The tolerance of direct seeded native species to herbicides.

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Introduction

Herbicides have proven to be the most potent and economic method of weed control in agriculture and forestry but their use for weed control in direct seeded plantings is minimal. Reasons for this include a lack of knowledge on the tolerance of native species to herbicides and an ideology based reluctance to use chemicals in these situations. The range of host species in these situations is often large and the target species often few which directly contrasts with agriculture and forestry situations. Land managers often request a single mixture of herbicides that will kill all the weeds and leave all the natives species. Unfortunately, such a mixture is unlikely to exist. However, there are a number of pre emergent herbicides that are quite selective for specific weeds and these may be safe for use with particular mixtures of native plant seed. Alternatively, mixtures of species that tolerate the herbicides required for weed control could be formulated. To tralkoxydim(Achieve®) either of the above the tolerance of the native species is required. This paper presents the results of a screening trial where the tolerance of 41 native species from 14 genera to 46 herbicides was evaluated and formulates strategies for weed control in native vegetation or plantings that are worthy of further investigation.

Materials and methods

Seeds of 41 Australian native plants from 14 genera were sown into potting mix in tray. Twenty one pre emergent herbicide treatments (table 1) were applied, at two rates, immediately after planting and watered in with approximately 2mm of overhead irrigation. They were subsequently watered from below to reduce leaching of herbicide from the tray.

Thirty nine post emergent herbicides (table 3) were applied, at two rates and with the same equipment, 8 weeks after planting as an overall spray.

Herbicides were applied in 267 L/ha water using a boom with fan jet nozzles mounted over a conveyor belt that transported the trays below the boom. The plants were initially grown in a white washed glasshouse then in a shade house.

The plants were scored for size, survival and symptoms approximately 60 and 100 days after spraying.

Some species did not germinate or survive in sufficient numbers, especially in trays watered from below. These were excluded from analysis.

Results

The growth and survival percentages were averaged and divided into three classes of response. These were; less than 50%, 50 to 75% and greater than 75% growth and survival. To ease presentation of results these scores were averaged over the two assessment times to produce the 3 classes of response in Table 1 to 4. In this system good growth or recovery may partially compensate for poor survival and vice versa.

Table 1: The tolerance of various native plant species to pre emergent herbicides.

Herbicide	Rate (mL or g/ha of product)	Herbicide group	Agonis flexuosa	Agonis hypericifolia	Agonis parviceps	Allocasuarina	Banksia baxteri	Banksia coccinea	Banksia media	Beaufortia sparsa	Bossiaea linophylla	Calothamnus	Dryandra formosa	Hakea laurina	Kunzea baxteri	Kunzea ericifolia
Chlorsulfuron 75%	10	B	?	?	?	?	X	ok	ok	?	ok	ok	X	?	?	?
(Glean®)	40	B	X	?	X	?	X	X	ok	?	X	?	?	X	?	X
Imazethapyr 24%	500	B	X	?	X	X	ok	ok	ok	ok	ok	ok	ok	X	ok	ok
(Spinnaker®)	2000	B	X	?	X	?	X	?	X	X	ok	?	X	X	?	ok
Sulfometuron	50	B	?	?	?	?	?	X	ok	?	?	?	?	X	?	?
(Oust®)	200	B	X	?	X	X	X	X	X	X	X	?	X	X	?	?
Triasulfuron 75%	40	B	?	?	X	?	?	?	ok	ok	X	?	ok	X	?	?
(Logran®)	160	B	?	?	X	?	X	?	?	?	X	X	X	X	?	?
Linuron 50%	2000	C	?	?	X	X	?	X	ok	X	?	X	ok	X	X	X
	8000	C	X	X	X	X	X	X	X	X	?	X	?	X	X	X
Atrazine 90%	1000	C	X	X	X	X	X	X	ok	X	X	X	X	X	X	X
	4000	C	X	?	X	X	?	X	ok	X	?	X	X	X	X	X
Cyanazine 50%	2000	C	X	?	X	X	X	?	ok	X	X	?	X	X	X	X
(Bladex®)	8000	C	X	X	X	X	X	X	?	X	X	X	X	?	X	X
Diuron 90%	500	C	X	X	X	ok	ok	X	ok	X	X	X	?	?	X	X
	2000	C	X	X	X	X	X	X	?	X	X	X	X	?	X	X
Metribuzin 75%	250	C	?	?	X	X	ok	ok	ok	X	X	X	?	?	X	X
(Lexone®)	1000	C	X	?	X	X	X	X	?	X	X	X	X	X	X	X
Simazine 90%	1000	C	X	?	X	X	ok	?	ok	X	X	?	X	?	X	X
	4000	C	X	X	X	X	X	X	ok	X	X	X	X	X	X	X
Chlorthal 75%	5000	D	?	ok	X	ok	ok	X	ok	ok	ok	ok	ok	?	X	ok
(Dacthal®)	20000	D	?	X	?	?	?	X	ok	?	ok	?	X	?	?	ok
Oryzalin 500 g/L	2000	D	?	?	?	?	X	X	ok	X	ok	X	ok	X	ok	ok
(Surflan®)	8000	D	X	X	X	X	X	X	?	X	ok	X	X	X	?	X
Trifluralin	2000	D	ok	ok	X	ok	?	?	ok	?	ok	ok	X	X	ok	ok
	8000	D	?	?	X	?	?	X	?	ok	X	?	?	?	ok	?
Metolachlor 72%	1000	K	X	X	X	X	X	ok	ok	X	ok	?	X	?	X	X
(Dual®)	4000	K	X	X	X	X	X	X	ok	X	?	X	X	X	X	X
Napropamide 50%	2000	K	?	?	ok	ok	ok	X	ok	ok	?	ok	ok	ok	ok	ok
(Devrinol®)	8000	K	?	?	ok	?	?	X	ok	?	X	X	ok	X	?	ok
Propachlor 48%	5000	K	X	?	?	X	X	X	ok	X	?	?	X	X	?	X
(Ramrod®)	20000	K	X	X	X	X	X	X	X	X	?	X	X	X	X	X
Propyzamide 50%	1000	K	?	X	ok	ok	ok	ok	ok	X	X	X	ok	X	X	X
(Kerb®)	4000	K	X	X	X	X	ok	X	ok	X	?	X	X	X	X	X
Oxyfluorfen 24%	250	G	X	?	X	?	X	ok	ok	X	X	X	ok	ok	ok	ok
(Goal®)	1000	G	X	?	?	ok	ok	X	ok	X	X	X	X	?	?	X
Chorthal55%+Linuron7.5%	5000	D,C	?	X	X	X	X	X	ok	X	?	ok	ok	?	?	?
(Shamrox®)	20000	D,C	X	X	X	X	?	X	?	X	X	X	X	?	X	X
Chlorthal50%+Propachlor	5000	D,K	?	?	X	X	?	ok	ok	ok	ok	X	ok	X	?	ok
(Prothal®)	20000	D,K	X	X	X	X	?	X	ok	X	?	X	X	X	X	X

