Establishment of *Leucaena leucocephala* cv. Tarramba in Eastern Indonesia

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Introduction

The adaptability and productive value of *Leucaena leucocephala* cv. Tarramba (Tarramba) in eastern Indonesia has been observed since 2001 (Nulik *et al*. 2004), with many farmers and other stakeholders currently requesting seed for planting. Tarramba has greater forage and timber production, and psyllid tolerance than other commercial cultivars and locally grown leucaena. The variability of soils and climate in eastern Indonesia means that establishment techniques specific to the region are required to achieve maximum adoption and utilisation of Tarramba.

Materials and Methods

A number of sites differing in soil type in west Timor (8 sites) and east Sumba (4 sites) were selected to study the establishment of Tarramba (Table 1). Management varied among sites for factors such as exclusion of animals during establishment and competition from weeds and trees.

Scarified seed (imported from Australia) was washed and immersed in clean water until the seed became imbibed (4-12 hours). The seed was germinated in petri-dishes (radicle length between 0.5 and 1.5 cm) and sown into polybags (December 2011) or directly seeded into the field between the rows, when planting maize.

Seedlings in polybags were well watered and pressed to prevent soil loss and wilting during transplanting to the field in January and February 2012. Plant height and basal stem diameter were measured to determine yield via a growth index (GI) (GI = height x basal diameter^2) (Stewart *et al.* 1992). Fifty plants from each site were identified for measurement. Mean GI data presented here are from a single measurement in October 2012. Young fully expanded leaves were collected from leucaena trees established at the Kambatatana sites in east Sumba to identify nutrient deficiencies, as the soils were highly eroded, poor karst limestone soils.

Table 1. Site description, management practices and Tarramba growth index (± standard deviation). Competition rated as 1 low and 5 high. For Kambatatana, planting was on vertisols on alluvial flats (site 1) below a limestone hill, and on a highly eroded limestone ridge (site 2). For direct seeded into maize, no measurements were made, visual assessment only.

Region	Site	Soil type	Animals excluded	Planting method	Weed competition	Competition from trees	Survival rate (%)	Growth index
East Sumba	Wanga	Vertisol	yes	Transplanted	1	1	85	4137 ±28
	Laindeha	Vertisol Inceptisol	no	Transplanted	3	2	75	NA
	Kambatatana (2 sites)	Vertisol (site 1) Limestone (site 2)	yes	Transplanted	3	2	100	974 ±164 272 ±15
West Timor	Oebola Dalam	Alfisol	yes	(a) Direct seeded into maize (b) Transplanted	1	2	90	1181±92
	Naunu	Mollisol Inceptisol	yes	(a) Direct seeded into maize (b) Transplanted	1	4	90	137 ±43
	Ponain	Vertisol	yes	Transplanted	2	2	80	1501 ±36
	Tesbatan (I)	Vertisol	yes	Transplanted	5	5	95	198 ±20
	Tesbatan (II)	Alfisol	yes	Transplanted	1	1	10	1259 ±59
	Oeli	Alfisol	yes	Transplanted	1	1	95	840 ±92
	Dusun 1	Alfisol	yes	Transplanted	1	1	80	482 ±37
	Batulesa	Vertisol	no	Transplanted	1	1	75	5430±63

Table 2. Nutrient concentrations in young fully expanded leaves of leucaena plants harvested November 24, 2012. Adequate and deficient levels from Ruaysoongnern *et al*. 1989 and Mullen *et al.* 2003.

Item	Al	B	Cu	Fe	Mn	Zn	Ca	K	Mg	Na (%)	P	S
Kambatatana (ridge)	48	99	10	103	53	21	1.90	0.94	0.42	0.04	0.12	0.19
Kambatatana (gully)	205	129	7	181	35	41	2.09	0.94	0.37	0.05	0.11	0.44
Adequate		>22	>4.40	>44	n/a	>13	>0.44	>1.65	>0.22	n/a	>0.27	>0.26
Deficient		<18	<3.60	<36	n/a	<11	<0.36	<1.35	<0.18	n/a	<0.22	<0.22

Results and Discussion

As anticipated, Tarramba performed differently according to method of planting and the environmental conditions and management during establishment. Soil type (particularly water holding capacity and fertility) and competition from weeds and shading affected the capacity of the plants to grow to their potential (Table 1). Plant growth was greatest in vertisols and alluvial sediments, such as at Batulesa in Kupang District and at Wanga in east Sumba, followed by Ponain on vertisol, then Tesbatan II and Oebola Dalam on alfisols, with poorest growth during establishment on poor karst limestone soils in Kambatatana and at Naunu, where competition from weeds and trees was high. Tissue analysis of leaf samples (youngest fully expanded leaves) indicated that there were deficiencies of P, K and S in samples taken from one or both Kambatatana sites (Ruaysoongnern *et al*. 1989; Mullen *et al*. 2003) (Table 2). Nevertheless, the nutritional value of Tarramba was superior to that of the native grasses present at Kambatatana, particularly in crude protein concentration (19% *vs* <3%).

Best seedling growth occurred at sites that involved transplanted seedlings from polybags, which allowed plants to establish for 2 months with daily watering without competition from trees or weeds, *e.g.* at the Batulesa and Wanga sites (GI>4000), with Ponain the next best site (GI = 1500). Transplant sites that were not well weeded did poorly (GI of Tesbatan 1 was 198). Establishment by direct seeding was best where competition from trees was minimised, *e.g.* GI at Oebola Dalam was 1180. Direct seeding of imbibed seeds into maize rows was best with good weed management, although competition from actively growing maize was initially high. This planting method provided excellent growth conditions (sufficient soil moisture content and low competition) following harvest of the maize.

Conclusions

This study has shown that *Leucaena leucocephala* cv. Tarramba can be established successfully in eastern Indonesia, when seed is prepared appropriately for germination, seedlings are allowed to establish without grazing, and competition from weeds and trees is minimal. Transplanting from polybags will give better initial growth than direct seeding, even into well weeded maize. Despite reduced plant growth in karst limestone soils owing to nutrient deficiencies, the forage produced is of better quality than existing native grasses even in the dry season. This cultivar shows great potential for improving livestock performance in eastern Indonesia regardless of soil type.

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