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Review of establishment practices of *Leucaena leucocephala* cv. Tarramba in West Timor, Indonesia

Revisión de prácticas de establecimiento de Leucaena leucocephala *cv. Tarramba en Timor Occidental, Indonesia*

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Abstract

With increasing cattle production in East Nusa Tenggara Province there is an urgent need to increase plantings of high quality forage such as Tarramba leucaena. This requires stakeholders to acquire knowledge and practical skills to achieve reliable plant establishment. As part of a study of Tarramba leucaena adoption in East Nusa Tenggara, it became clear that the best method to establish leucaena was by transplanting 1–2-month-old seedlings at the beginning of the rainy season that had been pre-prepared in poly-bags at a nursery. However, with varied conditions at the study locations, such as the absence of a dry season water source, farmers have used other methods, including: direct seeding; poly-bag seedlings planted later in the wet season; or older bare-root seedlings harvested from a high-density nursery or from volunteer seedlings growing between rows of established leucaena. This paper elaborates on the different methods of establishment in farmer plantings in Kupang District (West Timor region of East Nusa Tenggara Province), Indonesia.

Keywords: Bare-root seedlings, establishment, tree legumes.

Resumen

En vista del incremento de la producción de ganado en la provincia de Nusa Tenggara Oriental existe una necesidad urgente de aumentar la producción de forraje de alta calidad, por ejemplo de la leucaena cv. Tarramba. Esto requiere conocimientos y habilidades prácticas de los productores para poder lograr un establecimiento confiable del cultivo. Un estudio de adopción de la leucaena Tarramba en Nusa Tenggara Oriental mostró que el mejor método para establecer la leucaena fue el trasplante de plántulas de 1–2 meses de edad al comienzo de la época de lluvias, usando plántulas en bolsas de polietileno procedentes de un vivero. Sin embargo, en vista de la variabilidad de las condiciones de establecimiento en los sitios de estudio, tales como la disponibilidad de agua en la época seca, los productores usan diferentes métodos, entre ellos: siembra directa; trasplante de plántulas en bolsas plásticas más tarde en la época lluviosa; o trasplante de plantas pequeñas, menos jóvenes con las partes aéreas recortadas, cosechadas en un vivero de alta densidad u obtenidas de poblaciones espontáneas de leucaena que aparecen entre las hileras de árboles en producción. Este documento describe y analiza los diferentes métodos de establecimiento usados por los productores en el distrito de Kupang (región de Timor Occidental, provincia de Nusa Tenggara Oriental), Indonesia.

Palabras clave: Establecimiento, leguminosas arbóreas.

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Introduction

Adoption of the drought-resistant high-quality forage tree legume leucaena (*Leucaena leucocephala* cv. Tarramba) for cattle fattening is increasingly common in eastern Indonesia, especially in the Fatuleu subdistricts of West Timor. Successful establishment of Tarramba leucaena requires good knowledge of its establishment needs as well as practical skills. Earlier studies (Nulik et al. 2013) showed that the most successful method was planting of seeds in poly-bags 1–2 months before transplanting seedlings into the field once the rainy season had commenced in November–January. However, as the practice of planting Tarramba leucaena expanded, so did variation in site conditions. For instance, the Tunas Muda farmer group (Bilboto hamlet, Camplong II village, Fatuleu subdistrict), located in an area where availability of water was severely restricted during the dry season, waited until the early rainy season before poly-bag seedlings could be prepared for transplanting during February-March.

A review of modified establishment methods was conducted on several project sites where many new farmers had planted leucaena in West Timor, especially in Oebola Dalam and Camplong II villages in Fatuleu subdistrict, and in Nunsaen village in Central Fatuleu subdistrict. The objective was to observe how farmers had adapted their planting techniques to suit the various climatic and edaphic conditions and still achieve successful establishment of Tarramba leucaena.

Climate and soils of eastern Indonesia

Timor Island has a tropical wet and dry savanna climate (Köppen-Geiger classification: Aw) with a pronounced dry season. West Timor is characterized by a tropical monsoonal climate with erratic rainfall patterns (Table 1), often leading to plant establishment failures (Nulik 1994) even when establishment practices may have been conducted appropriately.

Timor Island was formed from coral uplift, and thus the main parent material of the soils is limestone rock. This parent material has led to the formation of 2 main soil types, black (Mollisol) and red (Alfisol) soils (Mella and Mermut 2010) (Figure 1). Nulik et al. (2013) reported that the black sediment soils (black clays and sandy clays) gave the best early plant growth during the establishment of Tarramba leucaena.

Current establishment techniques

Unlike Amarasi district in West Timor (Piggin and Nulik 2005), the Fatuleu region traditionally involved free grazing of breeding cows on communal pastures, where farmers produced calves for sale but suffered high calf mortality and consequently low weaning outcomes (Dahlanuddin et al. 2019). Moreover, with the increasing human and livestock populations, especially cattle, degradation of native pastures has become significant with extensive invasion by the unpalatable weed *Chromolaena odorata* (Figure 2). The introduction of Tarramba leucaena into the region was deemed the best solution to improve the livelihoods of poor farmers (Dahlanuddin et al. 2019) by greatly increasing productivity of their cattle herds, and therefore cash flow to families, while simultaneously controlling the invasion of the unpalatable *Chromolaena*.