X = Don't use - less than 50% growth and/or survival.

? = Further research required - 50-75% growth and survival.

ok = adequate tolerance displayed in pots – greater than 75% growth and survival.

Table 2: The tolerance of *Eucalyptus* and *Melaleuca* species to pre emergent herbicides.

Herbicide	Rate (mL or g/ha of product)	Herbicide group	Eucalyptus annulata	Eucalyptus gomphocephala	Eucalyptus macrandra	Eucalyptus occidentalis	Eucalyptus platypus var	Eucalyptus talyuberlup	Melaleuca acuminata	Melaleuca cuticularis	Melaleuca hamulosa	Melaleuca scabra	Melaleuca thyoides	Melaleuca uncinata
Chlorsulfuron 75%	10	B	?	ok	ok	?	ok	ok	ok	ok	ok	?	ok	?
(Glean®)	40	B	X	?	ok	X	?	ok	X	?	?	?	?	?
Imazethapyr 24%	500	B	ok	X	?	?	?	?	ok	?	ok	ok	X	X
(Spinnaker®)	2000	B	X	X	ok	ok	ok	?	?	?	?	?	?	?
Sulfometuron	50	B	?	?	?	?	?	?	?	ok	X	?	?	?
(Oust®)	200	B	?	X	?	X	?	?	X	?	X	X	?	X
Triasulfuron 75%	40	B	ok	ok	ok	?	ok	ok	X	?	X	ok	?	?
(Logran®)	160	B	X	X	X	?	?	?	X	?	X	?	?	?
Linuron 50%	2000	C	X	X	X	?	X	ok	X	X	X	X	X	X
	8000	C	X	X	X	X	X	X	X	X	X	X	X	X
Atrazine 90%	1000	C	X	X	X	X	X	X	X	X	X	X	X	X
	4000	C	X	X	X	X	X	X	X	X	X	X	X	X
Cyanazine 50%	2000	C	X	X	X	X	X	X	X	X	X	X	X	X
(Bladex®)	8000	C	X	X	X	X	X	X	X	X	X	X	X	X
Diuron 90%	500	C	X	X	?	X	X	X	X	X	X	X	X	X
	2000	C	X	X	X	X	X	?	X	X	X	X	X	X
Metribuzin 75%	250	C	X	X	X	X	X	X	X	X	X	X	X	X
(Lexone®)	1000	C	?	X	X	X	X	X	X	X	X	X	X	X
Simazine 90%	1000	C	X	X	X	X	X	X	X	X	X	?	X	X
	4000	C	X	X	X	X	X	X	X	X	X	X	X	X
Chlorthal 75%	5000	D	ok	ok	ok	ok	ok	ok	?	ok	?	ok	ok	ok
(Dacthal®)	20000	D	?	ok	ok	ok	ok	ok	ok	?	ok	ok	?	?
Oryzalin 500 g/L	2000	D	?	X	?	ok	ok	ok	?	ok	?	ok	X	ok
(Surflan®)	8000	D	?	X	?	?	?	?	X	?	X	?	X	?
Trifluralin	2000	D	?	ok	ok	ok	ok	?	X	ok	ok	ok	ok	ok
	8000	D	X	?	?	?	?	?	X	?	?	X	?	ok
Metolachlor 72%	1000	K	X	X	X	?	X	X	X	?	X	?	X	ok
(Dual®)	4000	K	X	?	X	X	X	X	X	X	X	X	X	X
Napropamide 50%	2000	K	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Devrinol®)	8000	K	?	X	ok	ok	ok	ok	X	?	?	X	?	?
Propachlor 48%	5000	K	ok	X	ok	?	?	ok	?	?	X	X	?	?
(Ramrod®)	20000	K	X	X	X	X	X	X	X	X	X	X	X	X
Oxyfluorfen 24%	250	G	X	X	ok	?	ok	ok	ok	ok	X	X	X	?
(Goal®)	1000	G	?	X	?	ok	X	ok	X	X	X	X	X	X
Propyzamide 50%	1000	K	ok	?	ok	X	X	ok	X	ok	X	X	X	?
(Kerb®)	4000	K	?	?	X	X	X	?	X	X	X	X	X	X
Chorthal55%+Linuron7.5%	5000	D,C	?	ok	ok	ok	ok	ok	X	X	X	X	X	X
(Shamrox®)	20000	D,C	?	?	ok	?	X	ok	X	X	X	X	X	X
Chlorthal50%+Propachlor	5000	D,K	?	X	ok	ok	ok	ok	X	ok	?	X	X	X
(Prothal®)	20000	D,K	X	X	X	X	X	ok	X	ok	X	?	X	X

X = Don't use - less than 50% growth and/or survival.

? = Further research required - 50-75% growth and survival.

ok = adequate tolerance displayed in pots – greater than 75% growth and survival.

