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Seasonal growth of *Leucaena leucocephala* cv. Tarramba in dry land of west Sumbawa, Indonesia

Crecimiento de Leucaena leucocephala *cv. Tarramba en la región de sequía estacional del oeste de Sumbawa, Indonesia*

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Introduction

Sumbawa Island in Nusa Tenggara Province is one of the main cattle-producing areas in eastern Indonesia. In 2017 the cattle population in Sumbawa was around 350,000 head (Dinas Peternakan Report 2017). Most cattle are raised in a traditional free-grazing system, where they are released to roam at will and find their own feed, which is obtained mainly from communal grassland and fallow land. Owing to the strongly seasonal rainfall in Sumbawa the production and availability of forage for cattle fluctuate during the year. While the annual rainfall is 1,400 mm, 88% falls in the months of November–April. Both availability and quality of feed in the dry season are poor. Availability of fallow land for grazing has been reduced as a result of the construction of a water reservoir, which is used to irrigate rice fields, resulting in more intensive use of land for rice and maize cultivation. In addition, communal grazing lands are being progressively invaded by weedy plants, such as *Chromolaena odorata, Lantana camara* and *Ziziphus mauritiana*, resulting in reduced grass production, forcing farmers to find alternative feed sources for their cattle. Improved forage species are needed to improve the nutritional regime for grazing livestock.

Wild leucaena (*Leucaena leucocephala*) has been used by farmers as a source of high protein feed for their cattle and recently the improved cultivar Tarramba was introduced to Sumbawa. Acceptance of cv. Tarramba by farmers should not pose a problem, as it is merely a change from a wild plant to a cultivated plant (Dahlanuddin et al. 2017). We conducted basic observations on the growth and biomass production of cv. Tarramba in a rain-fed grazing area of Sumbawa throughout the year and results are reported here.

Materials and Methods

The study was conducted in Seteluk village, Sumbawa District. To obtain seedlings for planting a raised seedbed was prepared and seeds of cv. Tarramba were spread at high density on the surface in mid-May 2015, covered with soil and watered daily. Four months after sowing, at the start of the rainy season in September 2015, plants, which had established from germinated seeds, were manually pulled from the ground, foliage was trimmed to about 40–50 cm and roots were severely trimmed (Figure 1) and plants transplanted into alluvial soil as bare stumps (Setiawan 2010).

There were 5 blocks consisting of 25 plants/block at spacings of 2 × 1 m. No fertilizer was applied. Plants were allowed to grow for 12 months and plant height and main-stem diameter were measured at monthly intervals. At 12 months after transplanting all plants were cut at 1.5 m above ground level. During the subsequent year, forage above 1.5 m was harvested every 2 months. Biomass was weighed fresh and subsamples dried in an oven at 70 °C until constant weight to determine dry matter percentage. For this, 10 plants were randomly sampled at each harvest in each block. At each harvest main-stem diameter was determined at 1.5 m above ground level and number of all new regrowth primary branches was measured. Following sampling the remaining plants in each block were cut to 1.5 m as well. All harvested material was weighed, fed to cattle and the consumed portion calculated, based on the unconsumed amount which was weighed. Data were then analyzed for average values and standard deviations.

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Figure 1. Leucaena seedling nursery and bare-stump seedlings ready for transplanting.

Rainfall received during the study (Figure 2) started in November 2015 about one month after transplanting the leucaena, and heavy rain continued until April 2016, with the heaviest falls during February. Some rain was received in September 2016, when the initial cut was applied to the plants. Relatively high rainfall continued from October 2016 to April 2017 with heaviest falls in December–February. For the 2016/17 rainy season, when biomass production was measured, the rainy season was wetter and longer than in previous years, e.g. when compared with rainfall registered 2013–2015 (essentially no rain during June–November).

Results and Discussion

Height

Tarramba grew very well in this study, achieving a height of 3.7±0.1 m at 12 months after transplanting into the field (Figure 3). This result confirms the previous work on the growth of Tarramba reported by Panjaitan et al. (2015). The highest growth rate (42±0.3 cm/month) was achieved during the peak of the rainy season (February–April) and the lowest (9±2.5 cm/month) during the driest months of September–October. The differences in growth rate in the different seasons reflected the different levels of plant-available water in the soil.

