Integrated control methods for bellyache bush (*Jatropha gossypiifolia* L.) in northern Queensland: preliminary results

Faiz Bebawi1,2, Joseph Vitelli1,2, Shane Campbell1,2 and Matthew Madigan1

1 Queensland Department of Natural Resources, Mines, and Energy, Tropical Weeds Research Centre, PO Box 187, Charters Towers, Queensland 4820, Australia

2 CRC for Australian Weed Management

Summary  In northern Queensland, an integrated trial has been established to determine the most cost effective combination of primary and secondary (follow-up) treatments for the control of bellyache bush (*Jatropha gossypiifolia* L.). This paper reports on the effectiveness of the primary control techniques that were applied: control, burning, foliar spraying (using metsulfuron (Brush Off®)), stickraking (using a D7 Dozer) and slashing (using a tractor-mounted slasher). Measurements undertaken included mortality of juvenile (up to 20 cm height), mature (20–100 cm height) and old (>100 cm height) bellyache bush plants, and post-treatment seedling recruitment and pasture response. Both slashing and the application of herbicide caused 100% mortality, irrespective of the size of plants. Fire was most effective on smaller plants (96% mortality), with efficacy decreasing with increasing size of plants. In contrast, stickraking was most effective on the largest plants (99% mortality). The natural mortality (control) was 38%.

For every plant killed by spraying, slashing, stickraking and burning, 20, 97, 74, and 69 plants were recruited from the seed bank, respectively. For every plant that died naturally, 74 were recruited from the seed bank. The impact of primary treatments on pasture yield varied between treatments. Brush Off increased pasture yield 17% when compared with the control whereas slashing, stickraking and burning reduced pasture yield 37%, 24% and 40%, respectively. Results suggest that foliar spraying of bellyache bush with metsulfuron was the best singular control method in terms of kill effectiveness, level of post-treatment seedling recruitment and sustainability of pasture yield.

Keywords  Bellyache bush, *Jatropha gossypiifolia*, weed control, north Queensland.

INTRODUCTION

Bellyache bush (*Jatropha gossypiifolia* L.) is currently one of the major exotic weeds invading the rangelands of northern Queensland (Bebawi *et al.* 2002). It is present to varying degrees in riparian and sub-riparian habitats of the Burdekin, Walsh, Palmer, Flinders and Gregory Rivers (Csurhes 1999, P. Davies pers. comm.). In western Queensland, it is found in the headwaters of Lake Eyre Basin.
identity and integrity of plots. Bellyache bush density per plot averaged 58,000 plants per hectare (SE ± 15,000). The trial was initiated in April–May 2002 with follow-up treatments in 2003.

**Plant mortality** Prior to the application of primary treatments, 20 live bellyache bush plants of three different life-stages that included juvenile (up to 20 cm height), mature (20–100 cm height) and old (>100 cm height) plants were marked with numbered pegs. Live plants could be readily identified as they exuded colourless latex when struck with a sharp knife at the base of the stem, and the characteristic colour of the internal parts of the cut bark was green.

Plant mortality was determined a year later, before the onset of the wet season and application of secondary treatments.

**Seedling recruitment** Twelve months after the implementation of primary treatments, seedling counts were recorded within 80 systematically placed 50 × 50 cm quadrats per plot. To avoid errors arising from edge effects, measurements were not taken within 1 m of plot boundaries.

**Pasture response** Within the same quadrats used to record seedling densities, the yield and composition of the pasture was visually estimated using the comparative yield method (Botanal) (Haydock and Shaw 1975, Tothill et al. 1978).

**Data analysis** For all parameters measured, analysis of variance was performed to detect differences between control methods. Percentages were arcsine-transformed prior to statistical analysis and later back-transformed.

**RESULTS**

**Plant mortality** Significant (P <0.01) control method × life stage interactions occurred for mortality of bellyache bush plants (Figure 1).

Some natural attrition of bellyache bush occurred irrespective of treatment (as measured within control plots), with seedlings the most susceptible life stage (56% mortality). Both slashing and the application of herbicide caused 100% mortality, irrespective of the size of plants. Fire was most effective on smaller plants (96% mortality), with efficacy decreasing with increasing size of plants. In contrast, stickraking was most effective on the largest plants (99% mortality).

**Seedling recruitment** Control methods significantly (P <0.05) affected seedling recruitment the following year. For every plant killed by spraying, slashing, stickraking and burning, 20, 97, 74, and 69 plants emerged from the seed bank, respectively. For every plant that died naturally, 74 regrew from the seed bank.

**Pasture yield** Highly significant (P <0.01) differences in pasture yield were detected between control techniques (Figure 2) 12 months after the application of treatments. Pasture yield within foliar sprayed plots was 17% higher than that within controls (Figure 2). In contrast, fire, stickraking and slashing reduced pasture yield 40%, 37%, and 24% respectively, when compared with the control (Figure 2).
DISCUSSION

Several primary control techniques proved effective in killing bellyache bush, with highest mortality achieved using foliar spraying and slashing. Seedling recruitment over the ensuing wet season occurred in all treatments, but was generally least in foliar sprayed plots and highest in those that had been slashed.

The results achieved by the fire and slashing treatments are consistent with findings from previous studies on bellyache bush (Bebawi and Campbell 2002a, b). Vitelli and Madigan (2002) also found Brushoff to be an effective foliar herbicide when applied aerially, but they emphasised the need for follow up control to treat the large-scale seedling regrowth that may occur following initial treatment.

The higher pasture yield in foliar sprayed plots is most probably attributable to the removal of competition from bellyache bush in a manner that caused minimal disturbance to the herbaceous vegetation, due to the selective nature of the herbicide used. All other treatments implemented would have caused some level of disturbance to the herbaceous vegetation.

Whilst the application of herbicides appears the most promising technique at this stage, final recommendations need to be deferred until secondary control options are implemented. Efficacy data will then be considered in combination with the costs of treatments in order to identify effective control strategies that not only remove initial infestations but also treat subsequent regrowth.

No single recommendation will be applicable for all situations where bellyache bush grows. For example, slashing may be feasible in open woodlands with a flat terrain but not in riparian habitats where the vegetation is generally dense and the terrain rough.

Other research being undertaken in conjunction with this integrated trial includes studies into the longevity of soil seed banks of bellyache bush. This information will identify how long follow up control will need to be implemented. Biological control options for bellyache bush have also been investigated and one agent (the jewel bug *Agonosoma trilineatum* Fabricius) is currently being mass reared and released in infestations in northern Queensland and the Northern Territory. This bug feeds on the fruits of bellyache bush and if effective should reduce the quantity of viable seed entering the soil seed bank.

It is envisaged that on completion of the ecological and agronomic research currently being undertaken on bellyache bush, effective integrated strategies will be available to assist landholders with management of this highly invasive and noxious weed.

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REFERENCES


