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Long Ashton Research Station

UNIVERSITY OF BRISTOL

Technical Report No. 107

PRE-EMERGENCE AND POST-EMERGENCE SELECTIVITY AND PERSISTENCE OF THE HERBICIDE UBI C4874

UBI C4874 is quizalofop-P-tefuryl

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August, 1992

Price: £4.00

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ISNN 0551 4136
ISBN 0 7084 0516 9

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THE PRE-EMERGENCE AND POST-EMERGENCE SELECTIVITY AND PERSISTENCE OF THE HERBICIDE UBI C4874

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1. SUMMARY

In pot experiments, the herbicide UBI C4874, at 5, 20 and 80g a.i. ha^{-1}, was tested for pre- and post-emergence activity and selectivity on up to 18 crop and 25 weed species. Soil persistence of UBI C4874 was assessed over a 52-week period.

Generally, there was little activity from UBI C4874 when applied pre- emergence to the soil surface, although some monocotyledonous species showed reductions in germination or in vigour at 80g a.i. ha^{-1}.

When applied post-emergence, some important annual grass weeds, including Alopecurus myosuroides, Avena fatua and Bromus sterilis and the perennial grass weed Elymus repens, were susceptible to UBI C4874, at doses to which all the dicotyledonous crop species tested and onion were tolerant. However, Poa annua and Festuca rubra were not controlled.

Soil persistence of active UBI C4874 residues, assessed by bioassay using perennial ryegrass as a sensitive test species and in comparison with cyanazine (short persistence) and simazine (long persistence), was found to be short.

UBI C4874 is quizalofop-P-tefuryl

2. INTRODUCTION

The pre- and post-emergence activity and selectivity of new herbicides are investigated by LARS Crop and Environmental Sciences Department on a range of temperate crop and weed species grown in pots. Persistence in the soil is also assessed and provides data which, in conjunction with data on crop susceptibilities, are useful in considering subsequent cropping of treated land. Although, in these investigations, only one crop variety or source of weed species is used, in one soil type, at one depth of sowing and without interspecific competition, the results provide a guide for more detailed investigations where warranted.

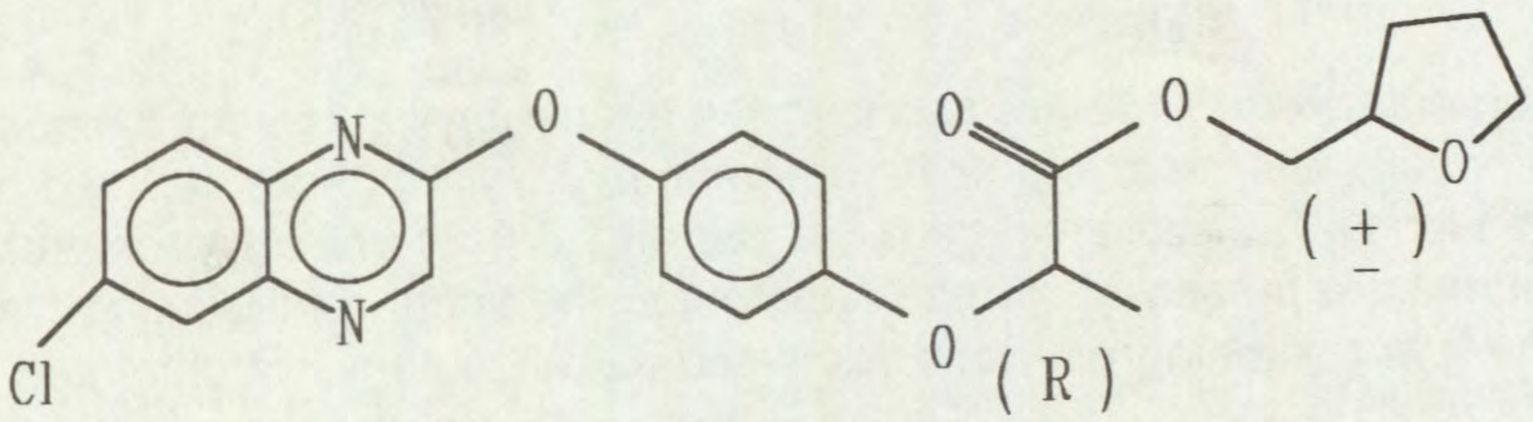
Suggested uses from originating company

UBI C4874 is a new herbicide from Uniroyal Chemical Company. It is being developed for post-emergence control of annual and perennial grass weeds in dicotyledonous crops at doses from 20-80 g a.i. ha^{-1}, the higher doses being required for perennial weed control. The adjuvant 'Cropspray Oil', added to spray solutions at 1.25% v/v, is recommended.

3. MATERIALS AND METHODS

3.1. Herbicide details

Source: Uniroyal Chemical Ltd., Evesham, Worcestershire, WR11 61W
Code numbers: UBI C4874
Common name: Quizalofop-P-terfuryl (proposed)
Trade name: Pantera
Chemical name (IUPAC): (±)-Tetrahydrofurfuryl (R)-2-[4-(6-chloroquinoxalin-2-yloxy) phenoxy] propanoate
Structure:



Formulation used: 100 g a.i. l^{-1} emulsifiable concentrate (formulation code UBI 9070)
Doses applied: 5, 20 and 80 g a.i. ha^{-1}

3.2. Pre-emergence selectivity experiment

For each species, pre-counted seeds, rhizomes or roots were planted prior to spraying in 9 cm diameter plastic pots containing a Mendip sandy clay loam (Table 1) with Vitax Q4 fertilizer added at 3.3g $litre^{-1}$. Numbers of seeds per pot, depths of sowing and seed sources are recorded in Appendix 1.

Herbicide was applied as a pre-emergence surface spray using a laboratory track sprayer. This was fitted with an 80015E Lurmark flat fan Evenspray nozzle delivering 340 l ha^{-1} at a pressure of 210 kPa (30 psi) and moving at 0.5 m sec^{-1}, 30 cm. above stationary pots. There were two replicates for each treatment. After spraying, pots were set out in two randomised blocks per species in a heated glasshouse where normal daylight was supplemented by mercury vapour lamps to provide 14-h photoperiods. Irrigation was by overhead hand watering.

3.3. Post-emergence selectivity experiment

Plants were grown outside in 9 cm plastic pots containing the Mendip loam plus

fertilizer. Sowing dates were staggered so that the majority of species would reach a pre-determined growth stage (2-4 leaves) by the time of spraying. Before spraying each species was thinned to the same number per pot. Plant numbers and growth stages are recorded in Appendix 2.