Thus expansion of programs to foster adoption of the legume was encouraged. In response to differing site conditions we observed that farmers had modified their establishment techniques according to their particular farm situations, i.e. some prepared seedlings in poly-bags (Figures 3 and 4) for planting in the early wet season, some direct-seeded leucaena while sowing corn (Figure 5), while others used 'bare-root' planting material derived from seedlings or plants up to 2–3 years old (Table 2), which are dug out from under established tree rows and stripped of small branches and leaves. The benefits and problems associated with each establishment technique are described in Table 3.

Table 1. Climate of Kupang, West Timor.

Climate variable	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Average Max Temperature (°C)	31	32	33	33	33	32	31	31	31	32	32	31	32
Average Min Temperature (°C)	21	21	22	23	23	24	24	24	23	23	22	22	23
Average Precipitation (mm)	5	3	2	18	89	246	389	366	221	64	28	10	1441
No. of Wet Days (probability of rain on a given day; %)	1 (3)	1 (3)	1 (3)	4 (13)	8 (27)	15 (48)	17 (55)	17 (60)	11 (35)	7 (23)	4 (13)	2 (7)	88 (24)

Figure 1. Black Mollisols (left) and Red Alfisols (right), derived from limestone rock parent materials, are the main two soils in West Timor.

Figure 2. Overgrazed communal lands invaded by the unpalatable weed *Chromolaena odorata.*

Figure 4. Poly-bags planted with young Tarramba leucaena seedlings.

Figure 3. Village group preparing poly-bags for seeding with Tarramba leucaena.

Figure 5. Tarramba leucaena established following planting with corn.

Table 2. Establishment techniques for Tarramba leucaena in eastern Indonesia.

Village, Farmer Group	Soil type	Dominant weed, other establishment problems	Establishment technique	Area established (% of available land)
Oebola Dalam village				
Bersaudara	Red rocky soils (Alfisols)	*Chromolaena*, native grasses, free grazing animals	Seedlings established in poly-bags before rains	5% of 125 ha
	Black and Red soils (Mollisols and Alfisols)	Native grasses, free grazing animals	Direct seeding	20% of 125 ha
	Red rocky soils (Alfisols)	*Chromolaena*, native grasses, free grazing animals	Bare-root seedlings from 1–3 yr plants	75% of 125 ha
Camplong II village				
Setetes Madu	Black rocky soils (Mollisols)	*Chromolaena*	1–2 months before rain seedlings	80% of >50 ha
		Chromolaena	Early rain seedlings	20% of >50 ha
Talekomonit	Red and Black rocky soils (Alfisols and Mollisols)	*Chromolaena*	Direct seeding	70% of 60 ha
		Chromolaena	Early wet season seedlings in poly-bags	30% of 60 ha
Tunas Muda	Red and Black rocky soils (Alfisols and Mollisols)	Native grasses, *Chromolaena*	Direct seeding	40% of 30 ha
		Native grasses	Early wet season seedlings in poly-bags	60% of 30 ha
Sabu Bani	Red rocky soils (Alfisols)	Native grasses, *Chromolaena*	Early wet season seedlings in poly-bags	100% of 30 ha
Sanam Tuan	Black and Red rocky soils (Mollisols and Alfisols)	*Chromolaena*, native grasses	Early wet season seedlings in poly-bags	90% of 30 ha
			Direct seeding	10% of 30 ha
Nunsaen Village				
Amtoas	Black and Red soils (Mollisols and Alfisols)	Native grasses, *Chromolaena*	Before rain and early wet season seedlings in poly-bags	90% of 150 ha
			Direct seeding	10% of 150 ha

Table 3. The benefits and problems with various establishment techniques.

Establishment technique	Benefits	Problems
Prepared poly-bag seedlings 2–3 months before rainy season	• High establishment rate • Less competition with native grasses	• High labor demand • Need to buy poly-bags • Need dry season water source
Prepared poly-bag seedlings in early rainy season (November–January)	• No need for dry season water source • Reasonable establishment rate • Less competition with native grasses	• High labor demand • Need to buy poly-bags
Direct seeding	• Less labor required • No need to buy poly-bags • Planting can be done together with planting of corn	• Need proper weeding • Susceptible to free grazing animals and fire
Bare-root cuttings from seedlings and young plants under established trees	• Less labor required, no need to prepare seed bed • Good for controlling spread of leucaena plants outside established rows • Seedlings can be taken any time during the rainy season (can be 1–3-year-old seedlings) • Less competition from native grasses and weeds	• Need to transplant when rain is reasonably stable

Conclusions

We found that farmers modified their planting techniques for establishment of Tarramba leucaena in West Timor in response to conditions at specific locations. These modified planting methods included: (i) preparation of seedlings in poly-bags early in the rainy season (December–February); (ii) direct seeding with corn early in the rainy season; (iii) and planting of bare-root seedlings obtained from under the established tree rows. The last technique was successful in Oebola Dalam village. Nevertheless, the best outcome was confirmed as transplanting of pre-prepared poly-bag seedlings 2–3 months before the onset of the rainy season. The review also confirmed that plant growth was best on black soils derived from coral limestone soil (Mollisols) compared with growth on the red Alfisols in the region.

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(Note of the editors: All hyperlinks were verified 2 May 2019.)

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