

# Wet Season Forage Production of *Leucaena leucocephala* cv Tarramba Planted in a Multiple Rows Configuration on Sandy Vertisol Soil at Naibonat, Kupang, East Nusa Tenggara-Indonesia

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## ABSTRACT

An experiment was conducted to measure forage production of *Leucaena leucocephala* cv Tarramba planted in a multiple rows of live fencing model. Plants were arranged in 8 rows which planted 2 meters from the main live fence of 1ha land. The plants were cut at of 1m height and then again at  $\pm 30$ cm from the ground level. Measurement of forage production was conducted to observe its ability in providing forage. Areas of 8x20 m on each of the 4 land sides (replications) were allocated for the measurements. Half of the observation plot (8x10m) was allocated for 2 months cutting interval and the other half (8x10m) were allocated for 4 months cutting interval. Measurements conducted were on fresh and dry matter of edible parts (leaf and stem skin), plant height, stem diameter and number of branches. The results showed that each plant produced in average of 8 to 11 branches at 2 months interval, while the 4 months interval produced 2 to 4 branches only. Plant heights and diameters were 150-280 cm and 0.6-2.5 cm on the 2 months cutting interval, and from 465-560 cm and 2.6-3.4 cm on the 4 months cutting interval. At 2 months interval, two harvests produced a total edible DM of 4 ton. While the 4 months interval obtained 1 harvest with 3.6 tons DM per harvest, able to support about 4-5 heads of Bali cattle for fattening during the 4 months. Thus, during the wet season the 2 months cutting interval is recommended.

**Keywords:** *Leucaena leucocephala* cv Tarramba, Cutting interval, Edible dry matter, Bali Cattle, Wet Season, East Nusa Tenggara.

## 1. INTRODUCTION

The dry climate with long dry season (8-9 months) in East Nusa Tenggara has significant effects on the growth and productivity of forage supply for the ruminant livestock, especially cattle in the region. The negative effects including high calf mortality of Bali Cattle in West Timor (30 to 50%) [1,2], long calving interval (2-3 year) of Sumba Ongole Cattle in Sumba Island, and low annual average live daily weight gain of cattle (0.2 to 0.3 kg/head/day) [3,4] in the whole province (Bali Cattle, Sumba Ongole Cattle as well as other local and introduced breeds) [5,6].

The low beef cattle productivity in the region was mainly caused by extensive cattle farming with free grazing or pen feeding relied on native grasslands and grasses with low productivity and quality, especially during the dry season. With the long dry season, the region needs drought tolerant forage species with deep rooting system reaching the deep soil moisture to enable the plant to produce sufficient high quality and quantity forage such as *Leucaena leucocephala* with protein content of > 24% [7,8].

There are three main soil types in West Timor, i.e. red soil (alfisol) and black soil (mollisol) derived from rock parent material [9] (Mella), while the black vertisol soils

are found mainly on the lowland rainfed rice area. The growth of *Leucaena leucocephala* planted on this difference soil types showed differences in its growth rate, where the best was observed when grown on the mollisols and vertisol soils [10]. Planting formation (thus plant density) may depend on the farming practices of the farmers. Farmers may grow the Leucaena plants as living fence, as monoculture plot, in alley cropping pattern, or multiple rows configuration on the border area of their land. These different planting formations, plant densities and soil type thus may give different production capacity in providing forage to feed cattle.

Thus, this experiment was conducted to measure forage production in the multiple rows planting formation on a sandy vertisol at Naibonat Village in Kupang District in East Nusa Tenggara, Indonesia. The area has an average long-term rainfall of around 1000 mm, mainly fallen in three to four months (from December to April) [11].

## 2. MATERIAL AND METHOD

### 2.1. Materials

*Leucaena leucocephala* cv Tarramba [12] was planted in 2014 as forage source for cattle feeding on a sandy vertisol soil at Naibonat, East Kupang Sub-District of Kupang District in East Nusa Tenggara. Seedlings of Tarramba were transplanted in December 2014 and planted in multiple rows along the perimeter of 1 Ha land with planting arrangement of 8 rows of 1 m x 0.5 m (1 m between the rows, and 0.5 m within the rows), started from 2 m away from the main live fence. Plants were cut down to 1 m height after one-year transplanting and then again down to 30 cm height from the ground in 2019. The planting configuration model in this experiment thus provide a total area of 3,132 m<sup>2</sup> with approximately 6,264 trees of *Leucaena leucocephala* cv Tarramba in the

planted area. This model was introduced to the farmers who still want to use their land to grow other crops, especially food crop such as corn.