Herbicide was applied using a laboratory track sprayer fitted with an 80015 Kemetal flat fan nozzle delivering 335 l ha^{-1} at a pressure of 210 kPa (30 psi) and moving at 0.5 m sec^{-1}, 45 cm above the target area of the plants. After spraying, plants were protected from rainfall for 24h and then put outside in two randomised blocks per species. Watering was by natural rainfall plus additional overhead hand watering as necessary.

3.4. Assessments

Assessments were made five to six weeks after spraying pre-emergence, and three to four weeks after spraying post-emergence. Survivors were counted and scored for vigour on a 0-7 scale, where 0 = dead and 7 = as untreated control. Pairs of histograms are presented for each treatment, the upper representing plant survival and the lower plant vigour, both calculated as percentages of untreated controls.

A table of observed selectivities, using the criteria specified is presented, along with comments to highlight important results.

3.5. Persistence in the soil

Residual phytotoxicity was assessed by bioassay at seven dates after spraying. UBI C4874 at 5, 20 and 80 g a.i. ha^{-1}, was applied as a surface spray to pots (7.5 cm diameter) containing the Mendip loam plus fertilizer. Standard treatments of cyanazine, at 1000 g a.i. ha^{-1} (short persistence), and simazine, at 1000 g a.i. ha^{-1} (long persistence) were included for comparison. These pots were kept in a temperate glasshouse, together with untreated controls, and watered overhead to keep soil moist.

For each bioassay, three replicate pots for each treatment were sown with perennial ryegrass 0.5 cm deep. Plants were harvested at a pre-determined growth stage of untreated controls, the number and fresh weight of shoots being recorded. The first bioassay commenced within a day of spraying. Bioassays were repeated at eight to ten-week intervals for one year, unless the phytotoxicity had disappeared before then.

Results are presented graphically (Fig. 7) and comments made in the text.

Table 1. Analysis of soil used in experiments

Mendip sandy clay loam		
Particle size analysis		%
Coarse sand	(600 μm - 2 mm)	2.1
Medium sand	(212 μm - 600 μm)	41.4
Fine sand	(63 μm - 212 μm)	13.8
Silt	(2 μm - 63 μm)	26.6
Clay	(<2 μm)	16.1
Organic matter (%)		4.6
pH (in water 1:2 soil : water ratio)		6.0

4. RESULTS

Potential selectivities are given in Tables 2 and 3, and full results in the histograms (Figs. 1 to 6).

4.1. Pre-emergence selectivity (Table 2 and Figs. 1 to 3)

There were no obvious effects on any species from UBI C4874 at 5 and 20 g a.i. ha^{-1} applied pre-emergence. At 80 g a.i. ha^{-1} wheat growth was slightly suppressed while germination of perennial ryegrass and Alopecurus myosuroides was reduced by 37% and 45%, respectively, although surviving plants appeared healthy. Poa trivialis was particularly sensitive, germination being reduced by 73% and plant vigour by 57%.

Table 2. Crop tolerance and weed sensitivity to pre-emergence treatments of UBI C4874

Dose (g a.i.ha^{-1})	Tolerant crops (number or vigour reduced by less than 15%)		Sensitive weeds (number or vigour reduced by 70% or more)
80	Barley Oat Maize Onion Dwarf bean Field bean Pea White Clover	Sugar beet Oilseed rape Kale Swede Carrot Lettuce Sunflower	Poa trivialis
20	Wheat Perennial ryegrass		None sensitive
5			None sensitive
Sensitive crops (considerable damage or kill a. 5g a.i. ha^{-1})			Tolerant weeds (no or only slight to moderate effects at 80 g a.i.ha^{-1})
No crops sensitive			Most graminaceous weeds All dicotyledonous weeds