Table 3: The tolerance of various native plant species to post emergent herbicides.

Herbicide	Rate (mL or g/ha of product)	Herbicide group	Acacia acuminata	Acacia cyclops	Acacia pulchella	Acacia saligna	Actinostrobus arenarius	Agonis flexuosa	Agonis hypericifolia	Agonis parviceps	Allocasuarina huegeliana	Banksia baxteri	Banksia coccinea	Banksia media	Beaufortia shaueri	Beaufortia sparsa	Bossiaea linophylla	Callistemon phoniceus	Calothamnus quadrifidus	Dryandra formosa	Hakea laurina	Kunzea baxteri	Kunzea ericifolia
Diclofop methyl 37%	1000	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?	ok	ok	ok	ok
(Hoegrass®)	4000	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?	ok	ok	ok	ok
Fenoxaprop ethyl 10%	500	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	ok	ok	ok	ok
(Wildcat®)	2000	A	ok	ok	ok	ok	ok	X	X	X	ok	ok	ok	ok	ok	X	?	X	X	X	ok	X	?
Fluazifop 21.2%	250	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	ok
(Fusilade®)	1000	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?
Haloxyfop 13%	100	A	X	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok
(Verdict®)	400	A	?	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	?	ok	ok	ok	ok
Sethoxydim 18.6%	500	A	ok	ok	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X
(Sertin®)	2000	A	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	X
Tralkoxydim 40%	500	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok
(Achieve®)	2000	A	ok	X	X	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok
Chlorsulfuron 75%	20	B	ok	X	?	X	ok	X	?	?	ok	ok	ok	ok	ok	X	ok	ok	X	ok	ok	X	X
(Glean®)	80	B	ok	?	?	?	ok	X	X	X	?	ok	ok	ok	X	X	?	X	X	X	?	X	X
Flumetsulam 80%	25	B	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	ok	ok	ok	ok
(Broadstrike®)	100	B	ok	ok	ok	ok	ok	ok	?	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	?
Imazethapyr 24%	500	B	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	ok
(Spinnaker®)	2000	B	ok	ok	?	ok	ok	X	X	X	?	ok	ok	ok	X	ok	X	ok	?	ok	?	?	?
Metosulam 71%	5	B	ok	ok	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?
(Eclipse®)	20	B	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?
Metsulfuron 60%	5	B	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	?	?	?
(Ally®)	20	B	ok	ok	ok	ok	ok	X	X	X	?	ok	X	ok	X	X	?	?	X	X	X	X	X
Sulfometuron	50	B	?	X	ok	ok	ok	X	X	X	ok	ok	ok	ok	ok	ok	ok	?	?	ok	ok	?	X
(Oust®)	200	B	?	?	X	X	ok	X	X	X	X	?	ok	ok	X	X	X	X	X	X	X	X	X
Triasulfuron 75%	40	B	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?
(Logran®)	160	B	ok	ok	ok	ok	ok	X	?	?	X	ok	ok	ok	ok	X	?	?	X	ok	ok	ok	X
Atrazine 90%	1000	C	X	ok	X	X	ok	X	X	X	X	X	X	ok	X	X	X	X	X	X	X	X	X
	4000	C	X	ok	?	X	ok	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bromoxynil 20%	1000	C	?	ok	ok	ok	ok	ok	ok	ok	?	ok	X	ok	ok	X	ok	ok	X	X	ok	X	X
(Buctril®)	4000	C	?	ok	?	ok	ok	X	ok	ok	?	ok	X	X	X	X	ok	ok	X	X	X	X	?
Cyanazine 50%	2000	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(Bladex®)	8000	C	X	X	X	X	?	X	X	X	X	X	X	X	?	X	X	X	X	X	X	X	X
Diuron 90%	500	C	X	ok	X	ok	X	X	X	X	ok	X	X	X	X	X	X	X	X	X	X	X	X
	2000	C	?	ok	?	ok	?	X	X	X	X	X	X	X	?	X	X	X	X	X	X	X	X
Linuron 50%	1000	C	X	X	X	X	ok	X	X	X	X	ok	X	?	X	ok	X	X	X	ok	X	X	X
	4000	C	ok	X	X	?	ok	X	X	X	X	ok	X	X	X	X	X	X	X	X	X	X	X
Methabenzthiazuron 70%	1000	C	ok	ok	ok	ok	ok	X	X	ok	ok	ok	X	ok	X	X	?	?	X	X	ok	ok	X
(Tribunil®)	4000	C	ok	ok	ok	ok	ok	X	?	ok	X	X	X	ok	X	X	X	X	X	X	?	X	X
Metribuzin 75%	250	C	ok	ok	X	X	ok	ok	ok	X	X	X	X	ok	X	X	?	X	X	X	X	?	?
(Lexone DF®)	1000	C	ok	?	X	X	ok	X	X	X	X	X	X	X	?	X	X	X	X	X	X	X	X

Table 3(cont): The tolerance of various native plant species to post emergent herbicides.

