with only minor reductions in vigour of roots, a result of particular interest in relation to C. rotundus. Excellent selectivity in relation to annual grasses in C. esculentus was also indicated in a wider range of crops including cowpea chickpea, soyabean, kenaf and perhaps pigeon pea.

Further work is in progress to determine the importance of depth of planting of C. rotundus in relation to the placement of UBI S-734.

Oxalis latifolia was completely suppressed by 4 kg/ha for five months and very slow to recover from 1 kg/ha. The compound could, therefore, be of some interest for control of this problem in cotton and perennial crops.

Maize was well protected by seed treatment with NA (by a factor of at least four) such that it would virtually tolerate the dose of 0.25 kg/ha. Fresh weights are shown in the table below.

Cyometrinil gave very little protection to sorghum against UBI S-734 although it was effective against metolachlor.

Table 3. Shoot fresh wt as % of untreated at 6 weeks

	Control	UBI S-734			Metolachlor	
	0	0.25	1.0	4.0	1.0	2.0
Maize	100	52	17	0	-	-
Maize + NA	85	73	54	11	-	-
Sorghum	100	18	0	0	3	0
Sorghum + cyometrinil	87	24	1	0	74	16

ACTIVITY EXPERIMENT

UBI-S734

		0.25 kg/ha	1.0 kg/ha	4.0 kg/ha
DWARF BEAN	F	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX	XXXXXXXXXXXXXX XXXXXX
	P	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX
	I	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX
KALE	F	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXX
	P	XXXXXXXXXXXX XXXXXXXXXXXXXX	XXXXXXXXXXX XXXXXXXX	XXXXXX XXXX
	I	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXX	XXXXXXXX XXXXXX
POLYGONUM AMPHIBIUM	F	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXX
	P	XXXXXXXXX XXXXXXXXXX	XXXX XXXXX	o o
	I	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXX	o o
PERENNIAL RYEGRASS	F	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXX	XXXXXXXXXXXXXX XXXX	XXXXXXXXXXXXXX XXXX
	P	o o	o o	o o
	I	XXXXXX XXXX	o o	o o
AVENA FATUA	F	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXXX	XXXXXXXXXXXXXX XXXXX	XXXXXXXXXXXXXX XXXX
	P	XXXXX XXXXXXX	o o	o o
	I	XXXXXXXXXXXXXX XXXXXXXX	XX XX	o o
AGROPYRON REPENS	F	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX	XXXXXXXXXXXXXX XXXXXXXXXXXXX
	S	XXXXXXXXXXXXXX XXXXXX	XXXXXXXXXXXXXX XXXXXX	XXXXXXXXXXXXXX XXXXXX
	P	XXXXXXX XXXXX	o o	o o
	I	XXXXXXXX XXXX	o o	o o

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

PRE-EMERGENCE SELECTIVITY TEST

SPECIES		UBI S-734 0.25 kg/ha		UBI S-734 1.00 kg/ha		UBI S-734 4.00 kg/ha
WHEAT	102	xxxxxxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxxx	68	xxxxxxxxxxxxxx
(1)	71	xxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
BARLEY	98	xxxxxxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxxx
(2)	79	xxxxxxxxxxxxxxxx	50	xxxxxxxxxx	14	xxx
OAT	102	xxxxxxxxxxxxxxxxxxxx	102	xxxxxxxxxxxxxxxxxxxx	38	xxxxxxxx
(3)	64	xxxxxxxxxxxxx	14	xxx	14	xxx
PER RYGR	92	xxxxxxxxxxxxxxxxx	25	xxxxx	0	
(4)	14	xxx	7	x	0	
ONION	71	xxxxxxxxxxxxxx	0		0	
(8)	29	xxxxxx	0		0	
DWF BEAN	120	xxxxxxxxxxxxxxxxxxx +	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx
FLD BEAN	104	xxxxxxxxxxxxxxxxxxx +	104	xxxxxxxxxxxxxxxxxxx +	104	xxxxxxxxxxxxxxxxxxx +
(10)	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	36	xxxxxxx
PEA	120	xxxxxxxxxxxxxxxxxxx +	60	xxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxx +
(11)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	57	xxxxxxxxxxx
W CLOVER	70	xxxxxxxxxxxxxx	16	xxx	0	
(12)	36	xxxxxxx	21	xxxx	0	
RAPE	89	xxxxxxxxxxxxxxxxx	26	xxxxx	11	xx
(14)	86	xxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
KALE	82	xxxxxxxxxxxxxxxx	51	xxxxxxxxxx	12	xx
(15)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	21	xxxx
CARROT	24	xxxxx	0		0	
(18)	43	xxxxxxxxx	0		0	
LETTUCE	33	xxxxxxx	5	x	0	
(20)	57	xxxxxxxxxxx	7	x	0	

PRE-EMERGENCE SELECTIVITY TEST

SPECIES	UBI S-734 0.25 kg/ha		UBI S-734 1.00 kg/ha		UBI S-734 4.00 kg/ha	
SUG BEET	95	xxxxxxxxxxxxxxxxxxx	68	xxxxxxxxxxxxxx	32	xxxxxx
(21)	79	xxxxxxxxxxxxxxxx	43	xxxxxxxxx	29	xxxxxx
FENUGREEK	100	xxxxxxxxxxxxxxxxxxxx	87	xxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx
(22)	71	xxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	43	xxxxxxxxx
BROM STE	0		0		0	
(24)	0		0		0	
FEST RUB	0		0		0	
(25)	0		0		0	
AVE FATU	80	xxxxxxxxxxxxxxxx	55	xxxxxxxxxxx	0	
(26)	14	xxx	14	xxx	0	
ALO MYOS	100	xxxxxxxxxxxxxxxxxxx	0		0	
(27)	14	xxx	0		0	
POA ANN	0		0		0	
(28)	0		0		0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	82	xxxxxxxxxxxxxxxx	15	xxx	0	
(30)	71	xxxxxxxxxxxxxx	21	xxxx	0	
RAPH RAP	102	xxxxxxxxxxxxxxxxxxx +	92	xxxxxxxxxxxxxxxxx	23	xxxxx
(31)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	36	xxxxxxx
CHRY SEG	45	xxxxxxxxx	6	x	0	
(32)	43	xxxxxxxxx	14	xxx	0	
TRIP MAR	62	xxxxxxxxxxx	0		0	
(33)	43	xxxxxxxxx	0		0	
SEN VULG	56	xxxxxxxxxx	24	xxxxx	0	
(34)	86	xxxxxxxxxxxxxxxx	36	xxxxxxx	0	

