

## Is aerial control of bellyache bush effective?

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**Summary** As part of a program to develop effective and affordable integrated pest management systems for the control of bellyache bush (*Jatropha gossypifolia* L.), six foliar herbicides were aerially trialled in north Queensland to determine their effectiveness in controlling medium density bellyache bush infestations (~45,000 plants ha<sup>-1</sup>). Five herbicides – triclopyr/picloram (Grazon® DS) at 450/150 g ha<sup>-1</sup>, glyphosate (Roundup®) at 2160 g ha<sup>-1</sup>, fluroxypyr (Starane® 200) at 400 g ha<sup>-1</sup>, metsulfuron (Brush-Off®) at 72 g ha<sup>-1</sup>, and metsulfuron/glyphosate (Cut-Out™) at 72/867 g ha<sup>-1</sup> – killed 92 to 100% of the plants treated in non-timbered county. The other herbicide, 2,4-D ester (Baton) at 4000 g ha<sup>-1</sup>, performed poorly killing only 63%. Efficacy dropped from 98 to 42% when bellyache bush growing in timbered country was aerially treated using triclopyr/picloram. No other herbicide was trialled in timbered country. The chemical cost of the six herbicides was \$40–\$75 ha<sup>-1</sup>, excluding cost of application. Seedling establishment in plots after aerial spraying was high – up to 4 million plants per hectare were recorded 6 months after application, dropping to 1.3 million plants per hectare 16 months post-application. Aerially applying herbicides to control bellyache bush growing in non-timbered areas is an effective control method, however follow-up control such as fire or herbicides is needed following initial treatment to remove seedlings. In timbered areas where control options for bellyache bush are limited, aerial control may provide partial success.

**Keywords** Bellyache bush, *Jatropha gossypifolia*, aerial application, weed control, north Queensland.

### INTRODUCTION

Bellyache bush (*Jatropha gossypifolia*) is a deciduous shrub or small tree native to tropical America. It was introduced into Australia in the late 1800s, probably as a garden ornamental or a medicinal plant. It is still grown in Australia and elsewhere as a garden plant for its shining, purple-tinged foliage and deep red flowers. However, bellyache bush has not stayed confined to garden beds and pots. Through the dumping of unwanted plants and cuttings, bellyache bush spread from its garden beginnings, and was naturalised in Queensland by 1912 (Bailey 1912). Today the plant can be found scattered throughout much of northern

and central Queensland. Bellyache bush initially invades disturbed areas such as dumps, roadsides, over-grazed paddocks or the banks of watercourses, dominates those areas, then slowly spreads onto less disturbed land. The worst infestations in Queensland are along the Burdekin River and its tributaries where more than 40,000 hectares are infested. In some parts of this area, bellyache bush forms monocultures, and the spread of the weed is increasing. Bellyache bush infestations can also be found in scattered populations elsewhere in Queensland and throughout the rest of the tropical savanna of northern Australia, where it is expected to increase in density in existing infestations and establish further populations (Csurhes 1999). It is already a declared weed in the Northern Territory (Pitt 1999) and Western Australia (Department of Agriculture Western Australia 2001).

Bellyache bush is unpalatable and toxic to stock. Hence, it can proliferate at the expense of palatable pasture grasses and native vegetation. This leads to dense infestations, where the shallow-rooted plant may prevent growth of other plant species under its canopy, rendering those areas totally unproductive to the grazing industry. These infestations also hinder mustering, harbour feral pigs, and decrease biodiversity (Csurhes 1999). All parts of the plant are toxic to humans and animals, particularly the seeds. Symptoms of bellyache bush poisoning are those associated with gastro-intestinal irritation (Begg and Gaskin 1994). In the Dalrymple shire, stock deaths due to ingesting bellyache bush have been reported, especially during seasons of drought (Csurhes 1999).

Bellyache bush can reproduce both from seeds and vegetatively. Infestations growing along watercourses have the potential to spread pods and vegetative sections in flowing water. Most bellyache bush plants start to flower at about two years of age, though plants only four to six weeks old and 15–30 cm high have been known to flower (Csurhes 1999). Flowering can occur most of the year if soil moisture is adequate. Seed production of bellyache bush is prolific – dense infestations of bellyache bush at Charters Towers, Queensland, have produced about two million seeds per hectare during the 2001–2002 wet season (W. Vogler, unpublished data). Adult plants may each produce between 2000 to 12,000 seeds per year. Pods dehisce

explosively, sending seeds up to 13 metres from the parent plant (F. Bebawi, unpublished data), hence new seedlings can be found expanding radially from parent plants in areas where seeds are not disturbed by floodwaters. Seeds have been known to germinate several years after mature plants have been removed or killed (Csurhes 1999).

Current control methods for bellyache bush include mechanical, fire and chemical treatments. Grubbing the plant by hand is effective, as the plant is shallow rooted. Repeated slashing will reduce the density of infested areas (Csurhes 1999). Fire is effective in killing bellyache bush, either through a controlled burn if there is a sufficient fuel load to carry the fire through an infestation (F. Bebawi, pers. comm. 2002) or by using a hand held burner (authors' unpublished data). Three species of insects and one fungus have also been identified as potential biological control agents for bellyache bush (Heard and Chan 2002). Two foliar applied chemicals, metsulfuron (Brush-Off) and fluroxypyr (Starane 200) are currently registered in Queensland for control of bellyache bush, however there are no registrations for aerial application (Cshures 1999).

