REPLACEMENT OF *LUDWIGIA PERUVIANA* WITH NATIVE PLANTS USING HERBICIDES IN AN URBAN WETLAND

G. McCorkelle[1], K.H. Bowmer[1], G.R. Sainty[1] and J. Stricker[2]
[1] CSIRO Division of Water Resources, Griffith NSW, Australia
[2] Water Board, Sydney NSW, Australia

Summary. The use of herbicides to control *Ludwigia peruviana* was investigated in the Botany Wetlands, a series of shallow urban lakes in the Sydney metropolitan area. Field trials over two years evaluated five herbicides registered for aquatic use. Glyphosate and 2,4-D amine (diethylamine salt) gave best control. Application in April-May was most effective but earlier treatment improved selectivity of several desirable species, notably *Typha* spp. and *Persicaria strigosa*. Other effective herbicides were dicamba, picloram/2,4-D, fluroxypyr, imazapyr and triclopyr when applied in January and May. They offered little advantage over glyphosate or 2,4-D.

INTRODUCTION

Ludwigia peruviana is a shrub-like plant that was introduced to Sydney in 1907 as a botanical specimen (1). It was recorded as naturalised in the Botany Wetlands in 1970 (although it was growing there before this date) and currently forms dense dominant stands over about 21 ha of the total area. *L. peruviana* is deciduous, seeds prolifically, thrives in shallow water or waterlogged areas and can grow up to 3 m tall (2, 3).

Restoration of the wetlands requires the removal of *L. peruviana* and its replacement with native species. Seven field trials were established to investigate the efficacy of herbicides for controlling *L. peruviana*, while minimising damage to native species.

METHODS

Two groups of compounds, registered aquatic herbicides and registered non-aquatic herbicides (Table 1), were evaluated in replicated randomised plot field trials. Plot size varied from 3x5 m to 30x8 m and plant stands were 2-3 m tall.

Herbicide application was made using an adjustable hollow cone nozzle attached to a 2.5 m hand lance connected to a 9 L back-mounted tank, pressurised by LPG gas to give a spraying pressure of 250-300 kPa. Spraying was done from the shore, penetration of foliage being obtained by altering nozzle pattern and angle. Volumes of application were to point of run-off, and ranged from 650-1875 L/ha.

Timing of application varied from mid-January through to mid-May (mid to late growing season) except for one trial where application was made in late August just as plant dormancy was breaking.

Table 1. Treatments used

Herbicide	Formulation	Rate a.i. (% w/v)	Wetter (% product)
Registered Aquatic Herbicides			
amitrole	250 g/L	0.10	Agral 600 (0.2)
amitrole + 2,2 DPA	250 g/L +740 g/kg	0.10 +0.33	Agral 600 (0.2)
dichlobenil	67.5 g/kg	15.0 (kg/ha)	-
diquat	200 g/L	0.10	Agral 600 (0.2)
glyphosate	360 g/L	0.36	-
"	"	0.54	-
"	"	0.36	Pulse (0.2)
"	"	0.54	Pulse (0.2)
2,4-D amine*	500 g/L	0.50	Agral 600 (0.2)
Registered Non-Aquatic Herbicides			
clopyralid	300 g/L	0.09	Agral 600 (0.2)
"	"	0.18	Agral 600 (0.2)
dicamba	200 g/L	0.10	-
"	"	0.20	-
fluroxypyr	300 g/L	0.09	-
"	"	0.18	-
imazapyr	250 g/L	0.13	-
"	"	0.25	-
metsulfuron	600 g/kg	0.001	Agral 600 (0.2)
picloram/2,4-D**	50/200 g/L	0.13	Agral 600 (0.2)
"	"	0.25	Agral 600 (0.2)
triclopyr	480 g/L	0.14	-
"	"	0.29	-

* diethylamine salt
** tri-isopropanol amine salt

RESULTS AND DISCUSSION

Registered aquatic herbicides (Table 2)

Amitrole alone and in mixture with 2,2 DPA, and dichlobenil, gave poor control. Dichlobenil activity may have been inhibited by the deep black fluffy benthos built up from urban run-off.

Diquat produced rapid and complete knockdown including extensive cane damage. However despite a second application at 62 DAT (days after treatment) the plants regrew to pre-treatment density from basal stem material.

Table 2. Phytotoxicity scores (mean) for all trials.