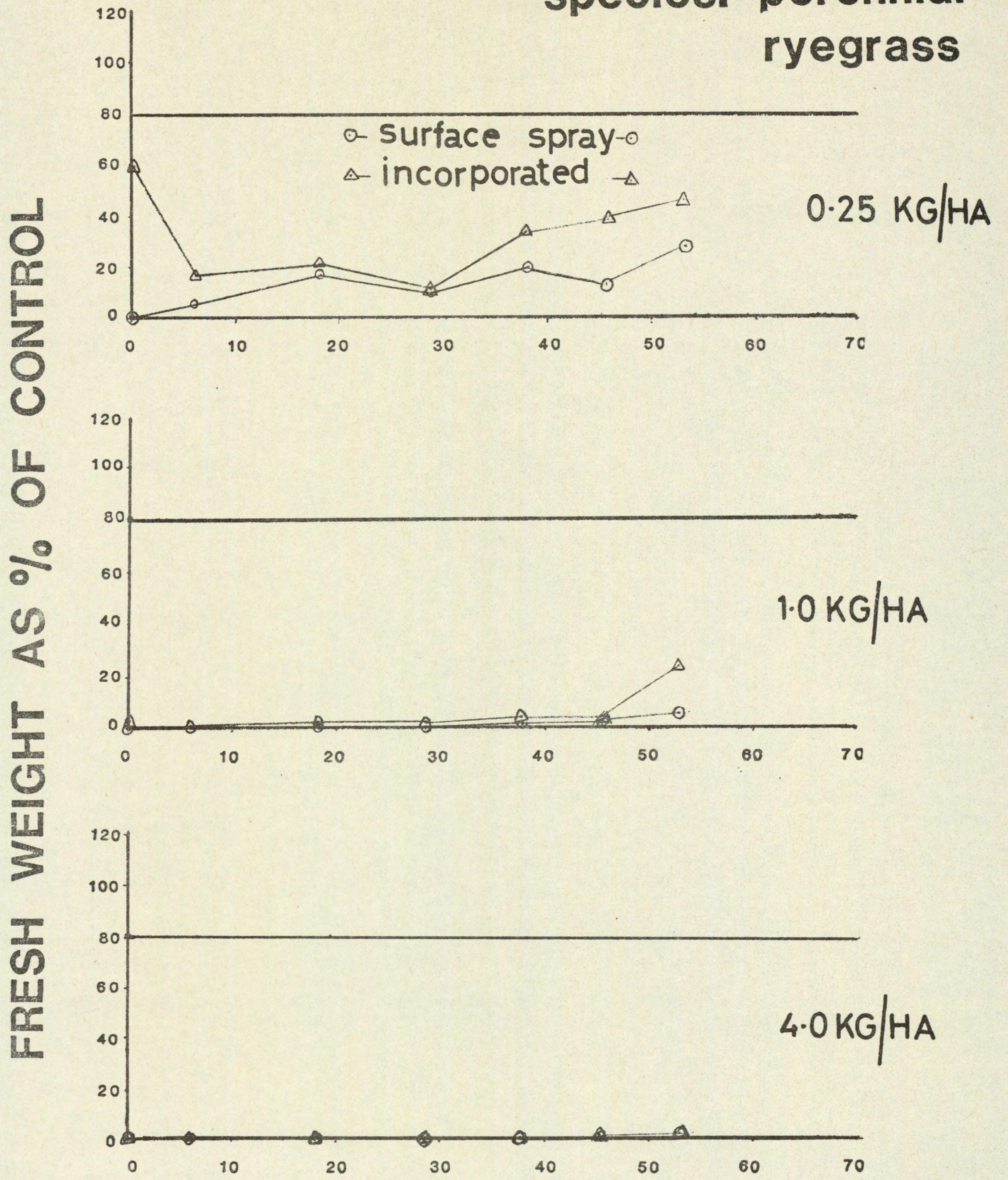
SPECIES		UBI S-734 0.25 kg/ha		UBI S-734 1.00 kg/ha		UBI S-734 4.00 kg/ha	
POL LAPA	89	xxxxxxxxxxxxxxxxxx	9	xx	0		
(35)	86	xxxxxxxxxxxxxxxxx	21	xxxx	0		
POL AVIC	97	xxxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	0		
(36)	93	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0		
GAL APAR	101	xxxxxxxxxxxxxxxxxxx +	71	xxxxxxxxxxxxxx	44	xxxxxxxxx	
(38)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx	
CHEN ALB	79	xxxxxxxxxxxxxxxx	0		0		
(39)	50	xxxxxxxxxx	0		0		
STEL MED	70	xxxxxxxxxxxxxx	7	x	0		
(40)	50	xxxxxxxxxx	7	x	0		
VER PERS	17	xxx	0		0		
(42)	21	xxxx	0		0		
RUM OBTU	65	xxxxxxxxxxxx	0		0		
(44)	100	xxxxxxxxxxxxxxxxxx	0		0		
HOLC LAN	0		0		0		
(45)	0		0		0		
AG REPEN	43	xxxxxxxxx	0		0		
(47)	14	xxx	0		0		
ALL VIN	89	xxxxxxxxxxxxxxxx	8	xx	0		
(49)	57	xxxxxxxxxxx	14	xxx	0		
CIRS ARV	124	xxxxxxxxxxxxxxxxxx +	141	xxxxxxxxxxxxxxxxxx +	0		
(50)	100	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	0		
TUS FARF	109	xxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxx +	41	xxxxxxxx	
(51)	100	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxx	21	xxxx	
MILLET	0		0		0		
(55)	0		0		0		

