The control of climbing asparagus (*Asparagus africanus* Lam.) in remnant Brigalow scrub in south-east Queensland

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Summary

A replicated trial was conducted at Tallegalla in south-east Queensland to assess the effectiveness of a range of control methods for climbing asparagus *Asparagus africanus* Lam. A total of 18 treatments using mechanical, cut stump, basal bark, foliar spray and splatter gun techniques were trialled with a range of herbicides and application rates. Removing the plant and placing it above the ground surface was most effective in killing climbing asparagus. Basal bark spraying of 24 g triclopyr ester (40 mL Garlon® 600) or 10 g fluroxypyr ester (50 mL Starane® 200) L^{-1} diesel and the cut stump application of neat diesel or 225 g glyphosate (500 mL Glyphosate CT®) L^{-1} water offered the best chemical control of climbing asparagus.

Introduction

Climbing asparagus (*Asparagus africanus* Lam.), a member of the Asparagus family (Asparagaceae), is native to southern Africa (Stanley and Ross 1989) and was introduced into Australia as a garden ornamental. The earliest record of Queensland naturalization is 1976 (Batianoff and Butler 2002), although *A. africanus* may be the plant mentioned by Bailey (1909) as *Asparagus racemosus* Willd. being a 'very troublesome weed'. However, Bailey may have also been referring to the only native asparagus fern of that same name, known in this region from a single collection in the Wide Bay district (Conran and Forster 1986). Climbing asparagus is now distributed from the dry Burnett, north west of Kingaroy to the wet rainforests of north east New South Wales (Armstrong 2002).

Climbing asparagus, as its name implies, has a climbing habit with stems up to approximately ten metres long that smother native scrub and trees. It produces clusters of whitish flowers in axils during spring, and prolific berries in summer, which turn from green to orange to eventually brown (Armstrong 2002). Its fern-like foliage is similar to the less common climbing asparagus fern (*Asparagus plumosus* Baker) which has softer axillary spined stems, solitary or paired white flowers, terminal on short lateral branches and fewer bluish to black berries from summer to autumn (Stanley and Ross 1989). Climbing asparagus seeds are viable while the fruit is immature and each mature plant produces an estimated 21,000 seeds that are dispersed by birds such as Silvereye (*Zosterops lateralis*) (Stanley 1994).

Materials and methods

This experiment was conducted in 2000 and 2001 at Tallegalla (152°34'6"E, 27°34'34"S) in south-east Queensland, the only virgin Brigalow scrub (*Acacia harpophylla* F.Muell. ex Benth.) to be left by open-cut coal mining in the Rosewood-Marburg ecosystem. Massive climbing asparagus infestations threaten the remnant patch, which includes other native species such as currant bush (*Carissa ovata* R.Br.), *Spartothamnella juncea* (A.Cunn. ex Walp.) Briq., *Parsonsia lanceolata* R.Br., wombat berry (*Eustrephus latifolius* R. Br. ex Ker Gawl.) and *Acalypha capillipes* Mull.Arg.. Introduced species also present at the site include Brazilian nightshade (*Solanum seaforthianum* Andrews), coral berry (*Rivina humilis* L.), lantana (*Lantana camara* L. var. *camara*) and madeira vine (*Anredera cordifolia* (Ten.) Steenis).

The trial was set out on 16–18 December 2000 during cloudy conditions. The experimental design consisted of eighteen treatments (Table 1) replicated three times (54 plots in total) including an untreated control (Table 1). Treatments were randomly assigned to 3 × 10 m (30 m^2) plots and within each plot three individual plants were tagged for consistent assessment.

A 12-volt 'ute pack' sprayer was used to reach vine foliage up to four metres above ground level with approximately 2000 litres of herbicide solution used per hectare for 'foliar spray' treatments. A Swissmex™ eight litre knapsack compression sprayer with a solid stream nozzle was used for 'basal bark' applications of diesel solutions around the full circumference of all stems from ground level to 30 cm height. A coarse nozzle was set on an adjustable Phillips splatter gun, delivering 5 mL per shot, and used for cut stump/crown and splatter gun treatments. The 'splatter gun' treatment was applied to regrowth that had grown a month after cut-stumping in December 2000, with one shot per 50 cm of height to a maximum of 1.5 m. Climbing asparagus plants were cut as close to ground level as practical for 'cut stump' treatments and chemicals were applied within 15 seconds of cutting stems ensuring solution also covered crowns. For the 'removal of crowns' treatment, a mattock was used to dig out each plant crown and their attached roots were suspended in a nearby shrub to ensure no re-rooting occurred.

Treatment effects were assessed using a phytotoxicity rating scale (1 = crown death, 2 = foliage and stems necrotic, 3 = stems yellowing, 4 = leaves yellowing, 5 = green and healthy). Percent total plant cover was also measured for each plot by a qualitative visual assessment. Repeated measures were taken monthly for one year.

The results were analysed using Systat™ 10 general linear model (GLM) module using a repeated measures analysis. The cut stump treatments were analysed separately from the non-cut treatments, as they are substantially different techniques. The repeated measures of phytotoxicity scores were dependent variables corresponding to an independent 'treatment' variable. The initial amount of percent plant cover present within each plot was crossed with the treatment variable as a covariate within the model. This interaction was not significant ($P > 0.05$).

