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**Submission date:** 10-Sep-2024 02:48AM (UTC-0400)

**Submission ID:** 2429455396

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Cekturnitin\_Richard\_Osak\_.LRRD\_Replacement\_of\_Napier\_grass\_with\_legume\_tree\_foliage\_in\_the\_coconut-beef\_cattle\_integrated\_farming\_system\_Coco-Beef\_IFS\_1\_.docx (121.52K)

**Word count:** 1284

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## Replacement of Napier grass with legume tree foliage in the coconut-beef cattle integrated farming system (Coco-Beef IFS)

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### Abstract

<sup>1</sup>  
In order to understand the role of forage legumes in the development on sustainable cattle farm, we gathered data from an *insitu* experiment conducted in Blongko, South Minahasa Regency, Indonesia, on land under coco nut plants, cultivated with legume *Indigofera zollingeriana* and grass *Pennisetum purpureum* cv. dwarf. The goal of the research was to determine the impact of feeding *Indigofera* sp. fodder instead of *Pennisetum purpureum* fodder on the live weight gain of beef cattle (Peranakan Sumba) (n=12) aged 18 to 24 months. The treatments given were a comparison (fresh basis) between *Pennisetum purpureum* grass and *Indigofera zollingeriana* legume, were: 100:0, 60:40 and 40:60. Water was plentiful, and feeding occurred twice a day at a rate equivalent to three percent of LW as DM. Following two weeks of adaptation, 3 months were devoted to data collection. Weight increase and survival showed a linear association ( $R^2 = 0.97$ ) when *indigofera* sp. foliage leaves replaced up to 60% of the grass.

**Keywords:** environment, *Indigofera zollingeriana*, stocking rate, sustainability

### Introduction

Legume forage production offers multiple environmental benefit and can enhance sustainability of farming, but occasionally lower gross margins relative to other agronomical cropping options might make it less viable. It can be improved, though, by accounting for the higher yield of the succeeding crops and possibly reducing the requirement for inputs like fertilizer, biocide and tillage (Preissel et al 2015). Attributes that contribute to environmental sustainabilities are reduction in green house gas emissions as tree crops capture more carbon than crops or grasses (Osak and Hartono 2016). Using fodder legumes has significant positive effects on the environment (Papendiek et al 2016), particularly in terms of lowering green house gas emissions (Preston and Leng 1989).

Quantity and quality of fodder vary greatly in tropical areas like South Minahasa regency, especially in the dry season. So, cattle with slow development rates yield less. It has long been known that tree legume forage can provide high quality feed, especially during the dry season when grass supplies are significantly reduced. Additionally, because tree legumes are less vulnerable to adverse environmental circumstances like the dry season than grasses are, trees and shrubs can yield a sizable amount of feed all season long.

The legume *Indigofera* sp. is one of the most well-known tree legume plants in the region; it has significant calcium, phosphate, and protein content in its leaves.

Cultivating legume plants in coconut fields and applying bovine dung compost to coconut crops and fodder can lower fertilizer costs while improving the yield of coconut goods and fodder. Cattle, grasses, and legume plants are expected to increase land productivity on coconut farms (Anis et al. 2014).

Given that grasses store less carbon than trees and release more methane than tree legumes, legumeous trees make sense as a primary source of feed for ruminants (Maselema and Chigwa 2017; Preston et al 2019). *Indigofera* sp. can be used in place of grass to increase cattle output for coconut and meat. The integrated crop-livestock farming method contributes significantly to environmental protection and increased livestock productivity since it is resource-efficient (IFAD 2009). Research on the potential replacement of grasses with legume trees in the Coconut-Beef Cattle Integrated Farming System (Coco-Beef IFS) in South Minahasa, Indonesia, is thus necessary.

## Materials and Methods

The study was carried-out on coconut plantation land owned by a farmer group in South Minahasa Regency, Indonesia. The aim of the research was to determine the effects of providing diets containing *Indigofera* sp. instead of *Pennisetum purpureum* cv. dwarf fodder to beef cattle.



