

Alligator Weed: Tasty Vegetable in Australian Backyards?

LALITH GUNASEKERA¹ AND JULIO BONILA¹

ABSTRACT

The present distribution of alligator weed (*Alternanthera philoxeroides* (Mart.) Griseb.) in Australia is cause for considerable concern, earning it a place among the top 20 weeds of National Significance. It is considered one of the worst aquatic and terrestrial weeds in the world. In all Australian states, the weed is cultivated as a green leafy vegetable by the local Sri Lankan community, in the mistaken belief that it is another plant sessile joy weed (*Alternanthera sessilis* (L.) R. Br. ex DC.), very popular in Sri Lanka. The Department of Natural Resources and Environment in Victoria, Australia embarked on an innovative community-department partnership with the Sri Lankan community to eradicate, manage and prevent reinfestation of the alligator weed. The main priori-

ties of the plan were to identify the problem, raise public awareness, and the develop eradication plan. The program also sought to identify and introduce acceptable alternative for Sri Lankan community. As results of this program, 775 alligator weed infestations have been located including 13 naturalized sites. Four herbicides were tested as an experimental basis in backyards. Seven hundred and sixty seven infestations were treated using Dichlobenil, Glyphosate, Metsulfuron methyl and Metsulfuron methyl with Glyphosate. One Australian native species common joy weed (*Alternanthera denticulata* R. Brown) was selected and tested for nutritional value and distributed to Sri Lankan families. The new vegetable appears to be very popular and now sold by 25 shops around Melbourne Australia.

Keywords: *Alternanthera philoxeroides*, aquatic, leafy vegetable, public awareness, herbicides, Sri Lanka.

¹Department of Natural Resources & Environment, Keith Turnbull Research Institute, Frankston, Victoria, 3199, Australia. Contact e-mail: Lalith.Gunasekera@nre.vic.gov.au. Received for publication July 17, 2000 and in revised form September 20, 2001.

INTRODUCTION

Alligator weed originates from the Parana River region of South America. It is a member of the dicotyledon family Am-

aranthaceae. Alligator weed is a perennial, an emergent semi-aquatic species that rarely sets seeds, and seeds produced are usually not viable (Julien 1995). It has the ability to grow in both aquatic and terrestrial habitats and in conservation and agricultural systems of tropical, subtropical and temperate regions (Julien and Stanley 1999). Alligator weed is a problem weed in 10 crops in 30 countries, a serious or principal weed in eight of these countries and a major weed in others. The range of impacts that alligator weed can have effects the community in a number of ways. As an aquatic plant, it produces large mats of stems and leaves, which are anchored by roots to the bank and extend across the water. So weed disrupts the aquatic ecology by forming a blanket over the surface of water. It interferes with waterways, drainage, and boat traffic, water quality, displaces native species and affects flow and sedimentation rates (Julien and Stanley 1999). In terrestrial situations, it forms large leafy materials and dense mats of lignified root materials under the soil. Alligator weed is highly competitive with other plants and displaces pasture and other plant species (Julian and Bourne 1988).

Alligator weed initially introduced into Australia near New Castle, New South Wales when ship ballast was dumped in 1946 (Hockley 1974). It has since become established in rivers and their tributaries and on flood plains in NSW. Alligator weed is a declared a noxious weed in all Australian states and territories and is a prohibited weed in Victoria and Tasmania. Under the Victorian Catchments and Land Protection Act (1994), the species has been targeted for eradication. The importance of alligator weed in Australia is reflected in its listing among the 20 weeds of National Significance nominated by the commonwealth government in 1999 (Thorpe 1999). Although alligator weed used to be considered a tropical plant, it can tolerate a wide variety of climates and has become a problem in cool and warm temperate regions. It requires a warm growing season, but will tolerate cold winters including severe frosts (Coulson 1977).

In December 1995, alligator weed was found in the vegetable garden of a neighbor by one of the weed scientist in Queensland, Australia. Follow-up work over the next five years by the state weed authorities has led to the discovery of cultivated plots of alligator weed growing all Australian states and territories, mainly in Victoria (Gunasekera and Adair 1999). The weed was being grown as a leafy vegetable by the Sri Lankan community mistakenly believing it to be the popular leafy vegetable Mukunuwenna or Sessile Joy Weed (*Alternanthera sessilis*), very popular leafy vegetable in Sri Lanka (Gunasekera and Rajapakse 1998).