FIGURE 1

PRE-EMERGENCE SELECTIVITY EXPERIMENT

UBI C4874

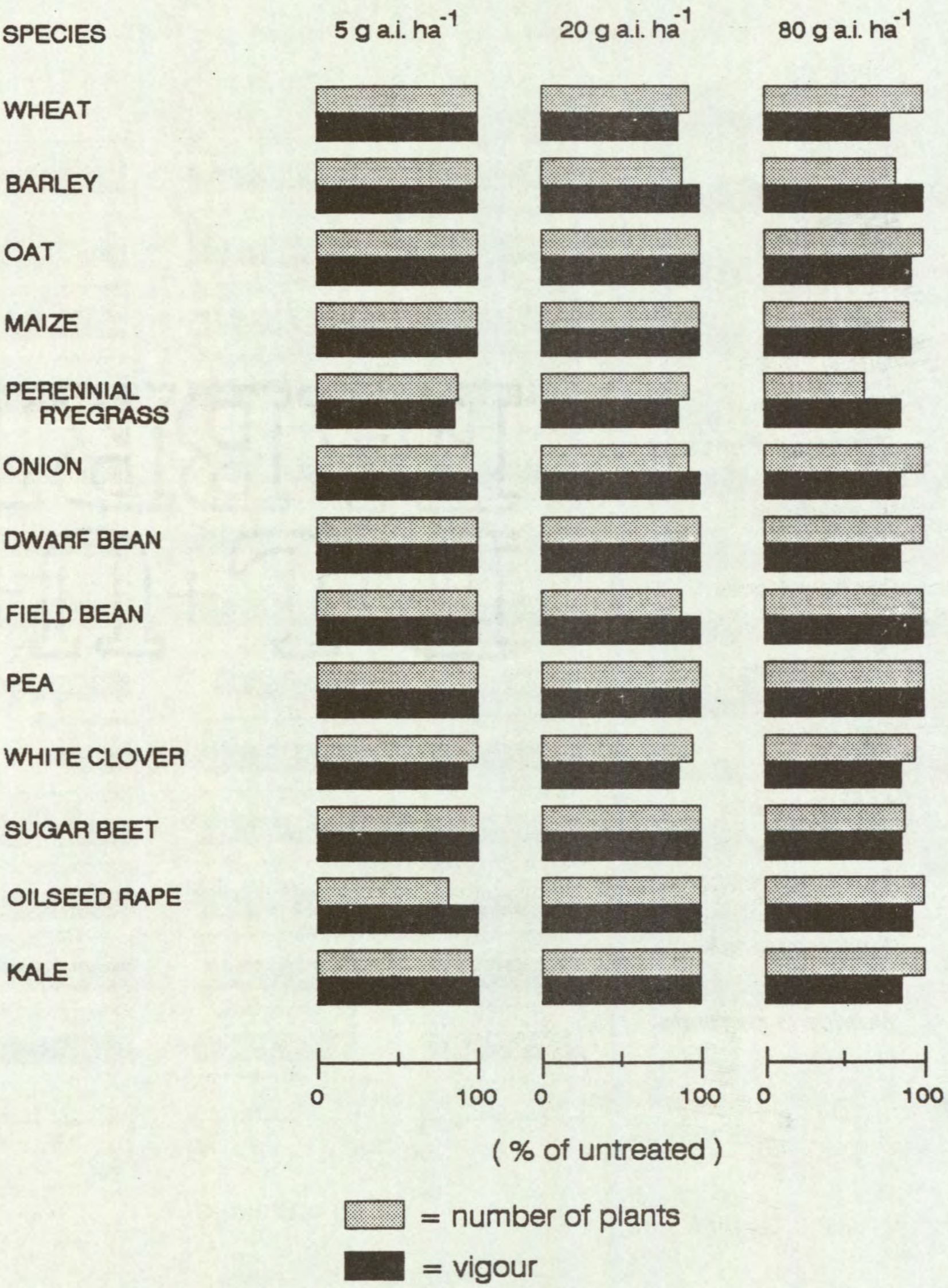


FIGURE 2

PRE-EMERGENCE SELECTIVITY EXPERIMENT

UBI C4874

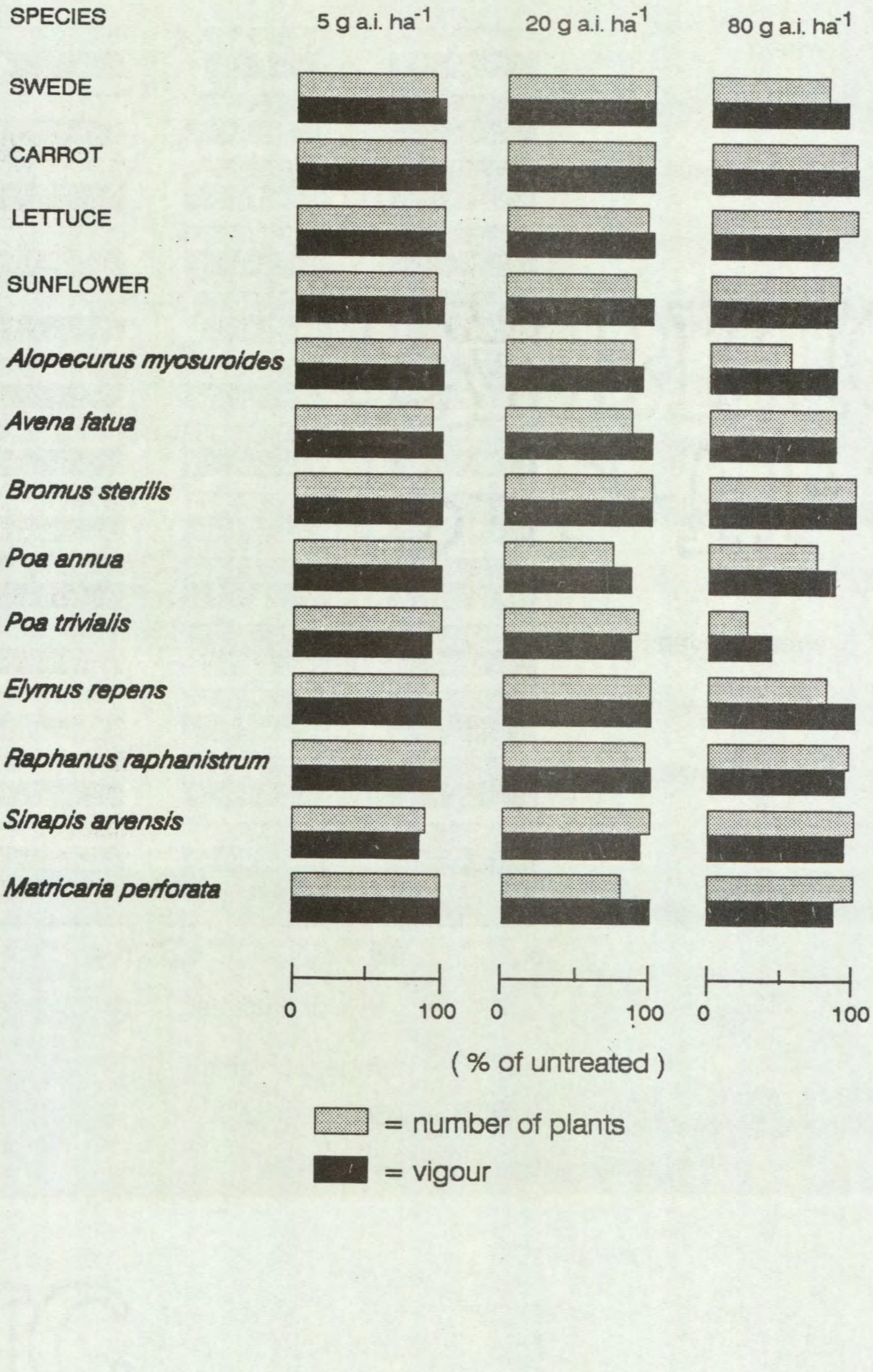
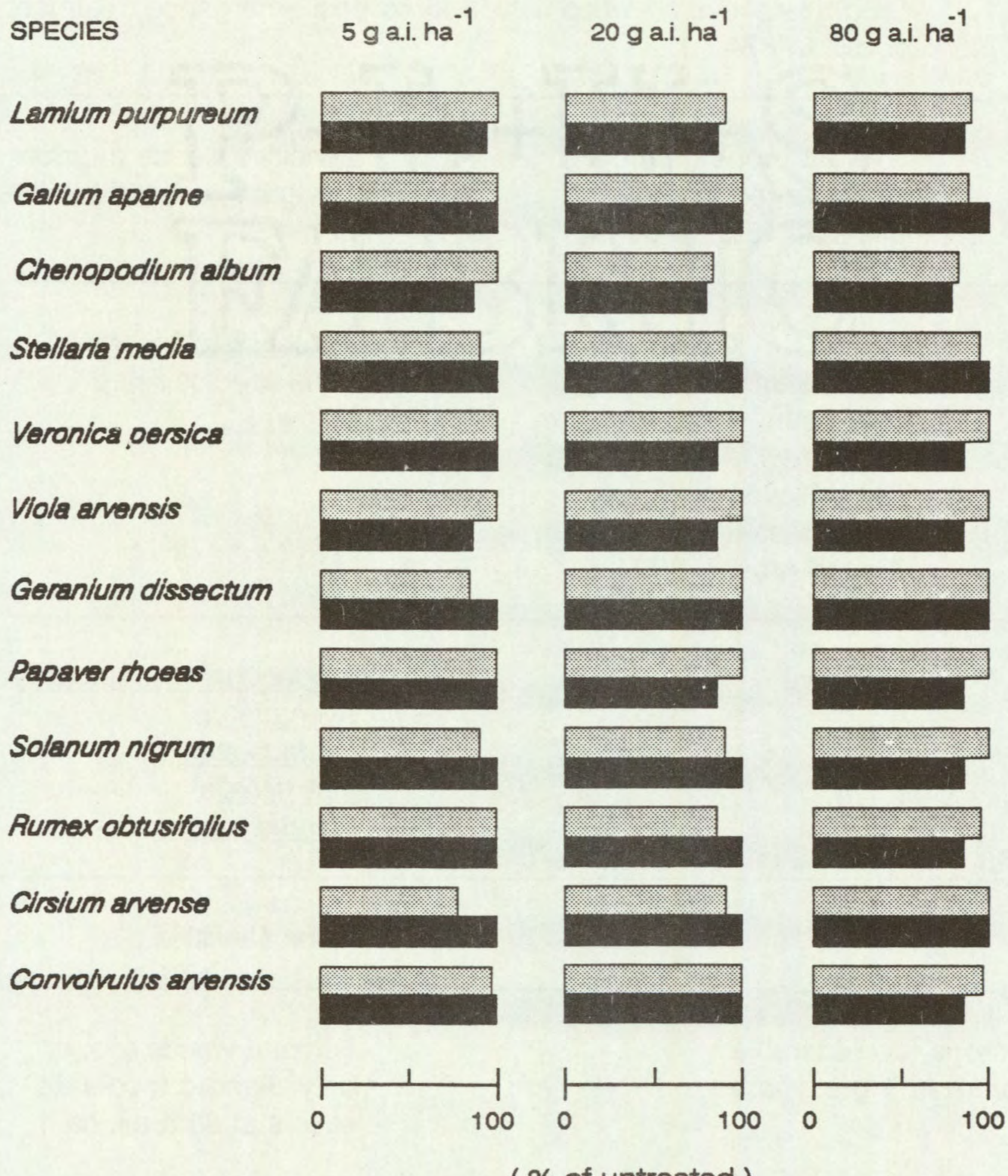