SPECIES		UBI S-734 0.25 kg/ha		UBI S-734 1.00 kg/ha		UBI S-734 4.00 kg/ha
MAIZE + A	106	xxxxxxxxxxxxxxxxxxxx +	106	xxxxxxxxxxxxxxxxxxxx +	79	xxxxxxxxxxxxxxxx
(56)	93	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	29	xxxxxx
MAIZE	103	xxxxxxxxxxxxxxxxxxxx +	103	xxxxxxxxxxxxxxxxxxxx +	94	xxxxxxxxxxxxxxxxxx
(57)	57	xxxxxxxxxxx	36	xxxxxxx	29	xxxxxx
SORG + A	29	xxxxxx	7	x	0	
(58)	29	xxxxxx	14	xxx	0	
SORGHUM	13	xxx	0		0	
(59)	50	xxxxxxxxxx	0		0	
RICE	23	xxxxx	0		0	
(60)	14	xxx	0		0	
PIGEON P	131	xxxxxxxxxxxxxxxxxxxx +	0		0	
(61)	79	xxxxxxxxxxxxxxxx	0		0	
COWPEA	100	xxxxxxxxxxxxxxxxxxxx	10	xx	0	
(62)	100	xxxxxxxxxxxxxxxxxxxx	36	xxxxxxx	0	
CHICKPEA	112	xxxxxxxxxxxxxxxxxxxx +	94	xxxxxxxxxxxxxxxxxx	37	xxxxxxx
(63)	100	xxxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	57	xxxxxxxxxx
GRNDNUT	109 R	xxxxxxxxxxxxxxxxxxxx +	109 R	xxxxxxxxxxxxxxxxxxx +	82	xxxxxxxxxxxxxxx
(64)	86	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx
SOYABEAN	98	xxxxxxxxxxxxxxxxxxx	98	xxxxxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxx
(65)	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	36	xxxxxxx
COTTON	92	xxxxxxxxxxxxxxxxx	115	xxxxxxxxxxxxxxxxxxx +	138	xxxxxxxxxxxxxxxxxxx +
(66)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxx
JUTE	10	xx	0		0	
(67)	21	xxxx	0		0	
KENAF	89	xxxxxxxxxxxxxxxxx	51	xxxxxxxxx	57	xxxxxxxxxx
(68)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	50	xxxxxxxxx

SPECIES		UBI S-734 0.25 kg/ha		UBI S-734 1.00 kg/ha	UBI S-734 4.00 kg/ha
SESAMUM	41	xxxxxxxx	0		0
(70)	21	xxxx	0		0
TOMATO	107	xxxxxxxxxxxxxxxxxxxx +	21	xxxx	0
(71)	64	xxxxxxxxxxxxx	29	xxxxxx	0
ECH CRUS	0		0		0
(75)	0		0		0
ROTT EXA	0		0		0
(76)	0		0		0
DIG SANG	0		0		0
(77)	0		0		0
SOL NIG	13	xxx	13	xxx	0
(81)	21	xxxx	14	xxx	0
BROM PEC	19	xxxx	0		0
(82)	36	xxxxxxx	0		0
SNOW POL	0		0		0
(83)	0		0		0
PHAL MIN	0		0		0
(84)	0		0		0
CYP ESCU	0		0		0
(85)	0		0		0
CYP ROTU	109	xxxxxxxxxxxxxxxxxxx +	31	xxxxxx	0
(86)	50	xxxxxxxxxx	21	xxxx	0
OXAL LAT	123	xxxxxxxxxxxxxxxxxxx +	14	xxx	0
(87)	71	xxxxxxxxxxxxxx	29	xxxxxx	0

PERSISTENCE OF UBI-S734

species: perennial ryegrass



TIME OF SOWING

weeks after treatment

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

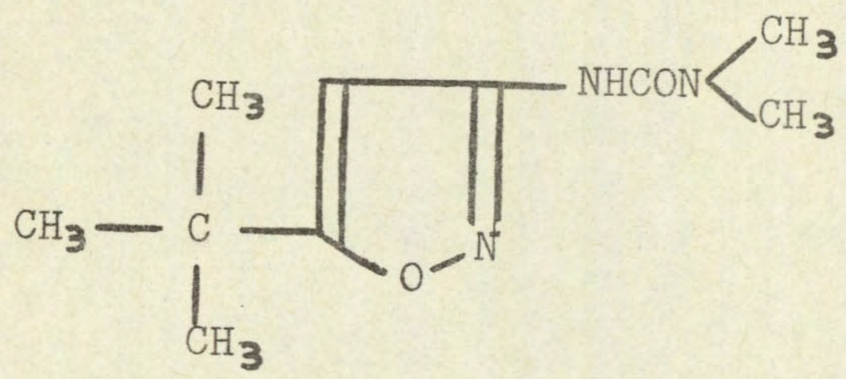
SSH-43

Code number SSH-43

Suggested common name Isouron

Chemical name N-(5-tert-butylisoxazol-3-yl)-N',N'-dimethylurea

Structure



Source

Shionogi & Co Ltd
12 Doshomachi Sanchome
Higashi-ku
Osaka 541
Japan

Information available and suggested uses

Suggested for annual grass and broad-leaved weed control pre- and post-emergence in sugar cane, fruit trees and maize at rates of 0.2-1.5 kg a.i./ha. Also in non-crop land at 2.0-4.0 kg a.i./ha when perennial weeds are also controlled.

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

Spray volume for activity experiment 370 l/ha
for pre-emergence selectivity experiment 370 l/ha

RESULTS

Full results are given in the histograms on pages 19-24 and potential selectivities are summarised in the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.9	none	none listed as no crops tolerant
0.3	(maize + antidote*) groundnut	Bromus sterilis Avena fatua Raphanus raphanistrum Veronica persica Agropyron repens Allium vineale Tussilago farfara Echinochloa crus-galli Rottboellia exaltata Bromus pectinatus + species below

* see comments below

(Table continued overleaf)

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
0.1	species above + field bean fenugreek maize sorghum sorghum + antidote cowpea chickpea soyabean cotton	Festuca rubra Alopecurus myosuroides Poa annua Poa trivialis Holcus lanatus Sinapis arvensis Chrysanthemum segetum Tripleurospermum maritimum Senecio vulgaris Polygonum lapathifolium Polygonum aviculare Chenopodium album Stellaria media Rumex obtusifolius Cirsium arvense Digitaria sanguinalis Solanum nigrum Snowdenia polystachya Phalaris minor

Comments on results

Activity experiment

A high level of activity was found even at the lowest dose of 0.1 kg/ha. Although most activity was found with application to the soil, severe sub-lethal effects occurred, especially on dwarf bean and kale with the foliar spray. Pre-emergence treatments were generally more active than post-emergence soil drenches. Application to the surface, pre-emergence, caused more toxicity to kale, perennial ryegrass and Avena fatua than did incorporated treatments but with the other species differences were much less distinct.