Herbicide	Rate (mL or g/ha of product)	Herbicide group	Acacia acuminata	Acacia cyclops	Acacia pulchella	Acacia saligna	Actinostrobus arenarius	Agonis flexuosa	Agonis hypericifolia	Agonis parviceps	Allocasuarina huegeliana	Banksia baxteri	Banksia coccinea	Banksia media	Beaufortia shaueri	Beaufortia sparsa	Bossiaea linophylla	Callistemon phoniceus	Calothamnus quadrifidus	Dryandra formosa	Hakea laurina	Kunzea baxteri	Kunzea ericifolia
Pyridate 45%	2000	C	ok	ok	?	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	X	ok	ok	ok
(Tough®)	8000	C	ok	X	ok	?	ok	X	?	ok	X	X	X	X	ok	?	ok	X	?	X	?	X	?
Simazine 50%	1000	C	X	ok	X	X	ok	X	X	ok	X	X	ok	ok	X	X	X	X	X	ok	X	X	X
	8000	C	?	X	X	X	X	X	X	X	X	?	X	ok	X	X	X	X	X	X	X	X	X
Terbutryn 50%	500	C	ok	ok	ok	ok	ok	X	X	X	X	ok	X	ok	X	X	?	X	X	X	ok	?	X
(Igran®)	2000	C	ok	ok	X	?	ok	X	X	X	X	ok	X	ok	X	X	?	X	X	X	X	X	X
Diflufenican 50%	200	F	ok	X	X	ok	ok	X	X	X	ok	ok	ok	ok	X	?	?	?	X	?	ok	X	X
(Brodal®)	800	F	X	X	X	?	ok	X	X	X	X	ok	?	ok	?	X	X	X	X	X	?	X	X
Oxyfluorfen 24%	250	G	ok	?	X	ok	ok	ok	X	ok	?	ok	ok	ok	?	ok	X	?	X	ok	ok	ok	ok
(Goal®)	1000	G	X	X	X	?	ok	?	?	X	X	ok	ok	ok	?	ok	X	?	X	ok	?	?	?
2,4-D Amine 50%	1000	I	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	X	ok	ok	?	ok	ok	?	ok	ok	ok	ok
	4000	I	ok	X	X	ok	ok	ok	ok	ok	X	ok	?	ok	X	?	ok	X	X	ok	?	ok	ok
2,4-DB 50%	2000	I	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X
	8000	I	ok	?	ok	ok	ok	ok	ok	X	X	ok	ok	ok	X	ok	?	ok	?	ok	ok	ok	X
Chlopyralid	250	I	X	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	?	ok	ok	?
(Lontrel®)	1000	I	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	ok	ok	X
Dicamba 20%	500	I	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	?	X	ok	ok	ok	X	ok	ok	ok	?
	2000	I	X	ok	X	ok	ok	?	X	X	ok	?	?	?	?	X	X	?	X	ok	ok	?	X
Fluroxypyr 20%	1000	I	?	?	ok	ok	X	X	X	?	X	X	X	X	ok	ok	ok	ok	?	?	ok	X	?
(Starane®)	4000	I	ok	ok	ok	ok	ok	X	?	X	X	X	?	X	X	ok	?	ok	X	X	?	X	X
MCPA 50%	1000	I	ok	?	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	?	ok	ok	ok	ok
	4000	I	?	?	ok	ok	ok	ok	ok	ok	X	ok	X	ok	ok	?	X	X	?	X	X	X	X
2,2-DPA 74%	5000	J	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok
(Propon®)	20000	J	X	X	X	?	ok	?	?	?	ok	ok	ok	?	ok	ok	?	ok	X	ok	?	X	?
Metolachlor 72%	1000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok
(Dual®)	4000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	?
Propyzamide 50%	1000	K	?	ok	ok	ok	ok	ok	ok	?	?	ok	X	ok	ok	ok	?	ok	?	ok	?	ok	?
(Kerb®)	4000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	?
Diquat 20%	1000	L	ok	?	ok	ok	X	X	ok	X	X	ok	ok	ok	X	X	X	X	X	ok	ok	X	X
(Reglone®)	4000	L	ok	ok	ok	X	?	X	X	X	X	ok	ok	X	?	X	X	X	X	X	?	X	X
Paraquat 20%	1000	L	X	ok	?	ok	X	?	X	X	X	ok	X	X	X	?	X	X	X	X	ok	X	X
(Gramoxone®)	4000	L	?	ok	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Glyphosate 45%	500	M	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok
	2000	M	ok	ok	ok	ok	X	ok	ok	?	ok	ok	ok	ok	ok	ok	X	ok	X	ok	ok	?	?
Glufosinate 20%	1000	N	ok	ok	?	ok	ok	?	ok	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Basta®)	4000	N	X	X	ok	X	ok	ok	X	ok	ok	?	X	ok	?	?	X	ok	X	ok	?	X	X
Diflufenican + MCPA	1000	F,I	X	X	?	ok	ok	ok	?	?	?	ok	ok	ok	?	ok	?	ok	?	?	?	X	?
(Tigrex®)	4000	F,I	?	?	X	ok	X	X	X	X	X	ok	X	ok	X	?	X	X	X	X	X	X	X

X = Don't use - less than 50% growth and/or survival.

? = Further research required - 50-75% growth and survival.

ok = adequate tolerance displayed in pots – greater than 75% growth and survival.

Table 4: The tolerance of *Eucalyptus* and *Melaleuca* species to post emergent herbicides.