Results and discussion

Significant ($P < 0.01$) differences between herbicide treatment, assessment interval and their interaction (response profile through time) were found within both non-cut and cut stump applications. Response profiles were generally similar within treatment method and herbicide applied. Response profiles for nine of the eighteen treatments are shown in Figure 1.

The most effective method trialled was the mechanical treatment, where plant crowns were dug out and placed above the ground (Figure 1a). Removing the plants from the soil and leaving them exposed above the ground surface was the quickest way to kill climbing asparagus. The plants desiccated quickly and were dead by 30 days after treatment (DAT). Although removing climbing asparagus is very effective, it is time consuming and would only be suitable for isolated plants or small infestations. For this reason, removing climbing asparagus is impractical for large-scale infestations.

The most effective cut stump treatment trialled was neat diesel (Figure 1b). A sharp decline in health was seen after application, with complete plant death occurring 150 DAT. The cut stump treatment of 225 g glyphosate (500 mL Glyphosate CT®) L^{-1} water (Figure 1c) was initially effective, however, regrowth resulted 270 DAT. In contrast to this, the poorest cut stump treatment was 112.5 g glyphosate

Table 1. Herbicide treatments applied to climbing asparagus (*Asparagus africanus* Lam.).

Application method	Trade name of product/adjuvant (rate L^{-1} solvent)	Active ingredient and concentration (g L^{-1} product)	Active ingredient rate (g L^{-1})	Treatment number
removal of crowns	–	–	–	1
cut stump only	–	–	–	2
cut stump and crown application	diesel	neat diesel	neat	3
cut stump	500 mL Glyphosate CT® in water	glyphosate (450)	225	4
cut stump	250 mL Glyphosate CT in water	glyphosate (450)	112.5	5
basal bark	35 mL Starane® 200 in diesel	fluroxypyr ester (200)	7	6
basal bark	50 mL Starane 200 in diesel	fluroxypyr ester (200)	10	7
basal bark	20 mL Garlon® 600 in diesel	triclopyr ester (600)	12	8
basal bark	40 mL Garlon 600 in diesel	triclopyr ester (600)	24	9
splatter gun	100 mL Glyphosate CT + 2 mL Pulse in water	glyphosate (450)	45	10
splatter gun	50 mL Glyphosate CT + 2 mL Pulse® in water	glyphosate (450)	22.5	11
splatter gun	2 g Brush-Off® + 2 mL Pulse in water	metsulfuron-methyl (600) [A]	1.2	12
splatter gun	1 g Brush-Off + 2 mL Pulse in water	metsulfuron-methyl (600) [A]	0.6	13
foliar spray	20 mL Glyphosate CT + 2 mL Pulse in water	glyphosate (450)	9	14
foliar spray	35 mL Glyphosate CT + 2 mL Pulse in water	glyphosate (450)	15.75	15
foliar spray	0.5 g Brush-Off + 2 mL Pulse in water	metsulfuron-methyl (600) [A]	0.3	16
foliar spray	0.25 g Brush-Off + 2 mL Pulse in water	metsulfuron-methyl (600) [A]	0.15	17
control	–	–	–	18

[A] g kg^{-1} – concentration of non-liquid product.