Symptoms

These were typical of those caused by other urea/photosynthetic inhibiting herbicides. Scorch and chlorosis occurred with the foliar spray. Severe chlorosis resulted with soil treatments usually followed by necrosis. Germination was not affected by pre-emergence treatments, plants usually emerging and dying back at the seedling stage, again usually preceded by chlorosis.

Persistence in the soil

A moderate to long period of persistence in the soil is indicated from the graph on 25. Perennial ryegrass plants were still being killed by residues of the higher doses 53 weeks after spraying. At 0.1 kg/ha some reduction in activity was apparent especially with incorporated treatments.

Pre-emergence selectivity among temperate species

Out of 24 weed species tested, 23 were killed or controlled by 0.3 kg/ha or lower. Galium aparine survived this dose, needing 0.9 kg/ha for control.

Only two crop species were tolerant, field bean and fenugreek, but only at the lowest dose of 0.1 kg/ha. All three cereals were reduced in vigour by 29% at this dose. Many smaller seeded crops were very sensitive, eg onion, white clover, lettuce and kale.

The high activity, limited selectivity and moderate to long persistence suggests that SSH-43 would be more suitable as a total herbicide rather than in crops. Although a wide spectrum of weeds was controlled in field bean, advantages over existing herbicides already approved, eg simazine, are not obvious except possibly for greater potency on certain weeds, eg Senecio vulgaris, Chenopodium album and Polygonum aviculare. The resistance of Galium aparine is a feature which SSH-43 has in common with other urea and triazine herbicides such as isoproturon and simazine.

Selectivities among tropical species

Selectivity was perhaps based on seed size rather than taxonomic groupings, all the smallest seeded species, both grass and broad-leaved, being killed at 0.1 kg/ha and the largest seeded, groundnut, cotton and maize showing the greatest tolerance. Groundnut is the only crop in which practical selectivity might be achieved against a reasonable range of annual weeds, but even 0.3 kg/ha may be too high as one replicate showed a distinctly weaker root system when eventually discarded at eight weeks.

There was some degree of protection of maize by NA as shown in the table below, but the fresh weights at six weeks indicate a lower degree of tolerance than the scores at three weeks, owing to a steady increase in damage with time. Sorghum showed very little protection by cyometrinil.

Table 4. Shoot fresh wt as % of untreated at 6 weeks

	Control	SSH-43 kg/ha		
		0.1	0.3	0.9
Maize	100	83	29	0
Maize + NA	85	84	57	9
Sorghum	100	87	29	2
Sorghum + cyometrinil	87	93	41	0

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl, SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

ACTIVITY EXPERIMENT

SSH-43

		0.1 kg/ha	0.4 kg/ha	1.6 kg/ha
DWARF BEAN	F	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxxx xxxx
	S	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xx
	I	xxxxxxxxxxxxxx + xxxxxxxxxxx	xxxxxxxxxx xxxx	xxxxx xxx
KALE	F	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxxx xxxxxx	xxxxxxxxxxxxxx xx
	S	xxxxxxxxxxxxxx xxx	xxxxxxxxxx xx	xxxxxxxxxxxxx xx
	P	x x	o o	o o
	I	xxxxxxxxxxxxx xxxxxxxx	o o	o o
POLYGONUM AMPHIBIUM	F	xxxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxx + xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxx	xxxxxxxxxxxxxx xxxxx
	I	xxxxxxxxxxxxx + xxxxxxx	xxxxxxxxxxxxx + xxxxxx	xxxxxxxxxxxxx + xxxxx
PERENNIAL RYEGRASS	F	xxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxx
	S	xxxxxxxxxxxxx xxxxxxx	xxxxxxxxxxx xxx	xxxxxxxxxxxxx xx
	P	x xxx	o o	o o
	I	xxxxxxxxxxxx xxxxxxxx	x x	o o
AVENA FATUA	F	xxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx
	S	xxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xx	xxxxxxxxxxx xx
	P	xxxxxxxx xxxxxxx	o o	o o
	I	xxxxxxxxxxxxx + xxxxxxxxx	o o	o o
AGROPYRON REPENS	F	xxxxxxxxxxxxx xxxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxxxx	xxxxxxxxxxxxx xxxxxxxxxx
	S	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxxxxxxxx xxxxx	xxxxxxxxxxxxx xxxx
	P	xxxxxxxxxxxxx xxxxxxxxx	xxxxxxx xxx	xxxxxxxxxxxxx xx
	I	xxxxxxxxxxxxx + xxxxxxxxxx	xxxxxxxxxxxxx + xxxx	xxxxxxx xx

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

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

SPECIES	SSH 43 0.1 kg/ha		SSH 43 0.3 kg/ha		SSH 43 0.9 kg/ha	
WHEAT	109	xxxxxxxxxxxxxxxxxxxx +	89	xxxxxxxxxxxxxxxxxx	95	xxxxxxxxxxxxxxxxxxx
(1)	71	xxxxxxxxxxxxxx	29	xxxxxx	14	xxx
BARLEY	91	xxxxxxxxxxxxxxxxxx	46	xxxxxxxxx	0	
(2)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	
OAT	102	xxxxxxxxxxxxxxxxxxxx +	102	xxxxxxxxxxxxxxxxxxxx +	83	xxxxxxxxxxxxxxxxx
(3)	71	xxxxxxxxxxxxxx	14	xxx	14	xxx
PER RYGR	46	xxxxxxxxx	0		0	
(4)	43	xxxxxxxxx	0		0	
ONION	0		0		0	
(8)	0		0		0	
DWF BEAN	80	xxxxxxxxxxxxxxxx	40	xxxxxxxx	0	
(9)	71	xxxxxxxxxxxxxx	29	xxxxxx	0	
FLD BEAN	91	xxxxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxxxx +	91	xxxxxxxxxxxxxxxxx
(10)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx
PEA	75	xxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxxx +	105	xxxxxxxxxxxxxxxxxxx +
(11)	79	xxxxxxxxxxxxxxx	57	xxxxxxxxxxx	14	xxx
W CLOVER	0		0		0	
(12)	0		0		0	
RAPE	33	xxxxxxx	0		0	
(14)	36	xxxxxxx	0		0	
KALE	0		0		0	
(15)	0		0		0	
CARROT	43	xxxxxxxxx	0		0	
(18)	57	xxxxxxxxxxx	0		0	
LETTUCE	0		0		0	
(20)	0		0		0	