As the range and size of bellyache bush infestations increase, aerial control of large, dense infestations would be a welcome option. This preliminary trial assesses the potential for control of bellyache bush through aerial application of herbicides.

#### MATERIALS AND METHODS

In December 2000, a preliminary screening trial was undertaken for herbicide control of bellyache bush by aerial application. The trial site was near the Burdekin River west of Home Hill, north Queensland (20°5.16' S, 147°17.38' E). Seven plots each measuring one hectare in size were marked out in country that had been

cleared three years earlier. An additional plot (half hectare) was chosen in timbered country adjacent to the cleared area. The timbered area was dominated by Moreton Bay ash (*Eucalyptus tessellaris*) and blue gum (*Eucalyptus tereticornis*). Trees were approximately ten metres in height and had a tree canopy area of ~22%. Bellyache bush density in the plots was ~45,000 plants ha<sup>-1</sup>, and plants ranged from 0.5 to 2 m in height. Within a 20 m wide transect running through the centre of each plot, 100 bellyache bush plants were randomly tagged. Basal diameter and height were recorded prior to herbicide application. Each of the cleared plots was randomly assigned one of seven treatments. Rates chosen are within registered rates for aerial application in a similar situation (Table 1.).

All applications were made with a Bell 47 G3B1 helicopter fitted with Isolair spray equipment on a 10 m swath, using raindrop nozzles (RD6 D81 46 Swirlies), in a complete double overpass at a speed of 55 km h<sup>-1</sup> and a spray volume of 200 L ha<sup>-1</sup>. A wetting agent, Uptake<sup>®</sup>, was used for each treatment at a rate of 1 L ha<sup>-1</sup>.

Assessments were made at 30, 90, 180, 360 and 480 DAT (days after treatment). Plants were assigned a rating from 1 (no effect) to 10 (dead). Regrowth was noted on a rating scale of 1 (abundant) to 5 (no regrowth). Results presented here are based on final percentage mortality only. Bellyache bush seedling density was determined in each treatment by counting seedlings in ten 0.25 × 0.25 m<sup>2</sup> quadrants at each assessment period. Only the 30 and 480 DAT seedling establishment data are shown here.

#### RESULTS

Mortality for all the treatments increased over time until 180 DAT, there was no change in mortality for 360 or 480 DAT. Five of the herbicides trialled were

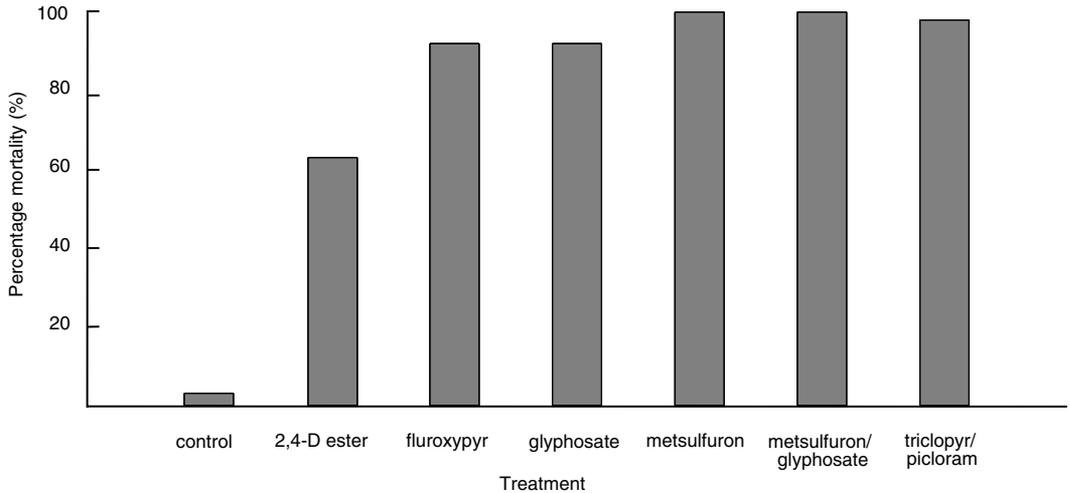
**Table 1.** Treatments used in aerial application trial for bellyache bush control near the Burdekin River, west of Home Hill, Queensland. Density of bellyache bush infestation was ~45,000 plants ha<sup>-1</sup>. A wetting agent (Uptake) at 1 L ha<sup>-1</sup> was added to each treatment.