### 2.2. Methods

An area of 20 m by 11 m from each side of the 4 sides of the land was selected for forage measurements (thus there were 4 replications).

Measurements included: plant height, plant diameter, fresh and dry matter of forage, fresh and dry matter of stem skin, fresh and dry matter of stem, and chemical properties of edible dry matter (leaf and stem skin). Data were obtained from the measurements of 10 plants from the middle site of sampling area of each replication. The dry matters of the harvested materials were obtained through sun drying for 2 days. The measurements from the 10 sampling plants were then averaged and samples were taken for dry matter measurements. The tabulated data were then statistically analyzed using SPSS, which was followed by LSD test to compare between treatment means.

## 3. RESULTS AND DISCUSSIONS

### 3.1. Plant height and number of stem branches

Plant height was significantly highest ( $P<0.01$ ) in the four months cutting interval both compared to the 1<sup>st</sup> and 2<sup>nd</sup> harvests of the two months cutting intervals; while the 1<sup>st</sup> harvest of the two months interval was significantly higher than the 2<sup>nd</sup> harvest of the same interval (Table 1). It was observed that the number of shoots per plant was higher at the 2 months cutting intervals (8-12 shoots/stems) compared to the 4 months cutting interval. This was noticed that the shoots or stems branching from each main plant or tree at the start of regrowth may produce 8-12 shoots or branching stems but by the time

**Table 1.** Plant growth, biomass production, and statistical analysis

| No | Treatment  | Plant height (cm)   | Plant diameter (cm) | Leaf DM (g/tree)    | Bark DM (g/tree)    | Total Edible DM (g/tree) | Fresh stem (g/tree)  |
|----|--|---------------------|---------------------|---------------------|---------------------|--------------------------|----------------------|
| 1. | 1 <sup>st</sup> two months cutting interval      | 259.25 <sup>b</sup> | 1.20 <sup>a</sup>   | 349.36 <sup>b</sup> | 97.94 <sup>b</sup>  | 447.30 <sup>b</sup>      | 1191.50 <sup>b</sup> |
| 2. | 2 <sup>nd</sup> two months cutting interval      | 165.50 <sup>a</sup> | 0.73 <sup>a</sup>   | 152.60 <sup>a</sup> | 28.93 <sup>a</sup>  | 188.76 <sup>a</sup>      | 696.50 <sup>a</sup>  |
| 3. | Total two harvests of two month cutting interval | -                   | -                   | 501.96 <sup>d</sup> | 134.10 <sup>c</sup> | 636.06 <sup>d</sup>      | 1888.00 <sup>c</sup> |
| 4. | 4 months cutting interval (one harvest)          | 495.25 <sup>c</sup> | 2.67 <sup>b</sup>   | 388.95 <sup>c</sup> | 203.15 <sup>d</sup> | 577.25 <sup>c</sup>      | 3081.92 <sup>d</sup> |

Numbers followed by different superscript within the column were significantly different ( $P<0.01$ )

of advancement into 4 months some of the stem branches will die and will only left down to 2-4 stem branches at the 4 months interval harvest.

### 3.2. Plant diameter

The statistical analysis showed that plant diameter was the highest in the 4 months cutting interval (averaged 2.67 cm) compared with that of the 1<sup>st</sup> and 2<sup>nd</sup> cutting interval branching stems (averaged 1.2 and 0.73 respectively), while there was no significant difference between the 1<sup>st</sup> and the 2<sup>nd</sup> harvest of the two month cutting interval ( $P>0.05$ ).