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

SPECIES	SSH 43 0.1 kg/ha		SSH 43 0.3 kg/ha		SSH 43 0.9 kg/ha	
SUG BEET	9	xx	0		0	
(21)	21	xxxx	0		0	
FENUGREK	94	xxxxxxxxxxxxxxxxxxx	19	xxxx	12	xx
(22)	86	xxxxxxxxxxxxxxxxx	29	xxxxxx	7	x
BROM STE	41	xxxxxxxx	5	x	0	
(24)	43	xxxxxxxxx	14	xxx	0	
FEST RUB	0		0		0	
(25)	0		0		0	
AVE FATU	104	xxxxxxxxxxxxxxxxxxx +	0		0	
(26)	57	xxxxxxxxxxx	0		0	
ALO MYOS	24	xxxxx	12	xx	0	
(27)	21	xxxx	14	xxx	0	
POA ANN	20	xxxx	0		0	
(28)	57	xxxxxxxxxxx	0		0	
POA TRIV	0		0		0	
(29)	0		0		0	
SIN ARV	0		0		0	
(30)	0		0		0	
RAPH RAP	37	xxxxxxx	0		0	
(31)	50	xxxxxxxxxx	0		0	
CHRY SEG	6	x	0		0	
(32)	7	x	0		0	
TRIP MAR	0		0		0	
(33)	0		0		0	
SEN VULG	0		0		0	
(34)	0		0		0	

PRE-EMERGENCE SELECTIVITY TEST

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

SPECIES	SSH 43 0.1 kg/ha		SSH 43 0.3 kg/ha		SSH 43 0.9 kg/ha	
POL LAPA	9	xx	3	x	0	
(35)	21	xxxx	7	x	0	
POL AVIC	0		0		0	
(36)	0		0		0	
GAL APAR	93	xxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxxxx	50	xxxxxxxxxx	14	xxx
CHEN ALB	0		0		0	
(39)	0		0		0	
STEL MED	0		0		0	
(40)	0		0		0	
VER PERS	163	xxxxxxxxxxxxxxxxxxx +	17	xxx	0	
(42)	64	xxxxxxxxxxxxx	21	xxxx	0	
RUM OBTU	0		39	xxxxxxxx	0	
(44)	0		7	x	0	
HOLC LAN	0		0		0	
(45)	0		0		0	
AG REPEN	103	xxxxxxxxxxxxxxxxxxx +	60	xxxxxxxxxxxx	0	
(47)	57	xxxxxxxxxxx	21	xxxx	0	
ALL VIN	89	xxxxxxxxxxxxxxxxx	16	xxx	0	
(49)	93	xxxxxxxxxxxxxxxxxx	36	xxxxxxx	0	
CIRS ARV	0		0		0	
(50)	0		0		0	
TUS FARF	68	xxxxxxxxxxxxx	0		0	
(51)	57	xxxxxxxxxxx	0		0	
MILLET	61	xxxxxxxxxxxx	20	xxxx	0	
(55)	71	xxxxxxxxxxxxxx	36	xxxxxxx	0	

PRE-EMERGENCE SELECTIVITY TEST

SPECIES		SSH 43 0.1 kg/ha		SSH 43 0.3 kg/ha		SSH 43 0.9 kg/ha
MAIZE + NA	106	xxxxxxxxxxxxxxxxxxxx +	97	xxxxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxx
(56)	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx
MAIZE	94	xxxxxxxxxxxxxxxxxx	103	xxxxxxxxxxxxxxxxxxx +	103	xxxxxxxxxxxxxxxxxxx +
(57)	93	xxxxxxxxxxxxxxxxxx	57	xxxxxxxxxx	43	xxxxxxxxx
SORG + A	107	xxxxxxxxxxxxxxxxxxx +	86	xxxxxxxxxxxxxxxxx	0	
(58)	93	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	0	
SORGHUM	98	xxxxxxxxxxxxxxxxxxx	78	xxxxxxxxxxxxxxxx	13	xxx
(59)	93	xxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxx	29	xxxxxx
RICE	74	xxxxxxxxxxxxxx	0		0	
(60)	64	xxxxxxxxxxxx	0		0	
PIGEON P	94	xxxxxxxxxxxxxxxxxx	0		0	
(61)	79	xxxxxxxxxxxxxxx	0		0	
COWPEA	110	xxxxxxxxxxxxxxxxxxx +	0		0	
(62)	93	xxxxxxxxxxxxxxxxxx	0		0	
CHICKPEA	94	xxxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxxx	0	
(63)	100	xxxxxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	0	
GRNDNUT	109	xxxxxxxxxxxxxxxxxxx +	109 R	xxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxx +
(64)	93	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx
SOYABEAN	91	xxxxxxxxxxxxxxxxx	65	xxxxxxxxxxxxx	0	
(65)	100	xxxxxxxxxxxxxxxxxxx	43	xxxxxxxxx	0	
COTTON	127	xxxxxxxxxxxxxxxxxxx +	104	xxxxxxxxxxxxxxxxxxx +	23	xxxxx
(66)	100	xxxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxxx	21	xxxx
JUTE	0		0		0	
(67)	0		0		0	
KENAF	77	xxxxxxxxxxxxxxx	0		0	
(68)	64	xxxxxxxxxxxxx	0		0	