FIGURE 3

PRE-EMERGENCE SELECTIVITY EXPERIMENT

UBI C4874



4.2. Post-emergence selectivity (Table 3 and Figs. 4 to 6)

All of the broad-leaved crops tested, and onion, were tolerant to UBI C4874 at 80 g a.i.ha^{-1}. The cereals, maize and perennial ryegrass were damaged at 5g a.i.ha^{-1}, maize being particularly sensitive. The annual grass weeds Avena fatua, Alopecurus myosuroides, Poa trivialis and Bromus sterilis, and the perennial grass Elymus repens were susceptible to UBI C4874 at 20 g a.i. ha^{-1}. Agrostis stolonifera made some recovery after considerable initial suppression at 20 g a.i. ha^{-1}, but was killed at 80 g a.i. ha^{-1}. Poa annua and Festuca rubra were slightly affected at 80 g a.i.ha^{-1}.

Table 3. Crop tolerance and weed sensitivity to post-emergence treatments of UBI C4874

Dose g a.i. ha^{-1}	Tolerant crops (number or vigour reduced by less than 15%)		Sensitive weeds (number or vigour reduced by 70% or more)
80	Onion Dwarf bean Field bean Pea White Clover Sugar beet Oilseed rape	Kale Cabbage Carrot Lettuce Parsnip Sunflower	Agrostis stolonifera (plus species listed below)
20	As above		Alopecurus myosuroides Avena fatua Bromus sterilis Poa trivialis Elymus repens
5			None sensitive
Sensitive crops (considerable damage or kill at 5 g a.i. ha^{-1})			Tolerant weeds (no, or only slight to moderate effects at 80 g a.i. ha^{-1})
Wheat Barley Oat	Maize Perennial ryegrass		Poa annua Festuca rubra All dicotyledonous weeds