The Department of Natural Resources & Environment (DNRE) in Victoria developed an innovative partnership with Victoria's Sri Lankan community in order to eradicate, control and prevent re-infestation of alligator weed. The project also looked at to identify and introduce an alternative vegetable plant for alligator weed. An alligator weed taskforce comprising Sri Lankan community members, officers from DNRE and Water management authority in irrigated districts representatives was formed to initiate, plan, manage, conduct and monitor the program to eradicate alligator weed from Victoria. The main priorities of the plan were to identify the problem, raise public awareness and develop an eradication plan.

METHODS AND MATERIALS

As described earlier an alligator weed task force was established in 1996 to initiate, plan, manage and coordinate and monitor the progress of the program to eradicate alligator weed from Victoria.

Weed Distribution

The first stage of the program was to survey the distribution of alligator weed in Victoria. In 1996, an alligator weed identification leaflet was produced and distributed amongst Sri Lankans visiting Buddhist temples, Sri Lankan groceries and local libraries. Sri Lankan names were identified from Victoria telephone directories and nearly 4,000 people were surveyed about whether the weed was growing on their property. Discussion with community groups in establishing community-council partnership in weed management also helped to collect further information on the distribution of alligator weed in Victoria.

Awareness

Because the Victorian community had little awareness of alligator weed, a public awareness program was important part of the project. Alligator weed was new story for Victorians, because they haven't seen this before. Thus the distribution of five different leaflets, a bookmark and a fridge-magnet, 100 articles in newspapers, newsletters, magazines and journal, six TV segments, ten radio programs and seven information workshops helped to created the necessary public awareness and to collect further information.

Management

An alligator weed control program started in December 1997. All identified infestations were prioritized according to the risk of naturalization using proximity to waterways, size of the infestation and land situation as risk factors.

There is no registered herbicide to control alligator weed in terrestrial in Victoria. Thus following herbicides were used as an experimental basis in backyards, with the consent and knowledge of property owners. With the knowledge and consent of property owners the terrestrial infestations were treated with dichlobenil 67.5kg/ha (Casoron® Nufarm Australia Ltd.) followed by glyphosate 360g/L (Roundup®, Monsanto Australia Ltd.), dichlobenil alone, glyphosate 760g/kg plus metsulfuron methyl 63g/kg (Trounce®, Monsanto Australia Ltd.) and metsulfuron alone on an experimental basis. Herbicides were applied as a spot-spray using a 5L knap-sack sprayer at label rates to fully wet all leaves except dichlobenil. An organosilicone penetrant (Pulse®, Monsanto Australia Ltd.) was used with glyphosate and metsulfuron methyl applications. Dichlobenil (granules) was applied by scattering around the infestations. The herbicide used depended on the type of plants associated with alligator weed in home gardens situations. Mainly dichlobenil at 60 kg/ha¹ was used the 1998/1999 and 1999/2000 summer, as it was successful during 1997/1998. All naturalized sites associated with water were treated with glyphosate (Roundup® Bio active™ at the rate of 3.24kg/ha¹ in 2 monthly intervals for three times.

Alternative Vegetable

Providing a replacement vegetable was the key to public participation in the eradication program. An Australian native species, in the same genus as alligator weed, common known as lesser joy weed (*Alternanthera denticulata*) was selected for this purpose. It was then tested for nutritional value and distributed to Sri Lankan families for trial as a suitable replacement. There were two forms (larger and small leaf) of this species. Both forms were evaluated as replacement vegetable for alligator weed. To encourage the adoption of the alternative vegetable, more than 5,000 seedlings were distributed to Sri Lankan families throughout the state and an Asian vegetable grower was supplied with 3,000 seedlings (large leaf form) to develop the vegetable commercially (Gunasekera 1999).

RESULTS AND DISCUSSION

The mail survey was successful. Nearly 50% of those who were surveyed responded and more than 300 backyard infestations of alligator weed were discovered within four months of the campaign start. All properties with alligator weed were visited to develop control options. As a result of the public awareness campaign, an additional 475 alligator weed infestations have been located including 13 naturalized sites in 130 suburbs of Melbourne by June 2000. Infestations continue to be reported although at a much reduced rate that at the beginning of the program. Majority (98%) of the backyard infestations were associated with Sri Lankan families.