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

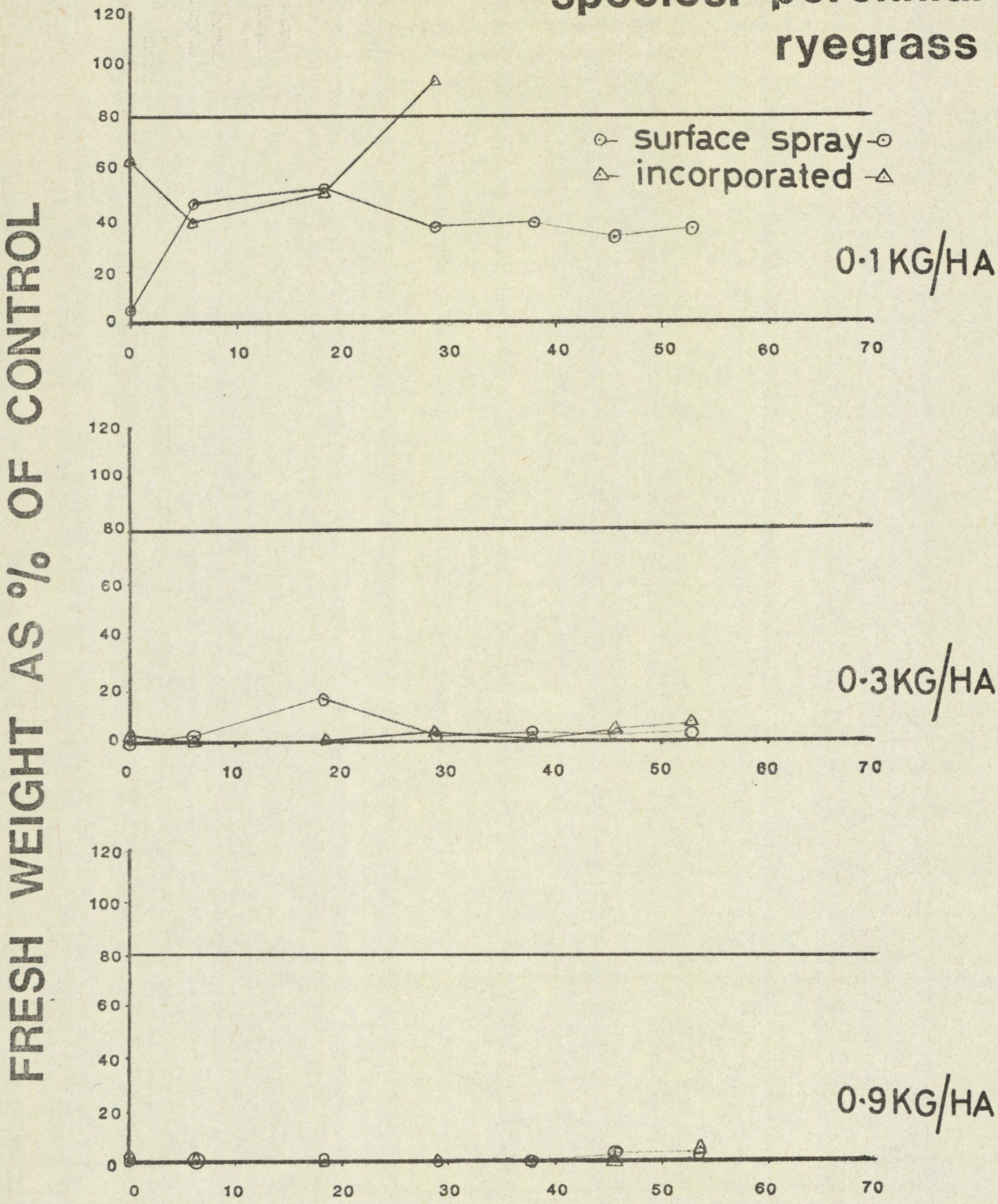
NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

SPECIES		SSH 43 0.1 kg/ha		SSH 43 0.3 kg/ha		SSH 43 0.9 kg/ha	
SESAMUM	82	xxxxxxxxxxxxxxxx	0		0		
(70)	71	xxxxxxxxxxxxxx	0		0		
TOMATO	29	xxxxxx	0		0		
(71)	43	xxxxxxxxx	0		0		
ECH CRUS	50	xxxxxxxxxx	0		0		
(75)	50	xxxxxxxxxx	0		0		
ROTT EXA	62	xxxxxxxxxxxx	10	xx	0		
(76)	64	xxxxxxxxxxxxx	29	xxxxxx	0		
DIG SANG	0		0		0		
(77)	0		0		0		
SOL NIG	0		0		0		
(81)	0		0		0		
BROM PEC	89	xxxxxxxxxxxxxxxxxx	22	xxxx	0		
(82)	57	xxxxxxxxxx	36	xxxxxxx	0		
SNOW POL	0		0		0		
(83)	0		0		0		
PHAL MIN	0		0		0		
(84)	0		0		0		
CYP ESCU	62	xxxxxxxxxxx	108 R	xxxxxxxxxxxxxxxxxx +	69	xxxxxxxxxxxxx	
(85)	71	xxxxxxxxxxxxx	57	xxxxxxxxxx	43	xxxxxxxx	
CYP ROTU	109	xxxxxxxxxxxxxxxxxx +	114	xxxxxxxxxxxxxxxxxx +	83	xxxxxxxxxxxxxxx	
(86)	100	xxxxxxxxxxxxxxxxxx	71	xxxxxxxxxxxxx	57	xxxxxxxxxx	
OXAL LAT	136	xxxxxxxxxxxxxxxxxx +	27	xxxxx	82	xxxxxxxxxxxxxx	
(87)	71	xxxxxxxxxxxxx	7	x	57	xxxxxxxxxx	

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

PERSISTENCE OF SSH-43

species: perennial ryegrass



TIME OF SOWING

weeks after treatment

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl, SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