FIGURE 4

POST-EMERGENCE SELECTIVITY EXPERIMENT
UBI C4874

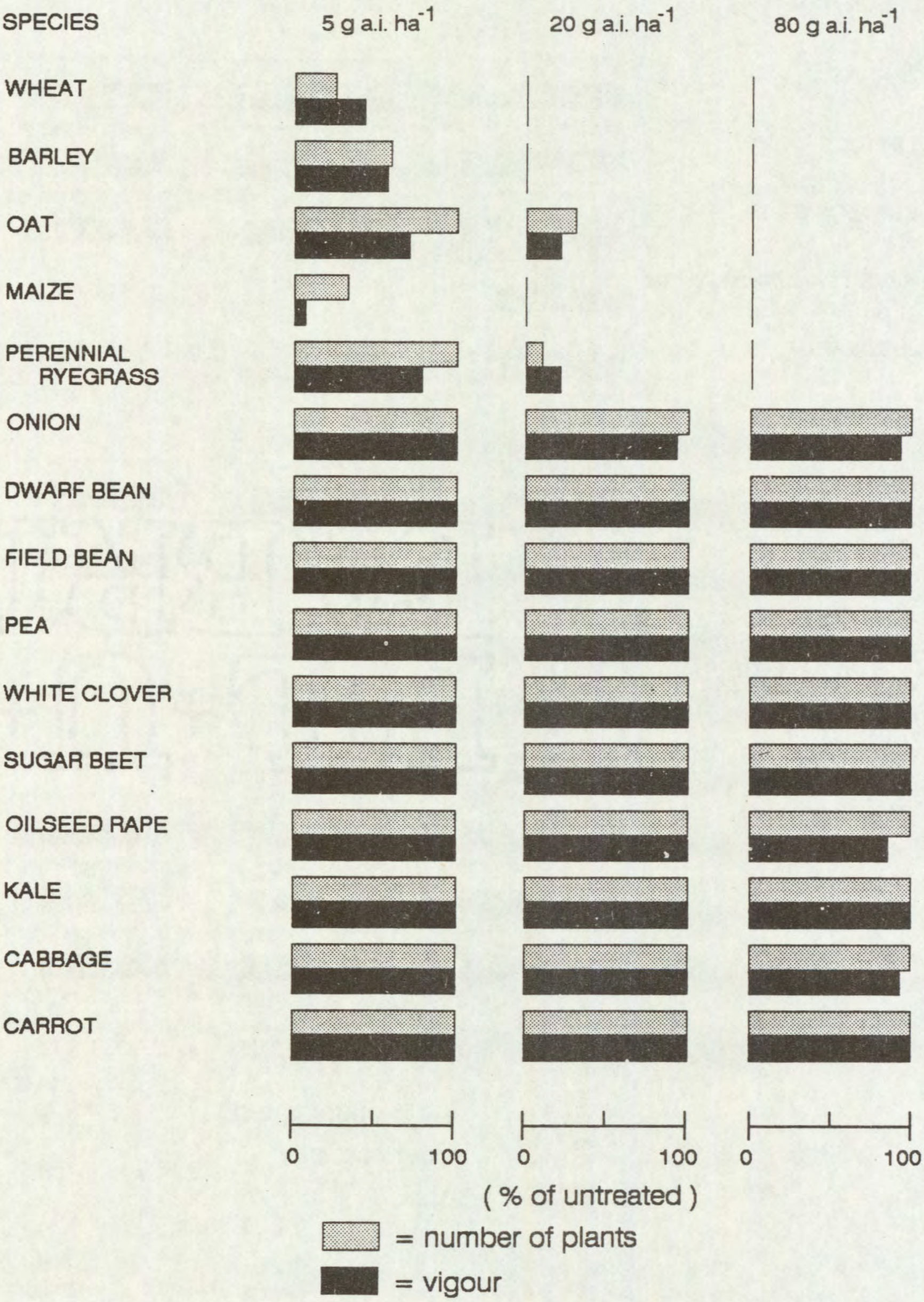


FIGURE 5

POST-EMERGENCE SELECTIVITY EXPERIMENT
UBI C4874

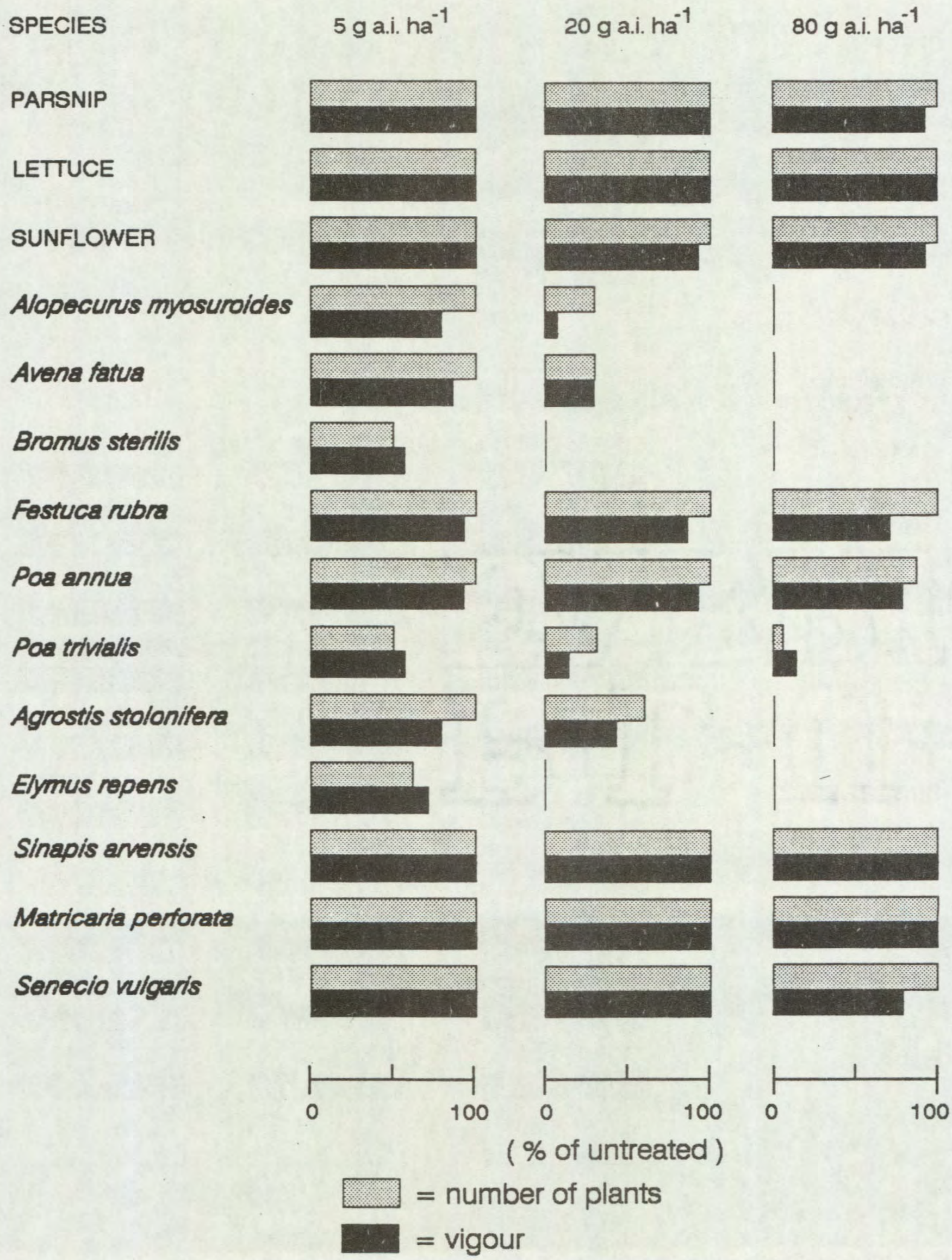
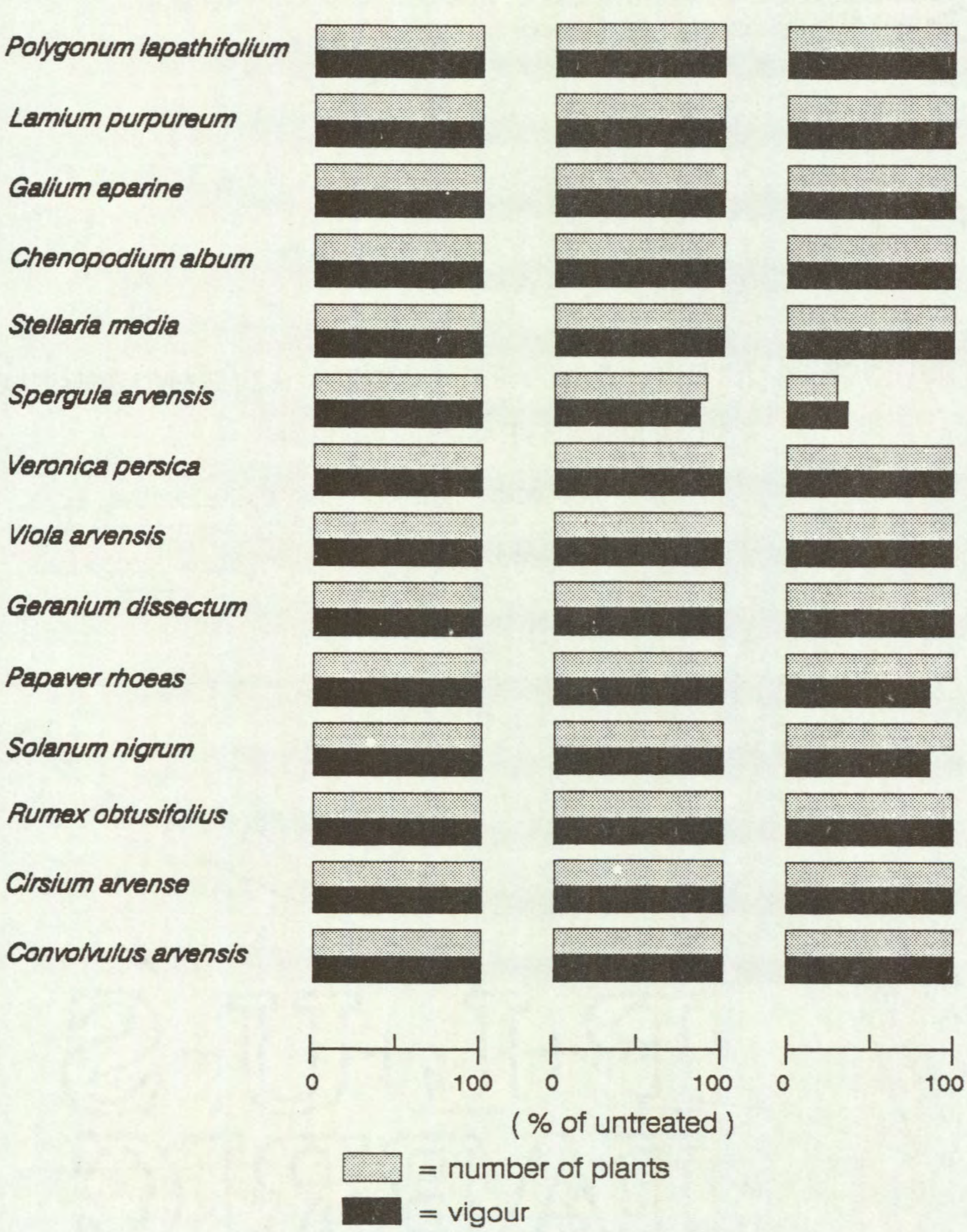


