

Uses for *Mimosa pigra*

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Abstract

Despite its detrimental impacts, mimosa, *Mimosa pigra* L., does have uses. It has been of botanical interest since the 19th century, which led to its introduction and cultivation in botanic gardens outside of its native range. As late as the 1980s, its ornamental value was still being promoted in a seed catalogue. Mimosa was purposely introduced to Thailand from Indonesia in 1947 as a green manure and cover crop in tobacco plantations. Mimosa fixes nitrogen and, in areas of Australia where it grows profusely, it increases soil fertility and redistributes nutrients from the lower soil profile to the surface. This may be beneficial for establishing vegetation after clearing mimosa. It is used for firewood, bean-poles and as temporary fences, and has been tested as a medium for growing mushrooms. Samples of fibreboard have been made from the wood in Thailand but the board was found to absorb too much moisture to be of commercial use. Mimosa has high protein content, and studies have been carried out in Thailand to evaluate its use as a substitute for *Leucaena leucocephala* (Lam.) de Wit in animal feed. It is heavily grazed by native animals in Nigeria and has been observed to be browsed by horses, buffalo, cattle and goats elsewhere. It has been used as a medicinal plant for colds, fever, toothaches, eye medicine, snakebite, weak heart and diarrhoea, and it has antimicrobial activity. In Australia, the harvest of mimosa to extract vegetable tannins and to provide biomass to generate electricity has been proposed under controlled conditions.

Keywords: history of spread, utilisation, legislation, mimosa.

Introduction

Mimosa, *Mimosa pigra* L., has well-documented impacts on primary industry and the environment in Australia and Asia. It forms tall, dense, impenetrable thickets over large areas. It competes with desirable vegetation, prevents access, causes sedimentation in rivers and results in economic problems (Robert 1982, Napompeth 1983, Lonsdale *et al.* 1989). When faced with an extensive weed infestation which has negative impacts and which is costly to manage, it is natural to seek ways to utilise the plant. Many weeds have traditional, adapted or potential uses, and mimosa is no

exception. This paper documents these uses and comments on the integration of harvesting mimosa with its management as a weed.

Uses

Botanical interest and ornamental value

Mimosa has been of botanical interest since the 19th century. It seems to have been deliberately transported to botanic gardens outside of its native range because a number of specimens held in the herbarium at the Royal Botanic Garden, Kew, UK, came from plants growing in other botanic gardens (C.R. Dunlop, pers. comm. 1986). In the mid 19th century it was introduced from Mexico to the Bogor Botanic Gardens in Indonesia (Teysmann and Binnendijk 1866), while Bentham

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(1875) reported that mimosa occurred in the East Indian Botanic Gardens. It is believed to have been introduced to the Darwin Botanic Gardens before 1891 (Miller and Lonsdale 1987).

As late as the 1980s, the ornamental value of mimosa was being promoted. It was being sold by a tropical seed supplier in Hawaii as "bashful plant", its virtues being that the "leaves close when touched" and that it is "an interesting conversation piece" (Anon. 1980). This catalogue stated that, "all seeds are sold for the purpose of germination and for producing plants".

Green manure and erosion control

In 1947, mimosa was purposely introduced from Indonesia into Thailand as a green manure and cover crop in tobacco plantations, and was later used to prevent ditchbank erosion around Chiang Mai (Napompeth 1983, Wara-Aswapati 1983). Its value for green manure is probably based on its ability to fix nitrogen. Root nodules containing *Rhizobium* are found on mimosa in its introduced and native ranges and are probably an effective source of nitrogen for the plant (Lumyong and Petpichittakul 1982, Lonsdale *et al.* 1989).

In areas where mimosa grows profusely in Australia, it increases soil fertility and redistributes nutrients from the lower soil profile to the surface. It increases the levels of organic carbon in surface and sub-surface soil beyond normal levels and increases total soil nitrogen, available phosphorus and available zinc. Total soil nitrogen was found to be up to 2.7 times the level in uninfested areas (N. Dasari, pers. comm.). This may have benefits for establishing native or introduced vegetation after clearing mimosa.

Timber

In Thailand and Vietnam mimosa is used as firewood (Robert 1982, M. Ashley, pers. comm. 2002). In Vietnam it is used as living fence (M. Julien, pers. comm. 2002). It is also used for beanpoles and occasionally as temporary fences in Thailand. However, it is not used extensively in construction because it rots too quickly (Robert 1982). Samples of fibreboard were made from mimosa in Thailand but the product was not produced commercially as it absorbs an unacceptable amount of moisture. Additional chemical treatment to prevent this raises the cost of production to a point where it is not price competitive (Robert 1982).

