

Acaciella angustissima: a soil seed bank study

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Summary *Acaciella angustissima* (syn. *Acacia angustissima*) was once considered a potential new shrub forage legume but due to its relative unpalatability and prolific seed production it is now regarded as a potential woody weed. Knowledge of the soil seed bank ecology of weeds is essential for planning and implementing control strategies. Studies at three north Queensland sites revealed considerable soil seed banks and hardseededness of this species.

Keywords *Acaciella angustissima* (syn. *Acacia angustissima*), soil seed bank, woody weed.

INTRODUCTION

Acaciella angustissima (Mill.) Britton & Rose (syn. *Acacia angustissima* (Mill.) Kuntze) (Mimosaceae) is a bipinnate shrub from the Americas, its nomenclature has recently been reviewed (Rico Arce and Bachman 2006). Trials evaluating it as a potential forage shrub legume for livestock production in Queensland found it to be less than ideal due to its low palatability compared to existing shrub legumes and its weedy traits, particularly its prolific seed production (Cox *et al.* 2007). A project sponsored by Meat Livestock Australia (MLA) has been implemented to control it and three other legumes namely *Aeschynomene brasiliana* (Poir.) DC., *Aeschynomene paniculata* Willd. ex Vogel and *Indigofera schimperi* Jaub. & Spach (Cox *et al.* 2007) in a number of old pasture research sites throughout Queensland.

Knowledge of the soil seed bank ecology of weeds is essential for planning and implementing control strategies. In north Queensland there are several sites where *A. angustissima* was cultivated in trials and two sites where feral populations occur. Over several years these populations have been largely brought under control by the application of herbicide, but it is not known if soil seed banks occur and whether or not they are transient or persistent seed banks and whether or not these sites may recolonised from the soil seed bank. A number of species within the Mimosaceae family are known to be weedy, and to have hardseededness and persistent seed banks (Paynter *et al.* 2003).

If this potential woody weed is to be controlled its soil seed bank as well as other attributes of the plant's ecology need to be investigated. This paper discusses germination and soil seed bank data retrieved from feral and cultivated *A. angustissima* sites.

MATERIALS AND METHODS

Collection sites Field work was conducted at three sites (Figure 1). At Ingham 18°14'S, 146°08'E in north Queensland (wet tropics, 2032 mm AAR), soil seed banks were collected from the seed shadow area (2 m radius) of three dead (approximately one year dead) but previously mature, lush and prolific *A. angustissima* shrubs. This site was a feral/uncultivated roadside thicket of *A. angustissima* that had been treated with herbicide over several years.

Near Woodstock 19°39'S, 146°48'E (seasonally dry tropics, 900 mm AAR) soil cores were taken from under three *A. angustissima* shrubs in a thicket of *A. angustissima* in an abandoned shrub legume trial site some 40 km south of Townsville, north Queensland.

In the Townsville suburb of Douglas 19°19'S, 146°45'E (seasonally dry tropics, 1100 mm AAR) soil cores were taken from a site where one large mature cultivated shrub had been removed in 2002 (approximately five years dead).

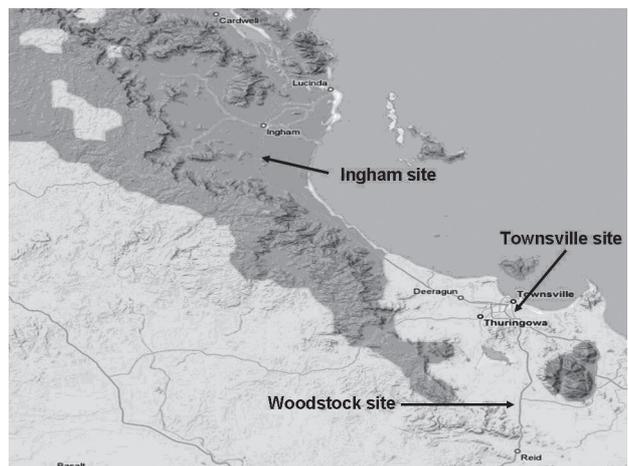


Figure 1. Location of study sites.

Seed germination Mature *A. angustissima* pods were collected from shrubs near Woodstock in June 2007. No seeds were available from the other two sites. Pods were dried at 40°C in a forced-air oven (Thermoline Scientific Equipment Pty. Ltd.) for 48 hours. The pods were thrashed by hand and seed collected. One hundred seeds were scarified in hot water (80°C for five minutes) and then placed in a 9 cm Petri dish on four sheets of filter paper (Whatman No.1) which were moistened daily. One hundred seeds (control) were untreated and placed in an identical Petri dish. The Petri dishes were placed in a controlled environment chamber at 29°C for 14 days. Germinating seeds were counted and removed daily.

Soil seed bank Soil cores were taken by inserting five stainless steel cylinders (75 mm diameter × 50 mm depth) into the soil at random locations in the seed shadow of the shrubs. The soil cores were dug out and inserted into bags for transport and storage until sieving. A wet sieving procedure was used where individual soil cores were placed in a 10 L bucket of water, stirred to break up clods of soil and then the resulting slurry was poured through two sieves one on top of the other, firstly a 2.8 mm sieve to remove coarse material and then a 1 mm (Endecott Ltd.) sieve. Running water was used to gently flush soil particles away through the sieves. The resulting material (small pebbles, organic matter and seeds) were air dried and then examined under a maggy lamp (Solex Electronics). Seeds of *A. angustissima* were picked out, counted and stored.

RESULTS AND DISCUSSION

Germination The control treatment had 1% germination while the scarified treatment had 86% germination. This confirms that *A. angustissima* seeds have hardseededness, and therefore have the ability to form long-lived seed banks.

Soil seed bank Soil seed bank was greatest under living adult trees, but was still significant where there had been no seed input for approximately five years (Table 1). This confirms that *A. angustissima* has a persistent soil seed bank. The larger soil seed bank found under living shrubs at Woodstock indicates the considerable weed potential of this species. The difference in the size of the soil seed banks at the three sites may indicate that the herbicide treatment of the

shrubs over several years at the Ingham site may have contributed to reducing seed production and therefore the size of the soil seed bank, however it may also be due to or in part due to environmental conditions (soil moisture and temperature) in the wet tropic which may enhance seed germination and or seed decay. The soil seed bank at Douglas shows that *A. angustissima* has a soil seed bank for at least five years. The relatively low seed density at this site may reflect the time since the shrub was removed, and rate of dormancy-release. The soil seed bank at Woodstock, in the dry tropics, may reflect the drier environmental conditions and the fact that the shrubs were still productive at the time of sampling. The large seed bank at this site plus the likely longevity of that seed bank suggests that the site will require monitoring and treatment for many years to come. Further studies on the viability, longevity and depth of the soil seed bank will enhance our knowledge of this species.

Table 1. Seed density in the soil seed bank.

Site	Years since last seed input (min.)	Seeds m ⁻²
Ingham	1–2	90.5
Woodstock	0–1	2322
Townsville	c. 5	95

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