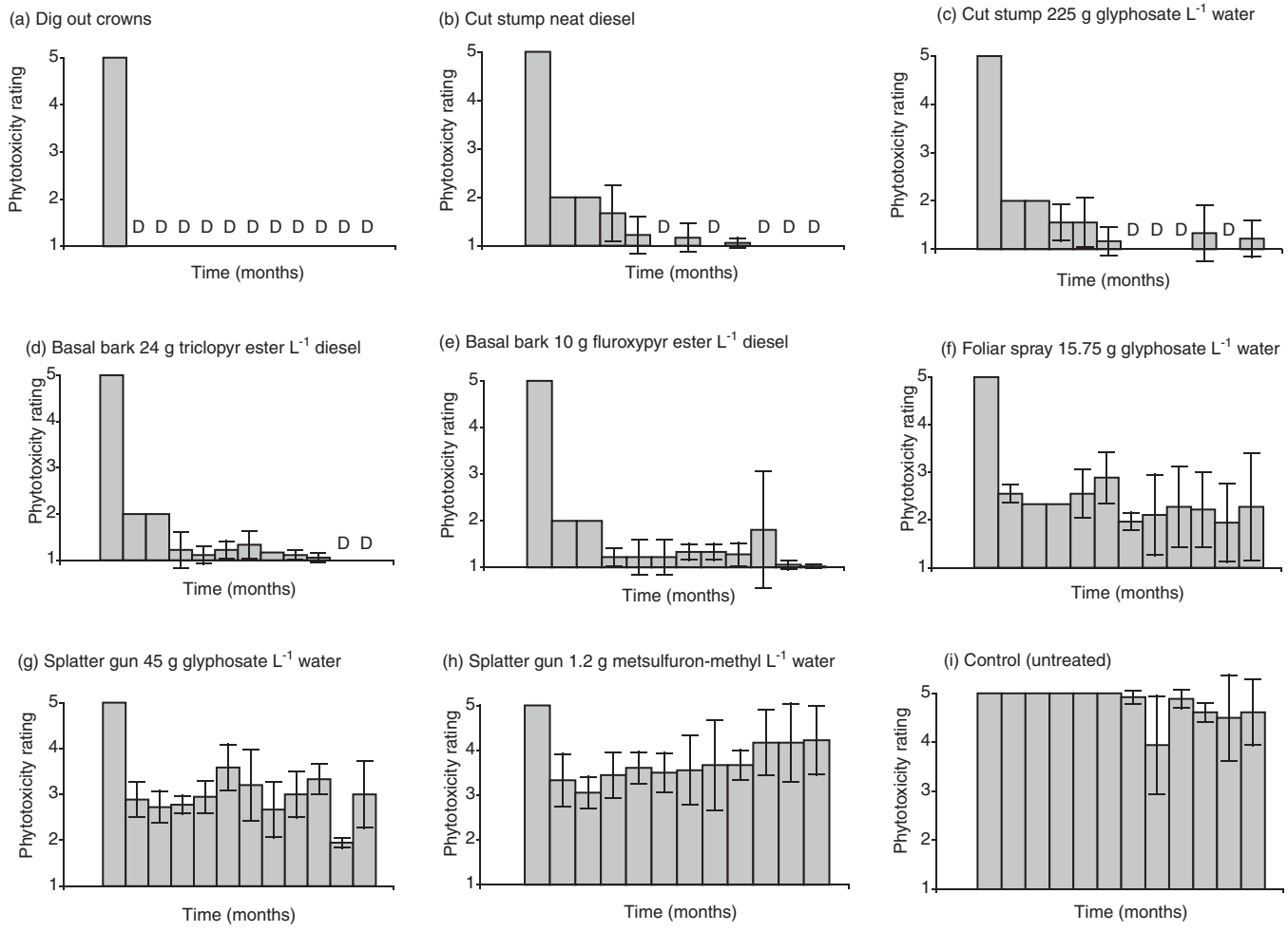

Figure 1. Mean phytotoxicity scores for climbing asparagus *A. africanus* over time for treatments 1 (a), 3 (b), 4 (c), 9 (d), 7 (e), 15 (f), 10 (g), 12 (h) and 18 (i). Time intervals are monthly from mid December 2000. D = dead.

(250 mL Glyphosate CT) L^{-1} water (data not shown).

The most effective non-cut treatments trialled were the basal bark application of 24 g triclopyr ester (40 mL Garlon® 600) or 10 g fluroxypyr ester (50 mL Starane® 200) L^{-1} diesel (Figures 1d and 1e). Plant health reduced very quickly after application (within 40 DAT) although plants remained alive to 300 DAT, with no regrowth occurring after this time. The lower concentrations of these two herbicides (12 g L^{-1} of triclopyr ester and 7 g fluoroxypyr ester L^{-1} diesel) also reduced plant health and density however complete death did not occur (data not shown).

The most ineffective non-cut treatments were splatter-gun applications of glyphosate (45 and 22.5 g L^{-1}) or metsulfuron-methyl (1.2 and 0.6 g L^{-1}) on regrowth (Figures 1g and 1h for the higher rate treatments). This was because the herbicides, especially the latter, are not particularly effective on climbing asparagus and there is insufficient foliage for a lethal dose. Foliar spraying adult virgin vines is also difficult as there is less leaf area to plant volume and much of it is too high for effective coverage without damaging hosts associated with it.

One of the key findings of this investigation was that climbing asparagus is not susceptible to metsulfuron-methyl whereas basket asparagus (*Asparagus aethiopicus* L.) is (Breadon *et al.* 2006). In this investigation, foliar spraying metsulfuron-methyl (0.3 or 0.15 g L^{-1}) and even higher rates as splatter gunning (0.6 or 1.2 g L^{-1}) gave unsatisfactory control of climbing asparagus. Although these treatments were more effective than the untreated control (Figure 1i), long-term reduction in plant health was minimal.

Climbing asparagus that was foliar sprayed with 15.75 g glyphosate (35 mL Glyphosate CT + 2 mL Pulse®) L^{-1} water gave the best foliar control (Figure 1f), especially if it was young, healthy and coverable. However, this was still inferior to basal bark or cut stump treatments. As outlined in earlier screening trials and subsequent control programs (Armstrong 2002, Armstrong personal observations), seedlings can be hand pulled or sprayed with (3.6 g L^{-1}) 10 mL glyphosate 360 L^{-1} water during follow up control programs.

Conclusion

Mechanical removal of plant crowns and leaving them exposed above the soil surface is the most effective control option for climbing asparagus. However, this method is labour intensive so is only suitable for isolated plants or small infestations. Basal bark spraying 10 g fluroxypyr ester or 24 g triclopyr ester L^{-1} in diesel is much less time-consuming than removing each plant, and is effective in control of this weed. The cut stump and crown application method using neat diesel is the best control option where immediate release of the host tree is desired.

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