### 3.3. Leaf production

Statistical analysis showed that there were significant differences in leaf DM production among the treatments ( $P<0.01$ ), with the highest dry matter (DM) production from the total 2 harvests of the 2 months interval cuttings compared to that of the single harvest of 4 months interval, and the leaf DM production of 4 month cutting interval was higher than that of the 1<sup>st</sup> and the 2<sup>nd</sup> harvests of the two months cutting intervals; the leaf DM production of the 1<sup>st</sup> two month interval was higher than the 2<sup>nd</sup> two month interval.

Thus, when harvested at 2 months interval during the rainy season the total area planted can provide about 3.14 tons of leaf DM. If harvested at the interval of 4 months, however, it can only provide 2.44 tons of leaf DM. Thus the, total leaf DM production of the two harvests of the two months interval gives more leaf DM than the 1 harvest at 4 months interval.

### 3.4. Stem skin production

In the field it is usually noticed that animals such as cattle and goat peal and eat the stem skin [13] of leucaena when the forage was offered with the whole plant attached to the animals. Cattle at free grazing also peeled and eat the stem skin of the living trees in the field.

The statistical analysis showed that the skin stem DM was highest in the single 4 month harvest compared to that of the 1<sup>st</sup> and 2<sup>nd</sup> as well as to the total of them both. The stem skin DM of 1<sup>st</sup> two month cutting interval has higher weight than the 2<sup>nd</sup> harvest (Table 1).

Thus from the area planted when harvested at 2 months interval it can provide (of the 2 harvests) 0.84 ton stem skin DM, while the 4 months cutting interval (1 harvest) provided 1.3 ton of stem skin DM.

### 3.5. Total edible dry matter

Statistical analysis indicated that the treatments have a high significant effect ( $P<0.01$ ) on the total edible (stem skin and leaf) DM. The LSD test further showed that the total edible DM of the 1<sup>st</sup> and 2<sup>nd</sup> harvests of the two

month cutting interval even significantly has higher edible DM ( $P<0.01$ ) compared to the single cut edible DM of the 4 month cutting interval. The edible DM of the 1<sup>st</sup> two month cutting interval was also significantly higher than that of the 2<sup>nd</sup> harvest of the two month cutting interval ( $P<0.01$ ).

From the data it can be calculated that stem skin portion in the edible forage may range from 15% in the 2 months cutting interval to 35% in the 4 months cutting interval, which may also reduce the quality of the feed, especially protein content (may range from 21% down to 17.8%) using the standard protein content of 24% in the leaf [14] DM and 6.5% in the stem skin.

The multiple rows configuration planting of Tarramba in this experiment may produce a total of edible forage from in the 4 months single harvest and approximately 3.6 tons DM and a total of 4 ton from 1<sup>st</sup> and 2<sup>nd</sup> of the two months interval cutting which may support to feed 4-5 Bali Cattle of 250kg/head.

### 3.6. Stem production

Fresh stem weight was highest in the 4 months cutting interval compared to the 1<sup>st</sup> and 2<sup>nd</sup> harvests of the two-months cutting interval and even compared to the total weight of them both. Fresh stem weight was higher in the 1<sup>st</sup> harvest of the two-months cutting interval compared to that of the 2<sup>nd</sup> harvest.

Leucaena wood is known to have good value for making paper and rayon, as well as for generating power [15]. Therefore, if wood would also be the target of planting leucaena then the longer the cutting interval would be better in producing more wood. However, as the current experiment and the planting of leucaena was to provide sufficient forage or edible DM for feeding cattle, the priority would be for leaf production or edible DM.

## 4. CONCLUSION

Better edible DM was produced by the 2 months cutting interval, which was the total of both harvests. This DM availability may be able to support feeding of 3-4 fattening cattle of 250kg/head for 4 months, during the wet season (January to April). Thus, it is recommended to use 2 months cutting interval to obtain more forage compared to 4 months cutting interval.

## AUTHORS' CONTRIBUTIONS

All authors contributed to the planning of the experiment for measuring the wet season production of Tarramba Leucaena and to do proof reading of the paper. Debora Kana Hau was responsible for getting the team to work together and making sure the writing of the paper. Tony Basuki contribute to the identification of soil type. Twen Dami Dato was responsible biomass production

measurements. Jacob Nulik was responsible for tabulating and running the statistical analysis of the wet season biomass production.

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