Control methods for ochna *(Ochna serrulata)* (Hochst.) Walp. in south-east Queensland

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Summary

We investigated potential chemical and mechanical methods for controlling the environmental weed, *Ochna serrulata* (Hochst.) Walp., using an unreplicated screening trial in Brisbane, Queensland. The 18 treatments tested included: foliar spray, cut stump, basal bark and splatter gun applications of glyphosate (Glyphosate® 360), fluroxypyr (Starane® 200), metsulfuron-methyl (Brush-Off®), triclopyr (Garlon® 600) and dicamba (Kamba® 500), as well as hand pulling seedlings and digging out adult crowns.

The most effective herbicide tested was fluroxypyr. All treatments containing fluroxypyr were effective in killing ochna, between 10 and 18 months after application. The two mechanical treatments (removal of seedlings and adult crowns) were also very effective. However these were time consuming and would only be appropriate for scattered plants or light infestations.

Introduction

Ochna (*Ochna serrulata* (Hochst.) Walp.) (Ochnaceae) is native to the sub-tropical east coast of southern Africa. In its native range ochna is widely distributed from sea level to altitudes of 1800 metres, and in many different habitats including forests, rocky hill slopes and grasslands (Mbambezeli and Notten 2002). The species is noted by these authors to grow best in frost-free areas, but can withstand light frost.

The first Queensland Herbarium record of this species was in 1932 (Batianoff and Butler 2003). Ochna is now recorded as invasive in both New South Wales and south-eastern Queensland, and there is potential for the species to be problematic in other regions of Australia that do not experience heavy frosts. In south-east Queensland, ochna has invaded disturbed riparian habitats (Department of Natural Resources and Mines 2002) and damp bushland sites such as drainage lines, creek beds and eucalypt forest edges (Morton 1998). Ochna also grows in dry locations (Muyt 2001) and has naturalized in dry sclerophyll forests and riparian vegetation throughout most of coastal south-east Queensland. These populations are believed to be well beyond eradication (Csurhes and Edwards 1998).

In Australia ochna is grown for its colourful flowers and berries (Csurhes and Edwards 1998) and in Brisbane it is commonly used in hedges (Hajkowicz 2002, Breaden personal observation). However, it has escaped from gardens and is now a serious woody weed in the Brisbane area. This has been attributed to prolific fruit production, avian dispersers (Morton 1998) and dense seedling recruitment (Hajkowicz 2002). Ochna can form new plants from root cuttings (Mbambezeli and Notten 2002), and when the plant is damaged, vigorous regrowth occurs (Muyt 2001). Understorey thickets are formed, shading out native flora (Muyt 2001, Breaden personal observation). An impact ranking by Batianoff and Butler (2003) places ochna at 16 on a list of 66 priority invasive weeds in south-east Queensland.

Birds are thought to be the primary dispersers of ochna seed, along with water and rubbish dumping (Batianoff and Butler 2003, Lismore City Council 2002). Seeds are contained individually in each berry and only germinate when very fresh (Mbambezeli and Notten 2002). A detailed seed bank survey of heavily infested areas in Toohey Forest (Brisbane) produced no ochna seedlings from the soil samples taken, suggesting that ochna produces only a transient seed bank (Morton 1998).

Little information exists regarding control of ochna. Much of the information is anecdotal and no control trials were identified during our search of the literature. Most of the current information on controlling ochna mentions glyphosate, primarily using the cut stump method. Control recommendations vary; for example, Lismore City Council (2002) recommends cutting, scraping and painting the stump with a 1:1.5 ratio of glyphosate to water, while other workers suggest using neat (undiluted) glyphosate (see Hajkowicz 2002). However most glyphosate treated ochna re-sprouts later, even when cut stumps are swabbed close to the ground and within 15 seconds (Armstrong personal observation). The literature also emphasizes complete removal of the root system to prevent coppicing (Buchanan 1989). However, the long, tough and angled taproot makes this very difficult, even for ochna seedlings, which often break off at ground level when pulled (Armstrong personal observation).

In this study we aimed to identify potential control methods for ochna by screening a broad range of chemical and mechanical control options.

Materials and methods

We conducted a screening trial at Chelmer on the banks of the Brisbane River (152°58'8"E, 27°30'43"S) in Queensland, commencing in June 2001. The site was a plantation of native hoop pine (*Araucaria bidwillii* Hook.) and bunya pine (*A. cunninghamii* Aiton ex D.Don.) Other introduced species present included balloon vine (*Cardiospermum grandiflorum* Sw.), climbing asparagus (*Asparagus africanus* Lam.), Chinese celtis (*Celtis sinensis* Pers.), mock orange (*Murraya paniculata* (L.) Jack.), glycine (*Neonotonia wightii* (Graham ex Wight & Arn.) J.A.Lackey), green panic (*Panicum maximum* Jacq.) and Brazilian cherry (*Eugenia uniflora* L.). This site had a rich alluvial soil, high in organic matter.

The trial was set out in randomly selected plots. Each plot was 4 m × 10 m (40 m^2) and contained three labelled ochna plants. Eighteen treatments (Table 1) were visually assessed at monthly intervals for 18 months, using a rating scale of phytotoxicity (5 = plant healthy, 4 = defoliated, 3 = stems green, 2 = stems brown to ground level, 1 = dead). Ochna seedling abundance within the plot was also recorded qualitatively (many, few or none) by visual inspection in order to identify any residual effects from the herbicides.