Herbicide	Rate (mL or g/ha of product)	Herbicide group	Eucalyptus annulata	Eucalyptus decipiens	Eucalyptus forrestiana	Eucalyptus gomphocephala	Eucalyptus lehmannii	Eucalyptus loxophleba	Eucalyptus macrandra	Eucalyptus marginata	Eucalyptus megacornuta	Eucalyptus occidentalis	Eucalyptus platypus var	Eucalyptus staeri	Eucalyptus talyuberlup	Eucalyptus tetragona	Melaleuca acuminata	Melaleuca cuticularis	Melaleuca hamulosa	Melaleuca scabra	Melaleuca thyoides	Melaleuca uncinata
Diclofop methyl 37%	1000	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Hoegrass®)	4000	A	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
Fenoxaprop ethyl 10%	500	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok
(Wildcat®)	2000	A	ok	X	X	ok	X	ok	ok	ok	ok	ok	X	ok	ok	ok	ok	ok	X	X	?	X
Fluazifop 21.2%	250	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Fusilade®)	1000	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	?	ok	ok
Haloxyfop 13%	100	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Verdict®)	400	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
Sethoxydim 18.6%	500	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	?	ok	ok	ok	ok	ok
(Sertin®)	2000	A	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	?	ok	ok	ok	ok	ok
Tralkoxydim 40%	500	A	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Achieve®)	2000	A	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
Chlorsulfuron 75%	20	B	ok	ok	ok	ok	?	?	ok	ok	ok	ok	ok	X	ok	X	?	ok	X	?	?	?
(Glean®)	80	B	?	X	ok	X	X	X	X	ok	X	?	X	?	X	X	?	?	X	X	X	X
Flumetsulam 80%	25	B	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	ok	ok	ok
(Broadstrike®)	100	B	ok	ok	ok	ok	ok	ok	ok	ok	?	?	ok	ok	?	?	ok	ok	?	?	ok	?
Imazethapyr 24%	500	B	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok
(Spinnaker®)	2000	B	?	?	ok	ok	?	ok	ok	ok	X	ok	ok	ok	ok	?	?	ok	X	?	ok	?
Metosulam 71%	5	B	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok
(Eclipse®)	20	B	ok	ok	X	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	?	X	ok	?	?	ok	?
Metsulfuron 60%	5	B	ok	ok	X	ok	ok	X	ok	ok	ok	ok	ok	?	ok	X	?	ok	ok	?	ok	?
(Ally®)	20	B	?	X	?	X	?	X	X	X	ok	ok	?	ok	?	X	?	?	X	X	X	X
Sulfometuron	50	B	?	ok	?	?	?	?	X	ok	ok	?	?	ok	?	X	?	ok	X	?	?	?
(Oust®)	200	B	X	X	X	X	X	X	X	ok	X	X	X	ok	X	X	?	?	X	X	?	X
Triasulfuron 75%	40	B	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	?	ok
(Logran®)	160	B	ok	ok	ok	?	?	ok	ok	ok	X	?	X	ok	?	X	?	ok	X	?	?	?
Atrazine 90%	1000	C	X	X	X	ok	X	X	X	X	X	X	X	ok	X	X	X	X	X	X	X	X
	4000	C	X	X	X	X	X	X	?	?	?	X	X	ok	X	X	X	X	X	X	X	X
Bromoxynil 20%	1000	C	X	?	?	X	?	?	X	X	X	X	ok	X	ok	X	?	ok	X	?	X	X
(Buctril®)	4000	C	X	X	ok	X	X	X	X	?	X	X	ok	?	X	X	?	ok	X	X	X	?
Cyanazine 50%	2000	C	X	X	X	ok	X	X	X	ok	X	X	X	ok	X	X	?	X	X	X	X	X
(Bladex®)	8000	C	X	X	X	X	X	X	X	ok	X	X	X	ok	X	X	?	X	X	X	X	X
Diuron 90%	500	C	X	X	X	X	X	X	X	ok	X	ok	X	X	X	X	ok	?	ok	X	X	X
	2000	C	X	X	X	?	X	X	X	ok	X	X	X	?	X	X	ok	X	X	X	X	X
Linuron 50%	1000	C	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	X	?	X	X	X	X
	4000	C	X	X	X	X	X	X	X	X	ok	ok	X	X	?	X	X	X	X	X	X	X
Methabenzthiazuron 70%	1000	C	ok	ok	ok	ok	ok	X	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	X	?	X
(Tribunil®)	4000	C	X	X	X	ok	X	X	X	ok	ok	ok	?	ok	?	X	?	ok	?	X	X	X
Metribuzin 75%	250	C	X	X	X	X	X	X	X	X	X	X	X	ok	X	X	?	X	X	X	X	X
(Lexone DF®)	1000	C	?	X	X	X	X	X	X	X	X	X	X	ok	X	X	?	X	X	X	X	X

Table 4(cont): The tolerance of *Eucalyptus* and *Melaleuca* to post emergent herbicides.