FIGURE 6

POST-EMERGENCE SELECTIVITY EXPERIMENT
UBI C4874



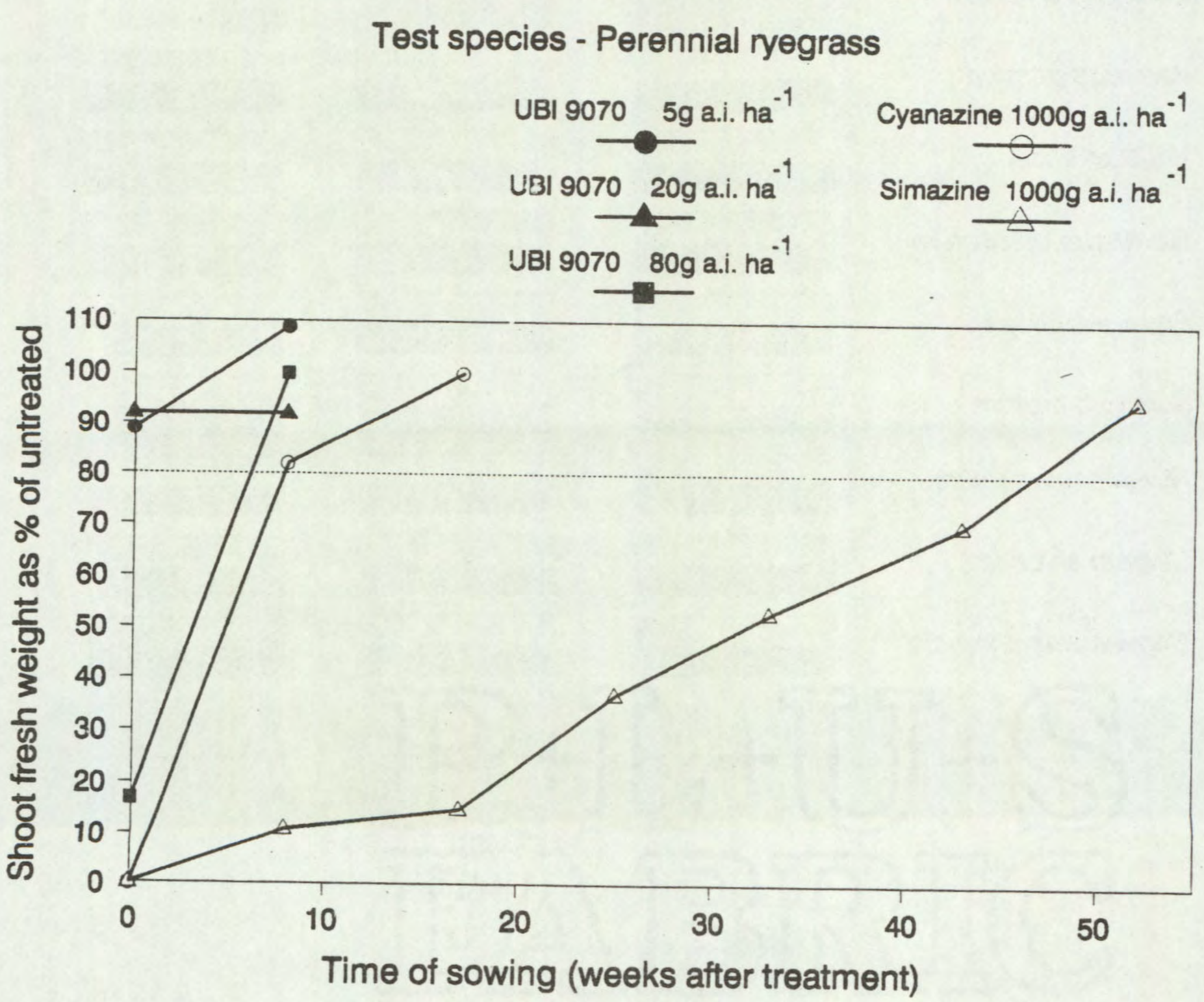
4.3. Soil persistence (Fig. 7)