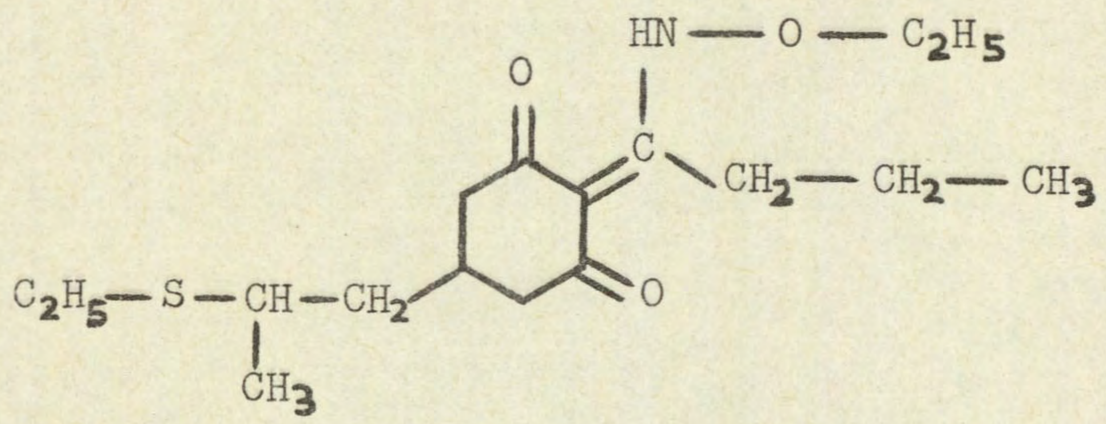
ARD 34/02

Code number: ARD 34/02
NP 55
BAS 9052

Proposed common name: cietoxidim

Chemical name: 2-[N-(ethoxyamino)butylidene]-5-(2-ethylthiopropyl)-cyclohexan-1,3-dione

Structure



Source

May & Baker Ltd
Ongar Research Station
Fyfield Road
Ongar
Essex, UK

Information available and suggested uses

Annual and perennial grass weed control in dicotyledonous crops.

Formulation used: 18.4% w/v a.i. emulsifiable concentrate

Spray volume: for pre-emergence selectivity experiment 370 l/ha

RESULTS

Full results are given in the histograms on pages 29-33 and potential selectivities are summarised in the following table.

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
1.6	onion dwarf bean field bean pea* white clover rape kale radish carrot lettuce sugar beet fenugreek pigeon pea	species below

* note a stand reduction but not due to herbicide

(Table continued overleaf)

RATE (kg a.i./ha)	CROPS: vigour reduced by 15% or less	WEEDS: number or vigour reduced by 70% or more
1.6	cowpea chickpea soyabean cotton jute kenaf tomato	
0.4	species above + groundnut sesamum	Bromus sterilis Avena fatua Agropyron repens Rottboellia exaltata Bromus pectinatus + species below
0.1	species above + maize maize + antidote	Alopecurus myosuroides Poa trivialis Holcus lanatus Echinochloa crus-galli Digitaria sanguinalis Snowdenia polystachya Phalaris minor

N.B. Stands of Senecio vulgaris and Rumex obtusifolius were reduced by more than 70% but this was thought to be caused by bad germination rather than the herbicide.

Comments on results

Richardson et al, (1980) reported a high level of post- and pre-emergence activity on grasses with broad-leaved species highly tolerant. In pre-emergence applications the surface spray was more effective than the incorporated treatment for perennial ryegrass and Avena fatua, but this difference was less clear cut for Agropyron repens. This should be taken into consideration when interpreting the results of this pre-emergence selectivity experiment, where application was to the surface, pre-emergence.

Persistence in the soil

A relatively short period of soil persistence is shown by ARD 34/02, similar to its analogue alloxydim (Richardson and Parker, 1979). From the graph on page 34 it is seen that residues of the highest dose of 1.6 kg/ha were undetectable with perennial ryegrass, 18 weeks after spraying. Surface treatments at the two lower doses (0.1 and 0.4 kg/ha) were undetectable six weeks after spraying, incorporated treatments still being detectable at this date but not at the next assay after 18 weeks.

Pre-emergence selectivity among temperate species

Most grass weeds were very susceptible, with broad-leaved species highly resistant. The only two exceptions in the grass weed control spectrum were Festuca rubra and more notably Poa annua both of which were highly resistant.

Onion and all broad-leaved crops were tolerant even at the highest dose. Oat and perennial ryegrass were very sensitive. Wheat and barley were less sensitive than these and the susceptible grass weeds.

Outstanding control of many annual and perennial grass weeds in onion and broad-leaved crops can be expected from ARD 34/02 (including volunteer cereals and ryegrass). Results correspond with those obtained post-emergence (Richardson et al, 1980) regarding both species susceptibilities and level of activity and are similar to those obtained earlier with its analogue, alloxydim (Richardson and Parker, 1978 and 1979), although its activity is about three times greater. The short period of soil persistence may be a disadvantage in controlling late germinating grass weeds but could be a distinct advantage if used for grass weed control in stubbles prior to sowing cereals. The resistance of Poa annua will necessitate studies in mixtures and possibly sequences with other herbicides in onion and broad-leaved crops, where this weed is common. Control of grass weeds in Festuca rubra which is grown as a crop for seed in Holland (Ziegenbein, 1976) is an interesting, though minor, use for ARD 34/02.

Selectivity among tropical species

Striking selectivity against annual grass weeds was confirmed in virtually all broad-leaved crops. The apparent lack of complete tolerance of groundnut and sesamum at 1.6 kg/ha was based on a very small number of plants and the damage may not have been significant. The broad-leaved and sedge weeds were equally resistant.

Control of most grass weeds at 0.1 kg/ha was even more complete than from post-emergence application of the same dose (Richardson et al, 1980). However. Rottboellia was not quite so well controlled and maize and sorghum were also somewhat less severely damaged. There was moderate protection of maize by NA but barely enough to allow reliable selective control of Rottboellia. Fresh weights after six weeks are indicated in the table below. Further work has shown a similar modest protection against post-emergence application of ARD 34/02 but again not enough to allow selective control of Rottboellia. There was negligible protection of sorghum by cyometrinil with either pre- or post-emergence application of ARD 34/02 and only modest protection by NA against post-emergence application.