Herbicide	Rate (mL or g/ha of product)	Herbicide group	Eucalyptus annulata	Eucalyptus decipiens	Eucalyptus forrestiana	Eucalyptus gomphocephala	Eucalyptus lehmannii	Eucalyptus loxophleba	Eucalyptus macrandra	Eucalyptus marginata	Eucalyptus megacornuta	Eucalyptus occidentalis	Eucalyptus platypus var	Eucalyptus staeri	Eucalyptus talyuberlup	Eucalyptus tetragona	Melaleuca acuminata	Melaleuca cuticularis	Melaleuca hamulosa	Melaleuca scabra	Melaleuca thyoides	Melaleuca uncinata
Pyridate 45%	2000	C	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	?	X	?	?	ok
(Tough®)	8000	C	ok	ok	ok	ok	ok	ok	X	X	ok	ok	ok	ok	X	ok	?	ok	X	ok	X	ok
Simazine 50%	1000	C	X	X	X	ok	ok	X	?	ok	X	?	X	ok	X	ok	?	ok	X	?	X	X
	8000	C	X	X	X	X	X	X	X	ok	X	X	X	ok	X	X	X	X	X	X	X	X
Terbutryn 50%	500	C	X	X	X	ok	X	X	X	X	X	ok	X	ok	ok	X	?	ok	X	?	X	X
(Igran®)	2000	C	X	X	X	X	X	X	X	?	X	X	X	ok	X	X	?	ok	X	X	X	X
Diflufenican 50%	200	F	ok	ok	ok	ok	ok	X	ok	ok	ok	ok	ok	X	ok	?	?	ok	ok	X	?	X
(Brodal®)	800	F	X	ok	X	ok	X	X	X	X	ok	ok	?	ok	ok	X	X	ok	ok	?	X	X
Oxyfluorfen 24%	250	G	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	?	ok	ok
(Goal®)	1000	G	ok	ok	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	?	X	?	ok	?	X	?	X
2,4-D Amine 50%	1000	I	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	?	?	ok	ok
	4000	I	?	ok	ok	ok	X	?	ok	ok	ok	ok	ok	ok	ok	ok	X	X	X	X	X	?
2,4-DB 50%	2000	I	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	?	?	ok	?	ok	ok
	8000	I	ok	?	ok	ok	ok	ok	ok	ok	?	ok	ok	?	ok	X	X	?	X	X	X	X
Chlopyralid	250	I	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Lontrel®)	1000	I	ok	ok	X	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
Dicamba 20%	500	I	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	?	ok	?	?	ok	?
	2000	I	X	X	ok	ok	X	ok	X	ok	?	ok	?	ok	ok	X	?	X	X	X	X	X
Fluroxypyr 20%	1000	I	?	?	X	ok	ok	ok	?	ok	X	?	ok	ok	ok	X	ok	?	ok	ok	X	ok
(Starane®)	4000	I	ok	X	X	?	?	?	ok	ok	X	X	?	ok	X	X	?	X	X	X	X	X
MCPA 50%	1000	I	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	?	X	X	ok
	4000	I	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	X	X	X	X	X
2,2-DPA 74%	5000	J	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok
(Propon®)	20000	J	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	?	ok	X	?	ok	ok	X	ok	?
Metolachlor 72%	1000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Dual®)	4000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	X	ok	ok	ok
Propyzamide 50%	1000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	?	ok	ok
(Kerb®)	4000	K	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	?	ok	ok
Diquat 20%	1000	L	X	X	X	ok	X	X	?	X	X	ok	ok	X	ok	X	?	?	X	X	ok	X
(Reglone®)	4000	L	X	X	X	X	X	X	X	?	X	X	X	?	X	X	?	X	X	X	X	X
Paraquat 20%	1000	L	X	ok	X	X	X	X	X	ok	X	ok	X	ok	X	X	?	?	?	X	ok	X
(Gramoxone®)	4000	L	X	X	X	X	X	X	X	X	X	X	X	X	X	X	?	X	X	X	X	X
Glyphosate 45%	500	M	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok
	2000	M	ok	ok	ok	ok	X	?	ok	ok	ok	ok	ok	?	ok	ok	ok	ok	ok	?	ok	ok
Glufosinate 20%	1000	N	ok	ok	?	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
(Basta®)	4000	N	ok	X	?	X	X	X	ok	ok	ok	ok	ok	ok	X	ok	ok	ok	ok	X	ok	X
Diflufenican + MCPA	1000	F,I	X	ok	ok	ok	ok	X	ok	X	ok	ok	?	X	ok	X	?	ok	X	X	X	X
(Tigrex®)	4000	F,I	X	X	X	X	X	X	X	?	ok	X	X	ok	X	X	X	X	X	X	X	X

X = Don't use - less than 50% growth and/or survival.

? = Further research required - 50-75% growth and survival.

ok = adequate tolerance displayed in pots – greater than 75% growth and survival.

Acacias

In the pre emergence treatments trial, Acacias had low germination levels ranging from 10% to 33%, so only general assessments can be made. The sulfonyl urea (group B) herbicides were surprisingly well tolerated by the Acacias and are worthy of further research because of their wide range of activity on common weeds. The overall tolerance was imazethapyr(Spinnaker®) > triasulfuron(Logran®) > sulfometuron(Oust®) > chlorsulfuron. The triazine and urea (group C) herbicides were generally very damaging apart from low rates of simazine. The benzoic and dinitroaniline (group D) herbicides were variable with trifluralin being the safest. The amide (group K) were also variable with propyzamide(Kerb®) being well tolerated and napropamide(Devrinol®) being very damaging. oxyfluorfen(Goal®) (group G) was generally well tolerated. Based on this data products worthy of further testing would include imazethapyr(Spinnaker®), triasulfuron(Logran®), sulfometuron(Oust®), trifluralin and propyzamide(Kerb®).

For the post emergent treatments establishment was better, presumably because they were watered from above rather than below. They generally tolerated group A herbicides with some showing sensitivity to tralkoxydim(Achieve®) and haloxyfop(Verdict®). They also showed surprising tolerance of the group B herbicides apart from chlorsulfuron(Glean®) and sulfometuron(Oust®). In the group C herbicides responses ranged from death of all species after cyanazine(Bladex®) to good tolerance of methabenzthiazuron(Tribunil®). The hormone herbicides of group I were generally tolerated at the low rates but not at the high rates. Group K herbicides were well tolerated. Glyphosate and glufosinate(Basta®) were less damaging than the bipyridyl herbicides.

Actinostrobus

These were quite tolerant of most post emergent herbicides apart from sethoxydim(Sertin®), metosulam(Eclipse®), cyanazine(Bladex®), diuron, simazine, paraquat(Gramoxone®), diquat(Reglone®) and glyphosate.

Agonis

Few pre emergent herbicides were well tolerated by this genus. Napropamide(Devrinol®) may be worthy of further work.

Post emergence, group A herbicides were well tolerated apart from fenoxaprop ethyl(Wildcat®). flumetsulam(Broadstrike®), metosulam(Eclipse®) and low rates of imazethapyr(Spinnaker®) were tolerated in the group B herbicides. The group C, F and G herbicides generally caused damage. Fluroxypyr(Starane®) and high rates of dicamba caused damage in the group I herbicides. Group K herbicides were well tolerated. Other groups had variable responses.

Allocasuarina

Pre emergent group B herbicides were marginally selective and odd members of other groups, such as diuron, chlorthal(Dacthal®), trifluralin, napropamide(Devrinol®), propyzamide(Kerb®) and oxyfluorfen(Goal®), showed some selectivity at normal use rates.

Post emergent applications of group A and the low rates of group B and I herbicides were generally well tolerated apart from fluroxypyr(Starane®). Group c herbicides were not generally tolerated. 2,2-DPA(Dalapon®), metalochlor(Dual®), propyzamide(Kerb®), glyphosate and glufosinate(Basta®) were well tolerated.