In Vietnam, an experiment has been conducted with promising results to process and sterilise mimosa wood for use as a medium to grow mushrooms (T. Triet, pers. comm. 2002). In Mali, goat

herders use mimosa to make animal enclosures as part of a project to limit cutting of *Acacia kirkii* Oliver, woodlands (Skinner 1988).

Animal feed

Mimosa has high protein content and studies have been carried out to evaluate its use as an animal feed. Its crude protein content is 20% to 23% (Vearasilp *et al.* 1981a,b). However, there have been conflicting reports on whether mimosa contains the toxic amino acid, mimosine, which could restrict its use for animals. Vearasilp *et al.* (1981a) reported that mimosa did not contain mimosine, but it has been isolated at a level of about 0.2% of leaf dry weight (Lonsdale *et al.* 1989). It is doubtful that the foliage would be toxic at this level of mimosine and it is considerably lower than the 8% to 10% of mimosine reported by Everist (1981) in the fodder legume, leucaena, *Leucaena leucocephala* (Lam.) de Wit.

When fed to sheep in Thailand at low levels mixed with para grass, *Brachiaria mutica* (Forssk.) Stapf., mimosa did not reduce digestibility of the feed and was considered as a high-protein feed component (Vearasilp *et al.* 1981b). In an experiment comparing the effect of substituting mimosa for leucaena in pig and rat rations, no significant differences were recorded for average daily gain, feed intake and feed-efficiency ratios, suggesting that mimosa can substitute completely for leucaena (Vearasilp *et al.* 1981a).

Leaves of mimosa have been used in quail diets, at a level of 6%, without any detrimental effect (Tongvitaya *et al.* 1980). In studies with buffalo, animals fed with rice straw plus mimosa lost less weight than buffalo fed on rice straw alone (Niemsup and Siri 1983).

Mimosa is commonly used by native animals in Nigeria, forming a favoured and stable part of the food supply for the larger herbivores in Yankari Game Reserve (Geerling 1973). Different animals use it in sequence, opening up a maze of trails through the mimosa shrubland. Elephants firstly open the tangled mimosa by putting their trunk around the branches and pulling off the leaves or eating the whole shrub. Buffalo, roan antelope and bushbuck follow to browse on the mimosa. Hartebeest, waterbuck and warthogs also eat it. Although it is heavily utilised, mimosa continues to grow during the dry season, and regains its healthy condition in the wet season when floods exclude animals. In Thailand, cattle and goats have been observed browsing on the plant. In Australia, it has been seen to be browsed by horses, buffalo and cattle (Miller 1988, Lonsdale *et al.* 1989). A negative aspect of browsing by animals is that viable seed is carried in the diges-

tive tract and excreted in the manure, seedlings having been observed growing in buffalo dung.

In a grazing trial comparing goats in a dense infestation of mimosa with those on pangola grass, *Digitaria decumbens* Stent., Bajau and Cox (2000) reported that the goats readily consumed mimosa when no other feed was available. They consumed leaves and shoots to a height of two metres. Tall plants were mechanically flattened to allow for complete defoliation. The goats lost weight initially but later regained body weight, compared with pangola grass, and their performance on mimosa was not significantly different.

Medicinal use

Claims have been made that the roots are sniffed for head colds, a decoction of the leafy stem is used as a mouthwash for toothaches, and that the fruits are used in eye medicines (Anon. 1980). Apparently it is also used for the treatment of snakebite in Africa (Irvine 1961). In Sumatra, roasted and ground mimosa leaves are made into an infusion, which is drunk to treat a weak heart or weak pulse (Grosvenor *et al.* 1995). A decoction of dried and ground male and female parts is used in the same manner. In Mexico, an infusion of mimosa was traditionally used in Mayan medicine for treatment of diarrhoea. This knowledge led to leaves of mimosa and other legumes being phytochemically screened and tested for antimicrobial activity (Rosado-Vallado *et al.* 2000). In phytochemical screening, flavonoides, quinones, saponins, sterols and tannins were detected in mimosa. Extracts of mimosa showed antimicrobial activity against four bacteria, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Candida albicans*, but not *Escherichia coli*. It was concluded that the use of mimosa, and the other legumes tested could not be justified for treating diarrhoea. However, the level of antibacterial activity shown could support the use of mimosa in treating infected wounds and eye and skin infections.