Table 5. Shoot fresh wt as % of untreated at 6 weeks

	Control	ARD 34/02 kg/ha		
		0.1	0.4	1.6
Maize	100	80	41	0
Maize + NA	85	89	75	2
Sorghum	100	29	1	0
Sorghum + cyometrinil	87	25	0	0

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl, SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

SPECIES		ARD 34/02 0.1 kg/ha		ARD 34/02 0.4 kg /ha		ARD 34/02 1.6 kg/ha
WHEAT	109	xxxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxxx +	0	
(1)	57	xxxxxxxxxxx	29	xxxxxx	0	
BARLEY	104	xxxxxxxxxxxxxxxxxxxx +	91	xxxxxxxxxxxxxxxxxx	65	xxxxxxxxxxxxx
(2)	79	xxxxxxxxxxxxxxxxx	43	xxxxxxxxx	14	xxx
OAT	89	xxxxxxxxxxxxxxxxxx	0		0	
(3)	14	xxx	0		0	
PER RYGR	10	xx	0		0	
(4)	7	x	0		0	
ONION	100	xxxxxxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxxxx	76	xxxxxxxxxxxxxxx
(8)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
DWF BEAN	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	80	xxxxxxxxxxxxxxxx
(9)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
FLD BEAN	65	xxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxxx +	91	xxxxxxxxxxxxxxxxx
(10)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
PEA	75	xxxxxxxxxxxxxx	90	xxxxxxxxxxxxxxxxx	75	xxxxxxxxxxxxxx
(11)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
W CLOVER	97	xxxxxxxxxxxxxxxxxx	105	xxxxxxxxxxxxxxxxxx +	90	xxxxxxxxxxxxxxxxx
(12)	100	xxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
RAPE	89	xxxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxx +	111	xxxxxxxxxxxxxxxxxx +
(14)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
KALE	78	xxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx	94	xxxxxxxxxxxxxxxxx
(15)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx
CARROT	104	xxxxxxxxxxxxxxxxxx +	92	xxxxxxxxxxxxxxxx	104	xxxxxxxxxxxxxxxxxx +
(18)	100	xxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx
LETTUCE	110	xxxxxxxxxxxxxxxxxx +	105	xxxxxxxxxxxxxxxxxx +	105	xxxxxxxxxxxxxxxxxx +
(20)	100	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxx

SPECIES		ARD 34/02 0.1 kg/ha		ARD 34/02 0.4 kg/ha		ARD 34/02 1.6 kg/ha
SUG BEET	109	xxxxxxxxxxxxxxxxxxxx +	73	xxxxxxxxxxxxxxx	86	xxxxxxxxxxxxxxxxx
(21)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
FENUGREK	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(22)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
BROM STE	56	xxxxxxxxxxx	0		0	
(24)	71	xxxxxxxxxxxxxx	0		0	
FEST RUB	100	xxxxxxxxxxxxxxxxxxxx	97	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
(25)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
AVE FATU	92	xxxxxxxxxxxxxxxxx	12	xx	0	
(26)	36	xxxxxxx	7	x	0	
ALO MYOS	0		0		0	
(27)	0		0		0	
POA ANN	116	xxxxxxxxxxxxxxxxxxxx +	102	xxxxxxxxxxxxxxxxxxxx +	82	xxxxxxxxxxxxxxxx
(28)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
POA TRIV	4	x	4	x	0	
(29)	7	x	7	x	0	
SIN ARV	67	xxxxxxxxxxxxx	127	xxxxxxxxxxxxxxxxxx +	67	xxxxxxxxxxxxx
(30)	93	xxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	36	xxxxxxx
RAPH RAP	102	xxxxxxxxxxxxxxxxxxxx +	102	xxxxxxxxxxxxxxxxxxxx +	92	xxxxxxxxxxxxxxxxx
(31)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
CHRY SEG	77	xxxxxxxxxxxxxxx	57	xxxxxxxxxxx	121	xxxxxxxxxxxxxxxxxxx +
(32)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
TRIP MAR	77	xxxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxx +	110	xxxxxxxxxxxxxxxxxxx +
(33)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxx
SEN VULG	43	xxxxxxxxx	29	xxxxxx	29	xxxxxx
(34)	79	xxxxxxxxxxxxxxxx	64	xxxxxxxxxxxxx	71	xxxxxxxxxxxxx

PRE-EMERGENCE SELECTIVITY TEST

SPECIES	ARD 34/02 0.1 kg/ha		ARD 34/02 0.4 kg/ha		ARD 34/02 1.6 kg/ha	
POL LAPA	109	xxxxxxxxxxxxxxxxxxxx +	103	xxxxxxxxxxxxxxxxxxxx +	103	xxxxxxxxxxxxxxxxxxxx +
(35)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
POL AVIC	106	xxxxxxxxxxxxxxxxxxxx +	93	xxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxxx
(36)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
GAL APAR	101	xxxxxxxxxxxxxxxxxxxx +	93	xxxxxxxxxxxxxxxxxxx	88	xxxxxxxxxxxxxxxxxx
(38)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
CHEN ALB	98 R	xxxxxxxxxxxxxxxxxxx	128	xxxxxxxxxxxxxxxxxxxx +	84	xxxxxxxxxxxxxxxxx
(39)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
STEL MED	77	xxxxxxxxxxxxxx	84	xxxxxxxxxxxxxxxx	89	xxxxxxxxxxxxxxxxx
(40)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	93	xxxxxxxxxxxxxxxxxx
VER PERS	146	xxxxxxxxxxxxxxxxxxx +	189	xxxxxxxxxxxxxxxxxxxx +	129	xxxxxxxxxxxxxxxxxxxx +
(42)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	79	xxxxxxxxxxxxxxxx
RUM OBTU	117	xxxxxxxxxxxxxxxxxxxx +	78	xxxxxxxxxxxxxxxx	26	xxxxx
(44)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
HOLC LAN	0		0		0	
(45)	0		0		0	
AG REPEN	60	xxxxxxxxxxxx	0		0	
(47)	71	xxxxxxxxxxxxxx	0		0	
ALL VIN	105	xxxxxxxxxxxxxxxxxxx +	41	xxxxxxxx	97	xxxxxxxxxxxxxxxxxxx
(49)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
CIRS ARV	106	xxxxxxxxxxxxxxxxxxx +	71	xxxxxxxxxxxxxx	106	xxxxxxxxxxxxxxxxxxx +
(50)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
TUS FARF	109	xxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxx +	109	xxxxxxxxxxxxxxxxxxx +
(51)	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx	100	xxxxxxxxxxxxxxxxxxxx
MILLET	0		0		0	
(55)	0		0		0	

NB: ARD 34/02 (NP55) is sethoxydim, DPX 4189 is chlorsulfuron, PP 009 is fluazifop-butyl,
SSH-43 is isouron, UBI S-734 is 2-[1-(2,5-dimethylphenyl)ethylsulfonyl]-1-oxidopyridin-1-ium (Uniroyal)

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