Banksia

Banksia media had a 100% germination and survival level and tolerated nearly all pre emergent herbicides at the low rate. The other two species had a low germination and survival level but appeared to be far less tolerant of herbicides. All three species tolerated imazethapyr(Spinnaker®), metribuzin(Lexone®) and propyzamide(Kerb®).
Post emergent group a and b herbicides, diflufenican(Brodal®), oxyfluorfen(Goal®), clopyralid(Lontrel®), 2,4-DB, 2,2-DPA(Dalapon®), metalochlor(Dual®) and glyphosate were generally well tolerated. The group C herbicides were generally damaging and others rather variable.

Beaufortia
These tolerated pre emergence imazethapyr(Spinnaker®), triasulfuron(Logran®), chlorthal(Dacthal®), napropamide(Devrinol®) and chlorthal plus propachlor(Prothal®) at low rates. None of the B. shaueri survived in the controls but odd plants survived in the above treatments indicating that it has similar tolerances.
Group A,J, K and M herbicides apart from fenoxaprop ethyl(Wildcat®) and possibly diclofop methyl(Hoegrass®) were well tolerated. Group B herbicides were often tolerated at the low but not the high rate. Group C and L herbicides were generally damaging apart from bromoxynil(Buctril®) and pyridate(Tough®).

Bossiaea
These tolerated high rates of pre emergent imazethapyr(Spinnaker®) and the group D herbicides.
Group A herbicides and metalochlor(Dual®) were generally well tolerated. Low rates of group B and I herbicides were generally tolerated. Group C herbicides and others were generally damaging apart from bromoxynil(Buctril®) and pyridate(Tough®).

Callistemon
This had a poor germination and survival level in the pre emergent experiment. Overall, they appeared reasonably tolerant of the group B and d herbicides.
Groups A, J, K, glyphosate and glufosinate(Basta®) as well as low rates of group B and I herbicides were generally well tolerated apart from sulfometuron(Oust®) and fenoxaprop ethyl(Wildcat®). Group C and L herbicides apart from bromoxynil(Buctril®) were generally damaging.

Calothamus
These were reasonably tolerant of the pre emergent group B herbicides, especially imazethapyr(Spinnaker®) and intolerant of the group C herbicides. They also tolerated normal rates of chlorthal(Dacthal®), trifluralin and napropamide(Devrinol®).
This species was very sensitive to most post emergent herbicides apart from clopyralid(Lontrel®), flumetsulam(Broadstrike®) and low rates of sethoxydim(Sertin®), propyzamide(Kerb®), 2,4-DB and glufosinate(Basta®).

Dryandra
These showed tolerance to odd pre emergent herbicides in various groups including, imazethapyr(Spinnaker®), triasulfuron(Logran®), linuron, chlorthal(Dacthal®), oryzalin(Surflan®), napropamide(Devrinol®), propyzamide(Kerb®) and oxyfluorfen(Goal®).
They also tolerated post emergent group A and K herbicides (apart from the high rate of fenoxaprop ethyl(Wildcat®)), low rates of group B and I herbicides, oxyfluorfen(Goal®),

2,2-DPA(Dalapon®), glyphosate and glufosinate(Basta®). There were generally damaged by group C and L herbicides.

Hakea
This was sensitive to most pre emergent herbicides apart from napropamide(Devrinol®) and oxyfluorfen(Goal®).
Post emergent group A, K and glyphosate as well as low rates of group B (apart from Ally), I and L herbicides, 2,2-DPA(Dalapon®) and glufosinate(Basta®) were well tolerated.
Group C herbicides were generally damaging apart from low rates of bromoxynil(Buctril®), terbutryn(Igran®) and pyridate(Tough®)

Kunzea
The Kunzea species were relatively tolerant of imazethapyr(Spinnaker®) and marginally tolerant of other group B herbicides. They also showed tolerance to group D herbicides, napropamide(Devrinol®) and oxyfluorfen(Goal®).
K. ericafolia was generally les tolerant to herbicides than K.baxteri.
K. baxteri were generally tolerant to group A herbicides apart from high rates of fenoxaprop ethyl(Wildcat®). K. ericafolia on the other hand was severely damaged by sethoxydim(Sertin®) and only marginally tolerant of the high rate of Fusilade. Group B and C herbicides were generally damaging apart from low rates of flumetsulam(Broadstrike®), metosulam(Eclipse®), triasulfuron(Logran®), imazethapyr(Spinnaker®), pyridate(Tough®). Low rates of oxyfluorfen(Goal®), metalochlor(Dual®), glyphosate and glufosinate(Basta®) were also tolerated.

Eucalyptus
Half of the species failed to establish in sufficient numbers for analysis in the pre emergent trial. The remaining six species were generally tolerant of the group D herbicides and napropamide(Devrinol®) with marginal to good tolerance to the group B herbicides. E. gomphocephala showed sensitivity to some herbicides in these groups. Group C herbicides were generally very damaging to eucalypts.
The post emergent group A herbicides were generally well tolerated by the 14 species tested. Odd species were damaged by diclofop methyl(Hoegrass®), sethoxydim(Sertin®) and fenoxaprop ethyl(Wildcat®) especially at the high rate. In the group B herbicides they generally tolerated low rates of flumetsulam(Broadstrike®), metosulam(Eclipse®), triasulfuron(Logran®) and imazethapyr(Spinnaker®). In the group C herbicides low rates of Linuron, pyridate(Tough®) and methabenzthiazuron(Tribunil®) were tolerated by most species. Low rates of Group I and K herbicides (apart from fluroxypyr(Starane®)) oxyfluorfen(Goal®), 2,2-DPA(Dalapon®), glyphosate and glufosinate(Basta®) were generally tolerated. Low rates of diflufenican(Brodal®) were tolerated by 11 of the 14 species. Group L herbicides were generally damaging.

Melaleuca
The Melaleuca species had similar tolerances to the eucalypts with the group D herbicides and napropamide(Devrinol®) being generally safe at the low rate when applied pre emergence. The group B herbicides had varying effects and group C herbicides were very damaging. Again odd species showed particular sensitivities to some herbicides that were generally tolerated by their relatives.