Biomass

In 1996, a company proposed the mechanical harvesting of mimosa in Australia to extract vegetable tannins for the leather tanning and wood product industries. It was planned to replace the \$9 million worth of imported vegetable tannin on the domestic market, as well as produce by-products for the industrial chemical and cellulose fibre markets. At that time there was no commercial production of tannin in Australia and the company saw mimosa as the world's single largest resource of vegetable tannin (Anon. 1997). As a result of this concept, the company won an

AusIndustry Award for the nation's best new enterprise plan (Austin 1996).

In 1997, a proposal was developed to harvest mimosa as a fuel to generate electricity. The weed would be harvested, chipped, dried, compressed into briquettes and ignited to produce a hydrogen-rich gas to fuel a generator (Sharp 2001). Development of this proposal is continuing, and is reported elsewhere in this symposium (Presnell 2004).

The use of mimosa in relation to control

Harvest

Limitations. If mimosa is harvested and used, it will still need to be managed as a weed. Mechanical harvest will not be possible from all habitats where it exists, due to accessibility problems, and mimosa will therefore continue to have a detrimental impact in these areas. In addition, harvesting as a physical control mechanism for mimosa has limitations. Cutting plants off at ground level, or 15 cm above ground level, results in most plants resprouting (Schatz 2001). Plants need to be cut off 10 cm below ground level for a high kill rate. Plants cut at ground level put out new shoots from a few centimetres below the soil surface. As regrowth is rapid, and there is a large seed bank in the soil (Lonsdale *et al.* 1989), the harvest of mimosa alone will not provide lasting control unless follow-up control is practised.

Benefits. Harvesting mimosa may assist with control, the main benefit being reduction in the size of plants. This would facilitate follow-up control by herbicides, further mechanical control or the planting of competitive species, all of which may be carried out at a lower cost than would be incurred for a large, dense infestation. Harvest may also be of benefit for certain biological control agents that feed on regrowth. A further benefit is that the integration of harvest with other control measures will alleviate the negative impacts of mimosa. It will allow for the return of floodplain vegetation and native animals, and facilitate the management of livestock.

Committee considerations

Two committees have examined proposals to use mimosa in the Northern Territory.

In examining the tannin proposal, the Sessional Committee on the Environment supported any use that can be made of mimosa, providing that safeguards are instituted to prevent the spread of seed during harvest and transport (Anon. 1997). The Committee recognised the accessibility problem, but acknowledged that it is possible to

harvest accessible dense stands. The Committee suggested that the harvest of accessible areas could be integrated into the control program for mimosa, and recommended that the Northern Territory Government and landholders cooperate in research into the harvest of mimosa for extracting tannins.

The Mimosa Management Committee considered the electricity-generation project. The Committee strongly supports schemes that can provide a return to the cost of mimosa control, but emphasised that mimosa is a Weed of National Significance and that it cannot be considered as a renewable crop. It was stressed that power generation should fit within the integrated strategy for mimosa control.

For both committees, the spread of seed in the harvested material during transport to a processing facility was a concern. To prevent spread of seed, it was proposed to operate a mobile tannin-extraction facility at the harvest location. Electricity generation would also be on-site. However, seed may be spread if machinery used in these projects is transported elsewhere. It is not easy to thoroughly clean mimosa seed from machinery, so the transport and use of contaminated machinery will need to be restricted.

Legislation

As a declared weed, the use of mimosa is permissible under Section 30 of the Northern Territory *Weeds Management Act 2001*. The appropriate Minister grants the permit, and conditions may be applied, such as lodgment of a bond to provide a security against costs that may be incurred to prevent spread of the weed. The permit may also specify management practices to reduce seed spread, such as timing of harvest, handling practices, cleaning and the off-site use of machinery.

Conclusion

Two committees have supported the use of mimosa under controlled conditions, but as there is a large resource of naturalised mimosa, cropping should not be supported.

The harvest and use of mimosa will not eradicate the plant, but harvest may be of benefit for its integrated control in selected infestations, provided that follow-up control is practised, and provided that the harvest and use does not contribute to spread of seed. Research to develop uses for mimosa should be encouraged. The use of mimosa under specified conditions, to prevent seed spread, may provide an economic benefit for

a weed that is currently having major detrimental impacts on agriculture and the environment in many countries.

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