Perennial ryegrass was considerably damaged when sown into treated soil 24h after spraying with UBI C4874 at 80 g a.i. ha^{-1}. Plants were unaffected at 5 and 20 g a.i. ha^{-1}. In this first bioassay perennial ryegrass plants emerged from soil treated with cyanazine, at 1000 g a.i. ha^{-1}, or simazine, at 1000 g a.i. ha^{-1}, but died soon after emergence.

Eight weeks after spraying there were no phytotoxic effects on perennial ryegrass sown into soil treated with UBI C4874 or cyanazine, whereas 43 weeks elapsed before the residual activity of simazine had ceased.

FIGURE 7

PERSISTENCE OF UBI C4874 COMPARED WITH CYANAZINE AND SIMAZINE



5. DISCUSSION

Results from the post-emergence selectivity experiment showed UBI C4874 to be a potentially useful treatment for grass weed control in dicotyledonous crops. It had good activity against several notable annual grass weeds and was effective against the intractable perennial grass weed Elymus repens. Tolerance of the dicotyledonous crops (including oilseed rape, sugar beet, sunflower, beans and pea) was excellent. However, UBI C4874 has a weakness similar to other phenoxypropionic graminicides in that Poa annua shows exceptional tolerance, as did Festuca rubra in this experiment.

In a separate experiment (West, unpublished data) UBI C4874 at 20 and 40 g a.i. ha^{-1} proved very effective in suppressing regrowth of established Elymus repens. Good control of the warm climate perennial grass weeds Sorghum halepense and Cynodon dactylon with UBI C4874 and tolerance of cotton, soyabean, peanut and sunflower has also been reported (Bell and Peddle, 1989).

In conclusion, the relatively low application rates, short soil persistence and the activity against E. repens, of UBI C4874, may be an advantage when compared with other graminicides.

6. ACKNOWLEDGEMENTS

I am most grateful to Mr R.F. Hughes and his staff for practical assistance and to Mrs. A. Berry for typing this report. I also thank Uniroyal Chemical Ltd. for providing the herbicide and relevant information. This work was funded by MAFF.

7. REFERENCES

Bell, A.R., Peddle, A.S. (1989) UBI C4874 a new post-emergence herbicide for control of annual and perennial grasses. Proceedings Brighton Crop Protection Conference - Weeds, 1, 65-70.

APPENDIX 1. Species information for pre-emergence experiment

Species	Cultivar or source	No. per pot	Depth of planting (cm)	Growth stage of untreated controls at assessment
Wheat (*Triticum aestivum*)	Avalon	8	1	4 leaves
Barley (*Hordeum vulgare*)	Igri	8	1	4 leaves
Oat (*Avena sativa*)	Peniarth	8	1	4 leaves
Maize (*Zea mays*)	LG 11	4	2	4-5 leaves
Perennial ryegrass (*Lolium perenne*)	Melle	12	0.5	4 leaves, 1 tiller
Onion (*Allium cepa*)	White Lisbon	15	0.5	3 leaves
Dwarf bean (*Phaseolus vulgaris*)	The Prince	3	2	2 trifoliates
Field bean (*Vicia fabia*)	Maris Bead	4	1.5	5 leaves
Pea (*Pisum sativum*)	Meteor	4	1.5	5 leaves
White clover (*Trifolium repens*)	Huia	15	0.25	5 leaves
Sugar beet (*Beta vulgaris*)	Hilma	8	1	4 leaves

Species	Cultivar or source	No. per pot	Depth of planting (cm)	Growth stage of untreated controls at assessment
Oilseed rape (*Brassica napus oleifera*)	Ariana	12	0.5	4 leaves
Kale (*Brassica oleracea acephala*)	Marrowstem	12	0.5	4 leaves
Swede (*Brassica napus*)	Marian	12	0.5	4 leaves
Carrot (*Daucus carota*)	Nandor	12	0.5	4 leaves
Lettuce (*Lactuca sativa*)	Webbs Wonderful	15	0.5	5 leaves
Sunflower (*Helianthus annuus*)	Frankasol	7	1.5	2 pairs leaves
Alopecurus myosuroides (Blackgrass)	Herbiseed	20	0.25	4 leaves, 2 tillers
Avena fatua (Wild oat)	LARS/BJW	10	1	4 leaves
Bromus sterilis (Barren brome)	Herbiseed	8	1	5 leaves, 2 tillers
Poa annua (Annual meadow-grass)	Herbiseed	20	0.25	5 leaves, 3 tillers
Poa trivialis (Rough meadow-grass)	Herbiseed	20	0.25	5 leaves, 2 tillers
Elymus repens (Common couch)	WRO	6	1.5	5 leaves