Post emergent applications of the group A herbicides were well tolerated by this genus apart from a few species that were sensitive to fenoxaprop ethyl(Wildcat®). Within the group B herbicides they had similar tolerances to the eucalypts with flumetsulam(Broadstrike®), metosulam(Eclipse®), triasulfuron(Logran®) and imazethapyr(Spinnaker®) being tolerated at the low rates. Clopyralid(Lontrel®) was the only group I herbicide tolerated by all species. Low rates of group K, 2,2-DPA(Dalapon®), glyphosate and glufosinate(Basta®) were also well tolerated.
The group C and L herbicides were generally damaging.

Discussion
When this trial was planned it was hoped that some herbicides or herbicide groups would be generally tolerated at the genus level. In many cases there has been one or two species that have been severely damaged by herbicides that were generally tolerated by other species in the same genus. This makes generalisation of results to other species that have not been tested difficult and potentially dangerous. However, given that it is unlikely that all herbicides will be rigorously tested on all native species a few generalisations can be made to reduce the risk of damage.
Pre emergence weed control.
Some species such as Banksia media tolerate a wide range of herbicides whilst others like Hakea and Agonis species tolerate very few. Reclamation of degraded vegetation using pre emergent herbicides is likely to lead to a species shift which may need to be remedied with other strategies such as supplemental planting.
Pre emergence napropamide(Devrinol®) and chlorthal(Dacthal®) were well tolerated by 21 of the 26 species tested. Chlorthal(Dacthal®) controls a wide range of weeds but tends to be weak on weeds from the Brassicaceae (radish, turnip and mustard) family. Napropamide(Devrinol®) has a narrower weed spectrum and both are quite expensive. Trifluralin was the next most selective herbicides. This was tolerated by 17 species but has a narrow weed spectrum of annual grasses and wireweed. Chlorsulfuron(Glean®) and imazethapyr(Spinnaker®) were tolerated by about half the species tested. Both have a wide spectrum. Chlorsulfuron(Glean®) tended to suppress intolerant species whereas imazethapyr(Spinnaker®) tended to kill them. This together with the price of chlorsulfuron(Glean®) may make it quite useful for bushland reclamation where survival may be more crucial than maximum growth.

Post emergence weed control.
Fusilade is the preferred grass selective herbicide because it well tolerated at 4 times normal use rates by a wide range of native species has a wider weed spectrum than diclofop methyl(Hoegrass®) or tralkoxydim(Achieve®). Haloxyfop(Verdict®) was tolerated only slightly less than Fusilade but does have the advantage of having action on the Erodium genus which commonly occurs in degraded bush.

Imazethapyr(Spinnaker®) was also tolerated by a wide range of species and has a wide weed spectrum including many of the common bushland weeds such as Brome grasses, Cape Tulip, Capeweed, Chickweeds, Clovers, Docks, Flatweed, Prickly Lettuce, Loosestrife, Small-flowered Mallow, Mustards, Nettles, Sorrel, Sowthistle, Spiny Emex, Squirrel-tailed Fescue, Turnips, Wall Fumitory, Wild Radish and Wireweed. At normal use rates it was tolerated by 37 out of the 41 species tested. At four times normal use rates it was safe on 21 species and 6 species were severely damaged.

2,2-DPA(Dalapon®) is also worthy of mention because of its action on grasses and the bulbous weed species such as Watsonia that often invades disturbed bushland. It was tolerated by 38 of the species tested at the 3700gai/ha rate.
Low rates of glyphosate applied post emergence were also well tolerated in this experiment. At 225gai/ha 38 species showed good tolerance and at 900gai/ha 31 species showed good tolerance.

For specific weeds in specific communities the tables can be used to determine appropriate herbicides for field testing. For example, to control Wild Radish in Agonis communities metosulam(Eclipse®) or 2,4-D amine may be chosen as appropriate products.

Overall, the group C herbicides were quite damaging, the sulfonyl ureas from group B less so, and the group D herbicides together with imazethapyr(Spinnaker®) the least damaging.

Conclusions

The aim of this work was to formulate some general weed control strategies for either native plants sown as seed or to assist natural regeneration of degraded vegetation from native species present in the seed bank. Chlorthal(Dacthal®) applied pre emergence was the most selective herbicide with a wide spectrum of weeds controlled. This would need probably need a follow up treatment about 6-8 weeks later to control Brassica weeds and late germinating grasses. Fusilade or haloxyfop(Verdict®) could be used to control grasses. Imazethapyr(Spinnaker®) could be used to control small Brassica weeds and a range of other weeds and extend the length of pre emergent weed control. For larger Brassica weeds metosulam(Eclipse®) is probably a better choice but less selective. Unfortunately both chlorthal(Dacthal®) and imazethapyr(Spinnaker®) are quite expensive which is likely to reduce their use in some situations. In these cases chlorsulfuron(Glean®) or triasulfuron(Logran®) are worthy of consideration as the pre emergence treatment followed by metosulam(Eclipse®) for Brassica weed control. This would cost $10-$22/ha compared to over $300/ha for the chlorthal(Dacthal®) followed by imazethapyr(Spinnaker®) strategy. It would also be less selective in many cases.
For regenerating disturbed bush and degraded roadside vegetation the selectivity of glyphosate at low rates demonstrated in this experiment is worthy of further investigation. At 225-450gai/ha many of the common bushland weeds would be controlled or suppressed for less than $6/ha. In addition many authorities already spray the road shoulder and drain with high rates of glyphosate and it would be a relatively simple task to add an extra nozzle to deliver a low rate of glyphosate to the vegetation beyond the drain. This may prevent or reduce weed establishment in the susceptible transition zone between the disturbed area and the undisturbed bush. Annual applications may help to reduce the rate of spread of some of our most serious roadside weeds such as the Bridal Creeper, Veldt grass, African Love grass, Wild Oats and Phalaris.
I hope that this work will help others plan field trials for their particular set of species.

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