The control program treated 769 sites including all thirteen naturalized alligator weed infestations with herbicides from 1997-2000 (Table 1). Regrowth was occurred in some places but repeated treatments helped to suppress the weed successfully. All previously treated sites were closely monitored throughout the program signs of regrowth. Sites treated with dichlobenil provided satisfactory control of alligator weed with very limited non-target impact on garden ornamentals or fruit trees. Metsulfuron methyl and mixture of metsulfuron methyl and glyphosate showed good results in backyard situation but non-target damage and persistence in soil occurred (for about two years) with the use of metsulfuron methyl. Fruit species susceptible to metsulfuron were apple, grape, lime and lemon. Observations showed that root uptake was responsible for this damage because the chemical were applied very carefully on alligator weed leaves, which were far lower than damaged tree leaves. Most people wanted to grow other vegetables in their gardens soon after treatment, thus reducing the suitability of these herbicides.

The introduction of replacement vegetable species for alligator weed has been important to citizen participation in

the control program. The Sri Lankan community accepts both forms of common joy weed. The larger leaf form is more popular than smaller leaf form because it has higher growth rate, leaf size, leaf yield, better taste and it is easier to grow. Joy weed has proven extremely successful as a replacement. More than 5,000 seedlings have been distributed through Buddhist temples, personal contacts, information centers and Sri Lankan grocery shops. One commercial grower supplied about 2,700 cut bunches per month and was sold by twenty-five shops around Melbourne during 1998/1999 summer. But his sales were fallen down in 1999/2000 summer, as most of the Sri Lankans had established the vegetable in their home garden and started to distribute among their friends and relatives. Supply of new seedling will be continued in next summer 2000/2001 as well as the public awareness campaign, monitoring and control program also in progress. Importantly, the majority of Sri Lankans in Victoria can now recognize the difference between their real vegetable plants. This is extremely good as it means the risk of reinfestation is much lower.

The program demonstrates that preventive management can be undertaken with active community involvement and support. Participation in the eradication program by the Sri Lankan community was high because accessible information on the problem was broadly distributed. The program had the support of religious and community groups, and the trust developed between government and community, which enabled an accurate assessment of the problem. This is good example for community-government partnership to control noxious weed.

ACKNOWLEDGMENTS

The authors wish to express appreciation for the financial assistance provided by the Victorian Weeds Initiative program of the Department of Natural Resources & Environment, Agriculture Victoria. The friendly support and kind assistance given by David McKenzie, Patrick Pigott, Eligo Bruzzese, Ian Faitfull and Janaka Wijewardena of Department of Natural Resources and Environment in Victoria is also gratefully acknowledged.

Disclaimer: The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. The state of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purpose and therefore disclaims all liability for any error, loss or other consequence, which may arise from you relying on any information in this publication.

TABLE 1. THE NUMBER OF HERBICIDE TREATMENTS ON ALLIGATOR WEED.

Year	Number of treated sites	Dichlobenil	Dichlobenil followed by glyphosate	Glyphosate (aquatic)	Metsulfuron methyl	Metsulfuron methyl and glyphosate
1997/1998	225	60	22	4	59	80
1998/1999	207	180	8	3	14	2
1999/2000	337	315	20	1	0	1

LITERATURE CITED

- Coulson, J. R. 1977. Biological control of alligator weed, 1959-1972. A review and evaluation. USDA Bulletin No. 1574. pp. 98.
- Gunasekera, L. 1999. Alligator weed—an aquatic weed present in Australian backyards. *Plant Protection Quarterly* 14: 77-78.
- Gunasekera, L. and R. Adair. 1999. The alligator weed battle in Victoria. Proceedings of 12th Australian Weeds Conference, Hobart, Australia 12-16 September. pp. 547-550.
- Gunasekera, L. and L. Rajapakse. 1998. Alligator weed—A potential disaster lurking in Australian backyards. Proceedings of 10th International Symposium on Aquatic Weeds, Lisbon, Portugal. September 21-25. pp. 261-264.
- Hockley, J. 1974. . . . and alligator weed spreads in Australia (London). 250: 704.
- Julien, M. H. 1995. *Alternanthera philoxeroides* (Mart.) Griseb. In: 'The Biology of Australian Weeds' 1: 1-12.
- Julien, M. H. and A. S. Bourne. 1988. Alligator weed is spreading in Australia. *Plant Protection Quarterly* 3: 91-96.
- Julien, M. H. and J. N. Stanley. 1999. The management of alligator weed, a challenge for the new millennium. Proceedings of the 10th Biennial Noxious Weeds Conference, Ballina, Australia. July 20-22. pp. 2-13.
- Maddox, D. M. 1968. Bionomics of an alligator weed flea beetle, *Agasicles* sp. in Argentina. *Annals of the Entomological Society of America*. 61: 1300-1305.
- Thorpe, J. 1999. Weeds of National Significance. Weeds Australia-National Weeds Strategy, www.weeds.org.au/natsig.htm.