Foliar-sprayed bushes were completely covered through application with hand-pumped Swissmex (portable back pack) knapsacks of 15 L capacity and Rega 1 mm adjustable nozzles. Basal bark spraying of the full circumference of all stems from at least 15 cm to ground level was achieved with a Swissmex compression sprayer of 8 L capacity with solid stream Rega adjustable nozzles. Cut stump applications were done within 15 cm of ground level and within 15 seconds of cutting with a Phillips injector 'splatter gun,' with a coarse nozzle attached by tube to a 2 L back pack bag. Splatter gun applications used the same apparatus set at 5 mL shots per 30 cm of height or width, preferably over reachable growing points. Weather conditions were slightly overcast, but no rain was present before, during or after treatment application. No wind was present.

Results and discussion

The most effective herbicide trialed was fluroxypyr (Starane® 200) (Table 1). All applications of fluroxypyr (splatter gun, foliar spray, cut stump and basal bark) reduced plant vigour until death, which occurred 10–18 months after treatment. Basal bark and cut stump applications of triclopyr ester (Garlon® 600) were also

Table 1. Effects of herbicide treatments applied to ochna (*Ochna serrulata*) in south-east Queensland.

Trade name of herbicide product	Active ingredient (g L^{-1} product)	Application rate (g a.i. L^{-1} water)	Treatment	Mean final rating	Months to plant death	Change in seedling density over time [B]
Starane® 200	fluroxypyr ester (200)	10	Cut stump	1	10	-ve
Starane 200	fluroxypyr ester (200)	7 [A]	Basal bark	1	12	0
Starane 200	fluroxypyr ester (200)	10	Splatter gun	1	18	0
Starane 200	fluroxypyr ester (200)	2	Foliar spray	1	18	-ve
Garlon® 600	triclopyr ester (600)	19.8	Cut stump	1	12	-ve
Garlon 600	triclopyr ester (600)	10.5 [A]	Basal bark	1	12	-ve
Garlon 600	triclopyr ester (600)	2.04	Foliar spray	3.33	#	-ve
Glyphosate® 360	glyphosate (360)	18	Splatter gun	1	12	-ve
Glyphosate 360	glyphosate (360)	3.6	Foliar spray	1	12	-ve
Glyphosate 360	glyphosate (360)	180	Cut stump	3	#	-ve
Diesel	diesel	Neat [A]	Basal bark	2.33	#	-ve
Brush-Off® + BS 1000	metsulfuron-methyl (600) + non-ionic surfactant (1000)	0.6 + 1 mL	Splatter gun	2.67	#	-ve
Brush-Off + BS 1000	metsulfuron-methyl (600) + non-ionic surfactant (1000)	0.06 + 1 mL	Foliar spray	3	#	0
Kamba® 500	dicamba (500)	20	Cut stump	4	#	0
Kamba 500	dicamba (500)	2	Foliar spray	5	#	-ve
–	–	–	Control	5	#	-ve
–	–	–	Dig out adult crowns	1	1	0
–	–	–	Hand pull seedlings	1	1	0

[A] = Diesel as the carrier, # = Death did not occur, [B] -ve = decrease in seedling density.

effective, killing all plants within 12 months. Foliar applications of triclopyr ester were not successful in controlling ochna (Table 1).

Glyphosate (Glyphosate® 360) results were variable. Cut stump applications of glyphosate resulted in regrowth, but the splatter gun and foliar spray treatments killed plants (Table 1). Dicamba (Kamba® 500) and metsulfuron-methyl (Brush-Off®) were the least effective herbicides trialed.

It is worth noting that many of the herbicide treatments resulted in plants appearing dead above-ground shortly after treatment, but resprouting 3–5 months later. These predominantly included the cut stump treatments, fluroxypyr foliar spray and glyphosate splatter gun and foliar treatments.

Interpretation of our results must take into account the drought conditions experienced during 2001. Such conditions may have increased plant mortality, particularly during the later part of the trial when treated plants were showing full effects of the herbicide. Future trials should test the more successful treatments (fluroxypyr and triclopyr ester) over several different seasons.

Hand pulling seedlings and digging out adult crowns was very effective in controlling ochna. Both treatments resulted in plant death and no regrowth was recorded. Mechanical removal occurred when the soil was relatively moist, which helped physical removal of ochna roots. However, given the time associated with these treatments, we conclude that they would only be time-effective if isolated plants or small infestations were present. In heavy weed infestations, soil disturbance may also encourage germination of other weed seeds within the seed bank. Visual assessment of ochna seedling abundance during this trial did not indicate that this method promoted seedling regeneration of this species in a shaded situation.

Seedling numbers stayed constant or reduced over time in all plots including the control (Table 1). Treatments that were very spatially restricted in their application (i.e. cut stump, basal bark) showed a reduction in seedling density, which leads us to conclude that environmental factors (e.g. drought) or other external influences were involved. Further research into factors affecting seedling recruitment is required.

Conclusion

Fluroxypyr was found to be the most effective product trialed on ochna. As all application methods using fluroxypyr were successful, there appears to be the flexibility to match the most relevant technique with the type of infestation (i.e. heavy, dense or scattered and large individuals vs. small seedlings). For example, basal bark spraying would suit adult (>2 m tall) ochna plants, dense infestations would be suitable for foliar applications, and isolated ochna plants (<1 m tall) could be splatter-gunned. Future work will focus on further testing the effectiveness of fluroxypyr in a replicated trial, to determine the application rates, timing and methods that are most effective against ochna.

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