Although there were big differences in height increase between the wettest and driest months, cv. Tarramba continued to grow and produce biomass during the dry season. This was most likely a function of the Tarramba root system, which is sufficiently deep to allow access to water deeper in the soil profile. Pachas et al. (2018) showed that leucaena roots could reach as deep as 400 cm. Furthermore, a previous study by Nulik et al. (2013) showed that cv. Tarramba grows very well in vertisols and alluvial soils.

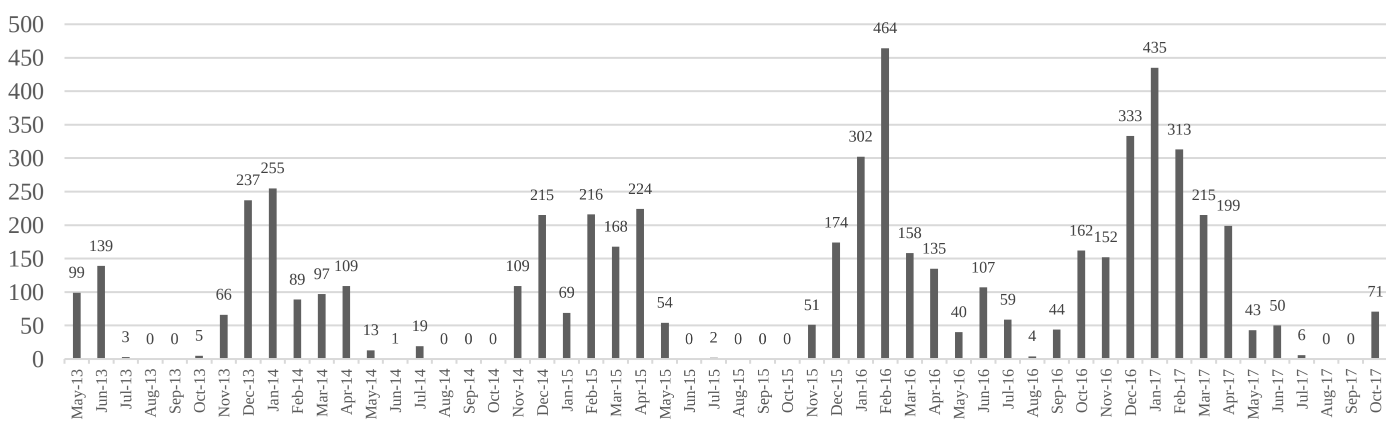

Figure 2. Rainfall during the study period in Sumbawa (BPS 2018).

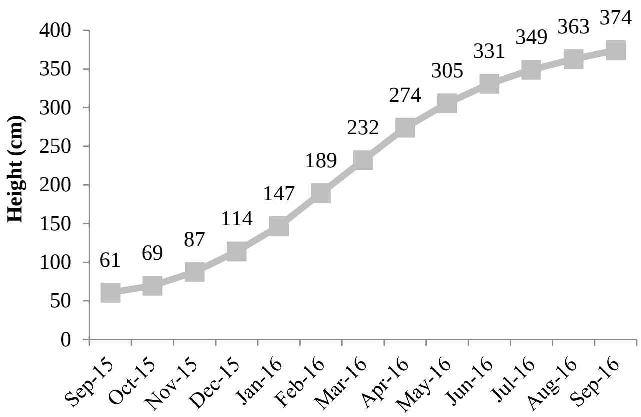

Figure 3. Progressive height of cv. Tarramba during the establishment year (2015-2016) under rain-fed conditions in Sumbawa.

Stem diameter

Main-stem diameter increased to 30 mm during the 12 months following transplanting but only a further 2.4 mm during the subsequent 12 months, when being harvested regularly (Figure 4). A longer study would be needed to determine what changes would occur as the plants matured. Since plants were cut regularly, the nutrients produced from photosynthesis during the harvesting period must have been used more for the formation of new branches and leaves than for growth of the main stem. The number of new primary regrowth branches produced between harvests remained relatively constant, varying between 13 and 15. This relatively constant number of primary regrowth branches enabled plants to produce a relatively constant amount of biomass (Figure 4) throughout the year, provided soil moisture levels were adequate.