Species	Cultivar or source	No. per pot	Depth of planting (cm)	Growth stage of untreated controls at assessment
Raphanus rapanistrum (Wild radish)	Herbiseed	15	0.5	6 leaves
Sinapis arvensis (Charlock)	Herbiseed	20	0.5	6 leaves
Matricaria perforata (Scentless mayweed)	Herbiseed	25	surface	7 leaves
Lamium purpureum (Red dead-nettle)	Herbiseed	25	0.5	4 pairs leaves
Galium aparine (Cleavers)	LARS/BJW	16	0.5	4 whorls, + axillaries
Chenopodium album (Fat hen)	Herbiseed (soaked in 1% KNO_3 for 48 h in light)	15	0.25	8 leaves
Stellaria media (Common chickweed)	Herbiseed	20	0.25	6 leaves 4-5 branches
Veronica persica (Common field speedwell)	Herbiseed	20	0.25	4 pairs leaves, + axillaries
Viola arvensis (Field pansy)	Herbiseed	25	0.25	4 leaves
Geranium dissectum (Cut-leaved cranesbill)	Herbiseed	12	0.5	6 leaves
Papaver rhoeas (Common poppy)	Herbiseed	30	0.25	6 leaves + axillaries
Solanum nigrum (Black nightshade)	Herbiseed	20	surface	5 leaves

Species	Cultivar or source	No. per pot	Depth of planting (cm)	Growth stage of untreated controls at assessment
Rumex obtusifolius (Broad-leaved dock)	Herbiseed	15	0.25	4 leaves
Cirsium arvense (Creeping thistle)	LARS stock (roots soaked in thiram)	6	1	8 leaves
Convolvulus arvensis (Field bindweed)	Herbiseed	20	0.5	5 leaves

APPENDIX 2. Species information for post-emergence experiment

Species	Cultivar or source	No. plants per pot	Growth stage of untreated plants	
			At spraying	At assessment
Wheat (*Triticum aestivum*)	Galahad	5	2.5 leaves	7 leaves, 3 tillers
Barley (*Hordeum vulgare*)	Igri	5	2.5 leaves	6 leaves, 3 tillers
Oat (*Avena sativa*)	Peniarth	5	3 leaves	5-6 leaves, 2 tillers
Maize (*Zea mays*)	LG 11	3	2.5 leaves	7 leaves
Perennial ryegrass (*Lolium perenne*)	Melle	8	3 leaves	5 leaves, 6 tillers
Onion (*Allium cepa*)	White Lisbon	5	2.5 leaves	4 leaves
Dwarf bean (*Phaseolus vulgaris*)	The Prince	4	Unifoliates expanded	2 trifoliates
Field bean (*Vicia faba*)	Maris Bead	4	3 leaves	8 leaves
Pea (*Pisum sativum*)	Meteor	4	3 to 4 leaves	8 leaves, flower buds
White clover (*Trifolium repens*)	Huia	5	3 trifoliates	8-10 leaves
Sugar beet (*Beta vulgaris*)	Hilma	5	4 leaves	10 leaves

Species	Cultivar or source	No. plants per pot	Growth stage of untreated plants	
			At spraying	At assessment
Poa trivialis (Rough meadow-grass)	Herbiseed	8	3 leaves, 1 tiller	16 tillers
Agrostis stolonifera (Creeping bent)	Herbiseed	5	3 leaves, 2 tillers	18 tillers
Elymus repens (Common couch)	WRO	5	3 leaves	7 leaves, 2-3 tillers
Sinapis arvensis (Charlock)	Herbiseed	5	3 leaves	5 leaves, flower buds
Matricaria perforata (Scentless mayweed)	Herbiseed	5	5 leaves	13 leaves, axillaries, flowering
Senecio vulgaris (Groundsel)	Herbiseed	5	4 leaves	15 leaves flowering
Polygonum lapathifolium (Pale persicaria)	Herbiseed	5	3 leaves	7 leaves, flowering
Lamium purpureum (Red dead-nettle)	Herbiseed	5	2 pairs leaves	3 pairs, axillaries, flowering
Galium aparine (Cleavers)	LARS/BJW	5	2 whorls	9 whorls, axillaries
Chenopodium album (Fat hen)	Herbiseed	5	6 leaves	10 leaves, axillaries, flowering
Stellaria media (Common chickweed)	Herbiseed	5	4 pairs leaves, 2 branches	Many axillaries, flowering

Species	Cultivar or source	No. plants per pot	Growth stage of untreated plants	
			At spraying	At assessment
Oilseed rape (*Brassica oleracea oleifera*)	Ariana	5	2.5 leaves	7 leaves
Kale (*Brassica oleracea acephala*)	Marrowstem	5	2.5 leaves	5 leaves
Cabbage (*Brassica oleracea capitata*)	Golden acre	5	2.5 leaves	8 leaves
Carrot (*Daucus carota*)	Nandor	5	2 to 3 leaves	5 leaves
Lettuce (*Lactuca sativa*)	Webbs Wonderful	5	3 to 4 leaves	6 leaves
Parsnip (*Pastinaca sativa*)	White gem	5	2 to 3 leaves	5 leaves
Sunflower (*Helianthus annuus*)	Frankasol	3	1.5 pairs leaves	4 pairs leaves
Alopecurus myosuroides (Blackgrass)	Herbiseed	5	2 leaves 2 tillers	12 tillers
Avena fatua (Wild oat)	WRO	5	4 leaves, 1 to 2 tillers	6 leaves, 4 tillers
Bromus sterilis (Barren brome)	Herbiseed	5	3 leaves	5 leaves, 6 tillers
Festuca rubra (Red fescue)	Herbiseed	5	3 leaves, 1 tiller	12 tillers
Poa annua (Annual meadow-grass)	Herbiseed	8	3 to 4 leaves, 1 tiller	15 tillers

Species	Cultivar or source	No. plants per pot	Growth stage of untreated plants	
			At spraying	At assessment
Spergula arvensis (Corn spurrey)	Herbiseed	5	2 whorls	4 whorls, axillaries, flowering
Veronica persica (Common field speedwell)	Herbiseed	5	3 pairs leaves	5 pairs leaves, flowering
Viola arvensis (Field pansy)	Herbiseed	5	4 leaves	9 leaves, axillaries, flowering
Geranium dissectum (Cut-leaved cranesbill)	Herbiseed	5	2.5 leaves	8 leaves
Papaver rhoeas (Common poppy)	Herbiseed	5	4 leaves	8 leaves, axillaries, flowering
Solanum nigrum (Black nightshade)	Herbiseed	5	3 leaves	8 leaves, axillaries, flowering
Rumex obtusifolius (Broad-leaved dock)	Herbiseed	5	3 leaves	5 leaves
Cirsium arvense (Creeping thistle)	LARS stock	5	3.5 leaves	8 leaves
Convolvulus arvensis (Field bindweed)	Herbiseed	5	3 to 4 leaves	8 leaves