		91-051 (3R) 11 MAT		91-052 (2R) 9 MAT		92-066 (2R) 10 MAT		91-057 (3R) 5 MAT		92-067 (3R) 10 MAT		92-071 (2R) 7 MAT		92-069 (2R) 9 MAT	
Herbicide	% w/v ai	phyto	c.v.	phyto	c.v.	phyto	c.v.	phyto	c.v.	phyto	c.v.	phyto	c.v.	phyto	c.v.
Registered Aquatic Herbicides															
amitrole	0.10	23	138.0	-		-		-		-		-		-	
amitrole + 2,2 DPA	0.10 + 0.33	7	87.0	-		-		-		-		-		-	
dichlobenil	15.0 (kg/ha)	7	87.0	-		-		-		-		-		-	
diquat	0.10	12	65.0	-		-		-		-		-		-	
glyphosate	0.36	93	11.5	99	0.7	95	0.0	33	45.8	99	0	100	0	-	
"	0.54	83	35.0	99	0.7	94	6.0	-		-		-		-	
" / Pulse	0.36 / 0.2	95	9.0	-		-		-		-		-		-	
" / Pulse	0.54 / 0.2	100	0.0	-		-		-		-		-		-	
2,4-D	0.50	43	104.0	35	60.5	78	32.0	27	21.7	-		-		-	
"	0.67	-	-	-	-	97	2.2	-		-		-		-	
Registered Non-Aquatic Herbicides															
clopyralid	0.09	-	-	-		-		-		7	173.0	-		-	
"	0.18	-	-	-		-		-		0	0.0	-		-	
dicamba	0.10	-	-	-		-		-		48	59.0	-		-	
"	0.20	-	-	-		-		-		78	22.0	-		-	
fluroxypyr	0.09	-	-	-		-		-		81	24.0	99	0.7	-	
"	0.18	-	-	-		-		-		90	6.0	99	0.7	-	
imazapyr	0.13	-	-	-		-		-		99	0.6	-		-	
"	0.25	-	-	-		-		-		100	0.6	-		-	
metsulfuron	0.001	-	-	5	141.0	-		-		32	55.0	-		-	
picloram/2,4-D	0.13	-	-	-		-		-		96	2.0	-		-	
"	0.25	-	-	-		-		-		99	0.6	-		-	
triclopyr	0.14	-	-	-		-		-		70	29.0	93	4.0	95	0
"	0.29	-	-	-		-		-		97	3.0	98	0	95	0
Untreated	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MAT - Months after treatmentDAT - days after treatment
c.v. Coefficient of variation %(-R) - Number of replicates
Phytotoxicity - % visual phytotoxicity score 0-100% linear scale

Aquatic weeds

Glyphosate alone at 0.36% w/v gave almost complete control and was equal to the higher rate of 0.54% when applied between January and May (summer-autumn). Trial 91-057 applied in August (late winter-early spring) gave poor control. The high rate of glyphosate (0.54% w/v) with Pulse adjuvant gave complete kill with one application in small plots. On a large scale re-treatment would be necessary to control seedling growth and two applications of glyphosate alone at the lower rate (0.36% w/v) would probably give the same result as using higher rates with Pulse. It would also be cheaper as well as reducing the potential contamination.

2,4-D gave initial control equal to glyphosate but erratic regrowth occurred. One re-treatment would probably give complete control.

Registered non-aquatic herbicides (Table 2)

Metsulfuron and clopyralid gave poor control and treated plants recovered readily. Dicamba was not quite as effective as 2,4-D, and was more expensive.

Fluroxypyr, imazapyr, picloram/2,4-D and triclopyr all gave excellent control when applied in January. Fluroxypyr and triclopyr gave slightly improved control when applied in May (autumn). Triclopyr has excellent aquatic toxicology, short half life in water and useful selectivity (registration is pending in the USA) thus it offers good potential for use in the Botany Wetlands.

Selectivity

Further work is planned to more clearly define selectivity for native plants. Observations to date indicate 2,4-D had strong selectivity to grasses, a useful species in steep sandy shore line areas prone to erosion. At the water line *Persicaria strigosa* recovered rapidly and *Typha* was tolerant to 2,4-D.

Glyphosate is most effective when applied in autumn on *L. peruviana*. The protective effect of *L. peruviana* should ensure reasonable survival of *Typha* which usually rapidly re-establishes. Re-treatment with an alternative herbicide such as 2,4-D is proposed in areas where *Typha* is desirable.

Observations on single plants indicated that *Schoenoplectus validus, Acacia longifolia, Kunzea ambigua* and *Triglochin procerum* can tolerate partial treatment with glyphosate. *Hydrocotyle bonariensis* and *Persicaria strigosa* were initially desiccated but regenerated readily.

With triclopyr good selectivity was noted to the grasses *Paspalum urvillei, Eragrostis curvula* and *Pennisetum clandestinum*. Other species that were tolerant or recovered included *Typha, Eleocharis sphacelata* and *Hydrocotyle bonariensis*. Triclopyr and 2,4-D show similar selectivity.

ACKNOWLEDGMENTS

This work was funded by the Water Board, Sydney NSW Australia.

REFERENCES

1. Records of the National Herbarium, Royal Botanic Gardens, Sydney.
2. Sainty, G.R. and Jacobs, S.W.L. 1981. Waterplants of New South Wales. Water Resources Commission of New South Wales, 550 pp.
3. Sainty, G.R. and Jacobs, S.W.L. 1988. Waterplants in Australia. Australian Water Resources Council Canberra, 144 pp.