Plot	Herbicide	Rate (herbicide ha <sup>-1</sup> )	Rate (a.i. ha <sup>-1</sup> )	Cost of herbicide ha <sup>-1</sup> *
Cleared	triclopyr/picloram	1500 mL	450/150 g	\$53.90
Cleared	fluroxypyr	2000 mL	400 g	\$44.40
Cleared	glyphosate	6000 mL	2160 g	\$41.25
Cleared	metsulfuron	120 g	72 g	\$40.26
Cleared	metsulfuron/glyphosate	1140 g	72/867 g	\$74.50
Cleared	2,4-D ester	5000 g	4000 g	\$53.80
Cleared	control	na	na	na
Timbered	triclopyr/picloram	1500 mL	450/150 g	\$53.90

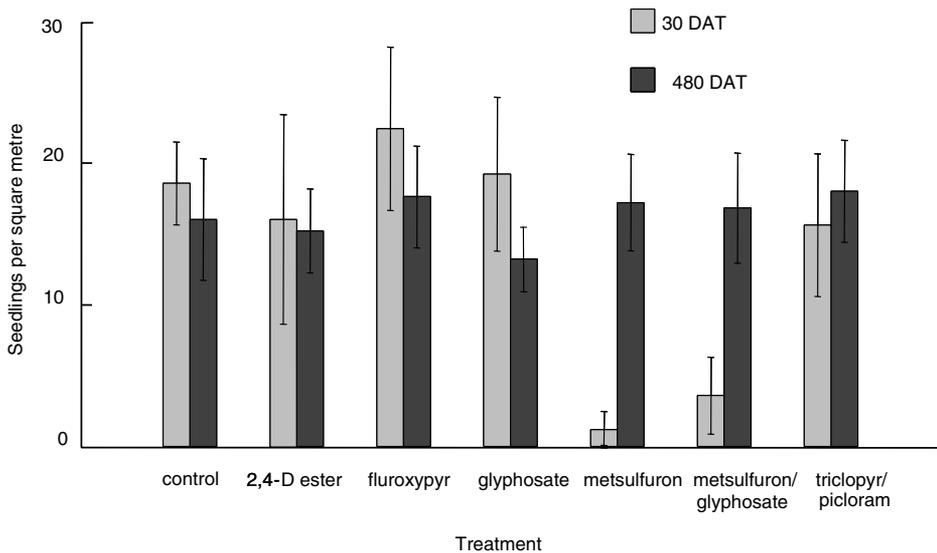
\* Cost of herbicide based on prices February 2002 and excludes helicopter costs.

highly effective in controlling bellyache bush, with mortality ranging from 92–100% in the cleared plots. The other herbicide, 2,4-D ester, gave only 63% mortality (Figure 1). In timbered country, triclopyr/picloram was the only herbicide trialled. The efficacy of triclopyr/picloram dropped from 98% in the cleared plot to 42% where bellyache bush was growing in the understorey.

At 30 DAT metsulfuron and metsulfuron/glyphosate treatments recorded a significantly lower number of bellyache bush seedlings when compared to the other treatments (Figure 2). By 90 DAT this residual control had ceased (data not shown). At 480 DAT there was no significant difference in residual control between treatments (Figure 2).



**Figure 1.** Effect of aerially applied herbicide treatments on bellyache bush (*Jatropha gossypifolia*) growing in non-timbered areas near Home Hill in north Queensland, 480 DAT. Plant mortality is based on 100 plants per treatment.



**Figure 2.** Bellyache bush seedling count m<sup>-2</sup> in a non-timbered area near Home Hill in north Queensland, at 30 and 480 days after herbicide application. Vertical bars represent the standard error of the mean.

Bellyache bush seedling establishment in plots six months after spraying was as high as four million plants per hectare. In the same area sixteen months after spraying, seedling establishment was still as high as 1,320,000 plants ha<sup>-1</sup>. The overall bellyache bush density following aerial application increased from ~45,000 plants ha<sup>-1</sup> to ~200,000 plants ha<sup>-1</sup>.

#### DISCUSSION

Aerial control of bellyache bush in non-timbered country would be effective for five of the herbicides trialled. Herbicide costs for metsulfuron, glyphosate, fluoxypyr and triclopyr/picloram range in cost from \$40–\$54 ha<sup>-1</sup>, while metsulfuron/glyphosate was more costly at \$74 ha<sup>-1</sup>. Further trial work leading to registration for these herbicides will be conducted in 2002/2003.

Though these chemicals gave up to 100% kill of adult bellyache bush plants, the problem of seedling recruitment still remains. Seedbanks counts have recorded as high as 2,500,000 bellyache bush seeds per hectare in areas near Charters Towers in 2002 (W. Vogler, unpublished data). Herbicides, which give residual control of bellyache bush, would allow a longer period of time before implementing follow-up treatments. Metsulfuron and metsulfuron/glyphosate seemed to offer some residual control by either preventing seedlings emergence or killing germinates below the soil surface. By 90 days this residual control was no longer effective.

As seedlings can flower within six weeks of germination, and seeds remain germinable for several years, periodic follow-up control using fire or herbicides is needed following initial treatment. If follow-up treatments are not made, initial control results are soon lost.

Control options for timbered country are often limited and accessibility difficult. Though triclopyr/picloram was effective in controlling bellyache bush in cleared country, in timbered country it provided less than 50% control. Aerial application could provide a partial solution for bellyache bush control in these areas, provided off-target damaged is minimised.

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