**Photo 1.** *Indigofera zollingeriana* and *Pennisetum purpureum* under coconut trees

The study, which was set up in a cut-and-carry feedlot system next to cooperative farmer-owned coconut farms, employed twelve Peranakan Sumba beef cattle. Cattle between the ages of 18 and 24 months were divided into groups of four animals and given 3 different treatments. The treatments included varying ratios of tree legume *Indigofera* sp. to grass *Pennisetum purpureum* cv. Dwarf. Grass : *Indigofera* were 40:60, 60:40, and 100:0 (new base). Feeding was done twice a day at a rate of 3% of liveweight (DM basis), and there was no charge for drinking water. Over the course of 3 months, feed intake & live weight changes were observed. The effect of the foliage on the increase in live weight was calculated using a linear regression of liveweight gain ( $Y = \text{kg/d}$ ) and the amount of *Indigofera* foliage in the diet ( $X = \% \text{ fresh basis}$ ).

## Results and discussion

The annual yield of fresh indigofera fodder on land planted with coconut trees was 31,990 kg/ha, which was lower than the 50,000 kg/ha noted in the ACIAR (2019) study. *Pennisetum purpureum* yielded an annual yield of 661 t/ha of fresh feed. Based on adult cattle consuming 40 kg of fresh feed per day (Osak et al 2018b), the stocking rate, or availability level of *Pennisetum purpureum* per hectare of land beneath coconut palms can be computed as 45 animal units (AU) per year.

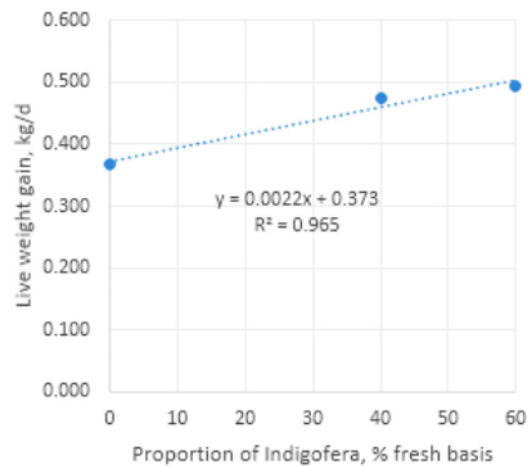
**Table 1.** Production of foliage of *Indigofera zollingeriana* and *Pennisetum purpureum* on land under coconut trees

	Fresh forage (kg/ha/year)
<i>Indigofera zollingeriana</i>	31,990
<i>Pennisetum purpureum</i>	661,900

The amount of *Indigofera* sp. leaf the cattle ate was found to have a linear link with their liveweight gain (Table 2; Figure 1).

**Table 2.** Average initial liveweight, final weight and daily liveweight gain

	Indigofera foliage, % in diet		
	0	40	60
Initial weight, kg	167	163	168
Final weight, kg	200	205	212
Live weight gain, kg/d	0.367	0.474	0.494



**Figure 1.** Relationship between liveweight gain and replacement of *Pennisetum purpureum* by *Indigofera zollingeriana* in the diet of beef cattle

The best ratio of grass : tree legume was 40:60 on the basis of cattle liveweight gain. However, in terms of stocking rate the best ratio was 60:40.

## Conclusions

- The best ratio of *Indigofera* tree legume to *Pennisetum purpureum* grass based on cattle live weight gain was 60 : 40 fresh basis.
- However, the best ratio based on legume forage availability or stocking rate was estimated to be 40:60.

## Acknowledgement

We thank the Directorate of Research and Community Service (DRPM), the Directorate General of Research & Development Strengthening, the Ministry of Research, Technology and Higher Education of the Republic of Indonesia, for funding the research that resulted in this paper through the PTUPT Research Grant.

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Received 21 November 2019; Accepted 30 November 2019; Published 2 January 2020

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