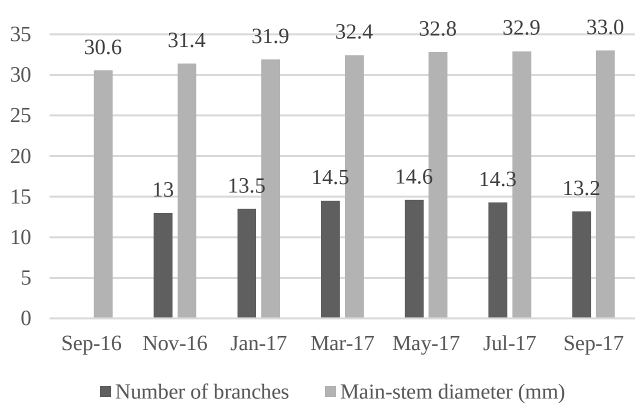

Figure 4. Main-stem diameter and number of primary branches of new regrowth produced by cv. Tarramba at 12 months after transplanting (September 2016) and at subsequent 2-monthly regrowth cuts under rain-fed conditions in Sumbawa.

Biomass production and forage consumption

Biomass production at the initial harvest 12 months after transplanting was 1.1±0.04 kg DM/tree, while subsequent regrowth (every 2 months) yields varied between 0.77 and 0.91 kg DM/tree (Figure 5). There was minimal variation in production between November and July but growth rates declined slightly in the July–September period to 0.77 kg DM/tree. Thus cv. Tarramba was able to produce significant amounts of biomass for cattle during both wet and dry seasons in this environment, suggesting it could be a useful feed source for cattle in rain-fed areas of Sumbawa.

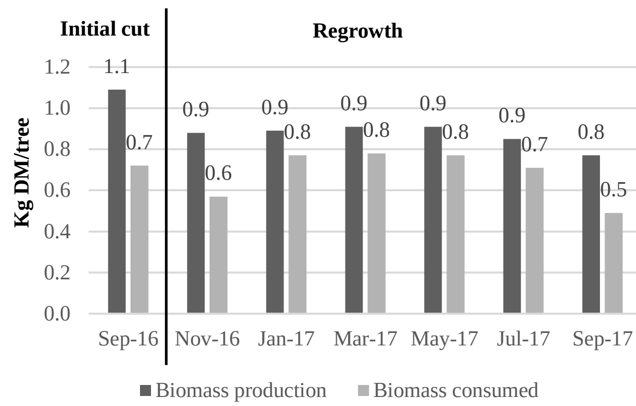

Figure 5. Biomass production and biomass consumed of cv. Tarramba at 12 months after transplanting (initial cut) and at subsequent 2-monthly regrowth cuts under rain-fed conditions in Sumbawa (2016-2017).

When the harvested forage was fed to cattle, the animals consumed an average of 76±11% of total harvested biomass (86±1% in the rainy season vs. 64±1% in the dry season) (Figure 5). The higher percentage of biomass consumed in the rainy season was due to a higher percentage leaf, softer branches and lower percentage of woody branches, making it more palatable for cattle. Although there were large differences in height increase in trees between wet and dry seasons (by a factor of 3–4), DM production varied by only 15.4% and consumed biomass by 37.2%, indicating that plants devoted more nutrients to woody growth in the dry season than in the wet. As these plants were in the development stage, results might have been different once trees matured. Thus longer-term studies are needed.

Conclusions

This study has shown that leucaena cv. Tarramba established well in the rain-fed areas of Sumbawa when planted by the bare-stump technique early in the rainy season and plants were allowed to grow until the late dry season before initial harvesting. Our findings suggest that Tarramba would provide a valuable feed source for cattle in Sumbawa in both rainy and dry seasons and support the findings of Dahlanuddin et al. (2019). Further studies are needed to determine the production of cv. Tarramba as plants mature as well as optimal harvesting regimes throughout the different seasons.

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(Note of the editors: All hyperlinks were verified 21 August 2019.)

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