The Effect of Timor Island Legumes on Body Weight Gain of Post Weaning Bali Cattles

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Abstract: One major problem is the high mortality of calves due to feed shortages during the dry season. To overcome this problem, it needs feeding strategies based on local resources that can be provided by farmers. The purpose of this study was to determine body weight gain (BWG) of post weaning Bali cattle fed with legume. The study was conducted in experimental garden Lili, Kapang and designed with completely randomized design (CRD) 4 × 5; four kinds of legumes were used as treatment, such as: (1) Centrosema pascuorum; (2) Clitoria ternatea; (3) Desmodium sp.; (4) Leucaena leucocephala. Cattles used as the subject were separated into five groups based on body weight as the replication. The experimental data was tabulated and analyzed by covariance analysis (GenStat) and financial analysis (for analyzing revenue and real cost during the study). The result shows that legume feeding of Leucaena leucocephala at the second, fifth, eighth and ninth week have no significant effect (P < 0.05) to BWG, but shows significant effect (P < 0.05) to BWG at the fourth week. The feeding of Centrosema pascuorum, Clitoria ternatea, Desmodium sp. and Leucaena leucocephala to post weaning Bali cattle showed higher feed consumption and higher BWG, especially in Leucaena leucocephala treatment. Feeding legume to post weaning Bali cattle is also economically profitable (return/cost (R/C) ratio > 1).

Key words: Bali cattle, BWG, legume, Timor Island.

1. Introduction

Livestock farming applied in Timor Island is traditional pattern. Traditional pattern has several characteristics: (1) rely on native grass as feed; (2) cheap production cost; (3) less labor; (4) cattle productivity varies with season. Traditional pattern impacts on forage production in rainy season are different with dry season. In rainy season, forage production becomes abundant which help to increase body weight gain (BWG) of cattle. Contrary, in dry season, forage production and quality become lower and make cattle BWG reduced and calves mortality increased.

East Timor farmer usually use Bali cattle in their farm. Bali cattle or Bos sondaicus is Indonesian native cattle (Figs. 1 and 2). The Bali cattle has already spread across Indonesia now because of its high adaptability and become the highest population among other native cattle. Bali cattle has several characteristics: (1) white color of the snout, butt, ear tip, and white stocking form in both tarsus and carpus to upper edge of nail; (2) black color on switch; (3) red skin on cow, calf and steer; (4) black color on bull; (5) black line on the back. Bali cattle is adaptive to low quality feed and still has good reproduction function.

Pamungkas et al. [1] reported that Bali cattle had high fertility but also high in calf mortality. Malessy [2] recorded that calves mortality reached 47% from total calves born, while Fattah [3] reported 53.3%. Based on Wirdahayati et al. [4], the high level calves mortality was caused by bad handling in both the extensively rearing system and semi-extensive rearing system (ranging from 25% to 30%).

The weaning in Bali calves is applied mostly at seven months old, cited by Ref. [1]. The high calves mortality of Bali cattle can be reduced by accelerating the weaning time from seven months to three or six months [1], if calves were supported with good calves milk replacer at weaning process and sufficient fed
nutrition at post weaning [1]. Although Bali cattle are well adapted to low quality feed, they show better performance—0.14 kg/head/day on average BWG, after given 1.8% additional concentrate [1]. Based on this, good nutrition combined with early weaning management strategies can also improve the production of Bali cattle after weaning.

In order to improve the feeding strategy with low cost, it is very wise to utilize local resources for feeding. One of the local resources is pasture forage. Forages on pasture in Timor Island are dominated by native grass with very low productivity. In order to increase the productivity of these forages, legume crops, such as *Leucaena leucocephala*, *Clitoria ternatea*, *Centrosema pascuorum* and *Desmanthus* sp. were introduced on Timor Island. Those kinds of legumes are annual plant that is capable to grow and produce well even in the peak of dry season. With those kinds of characteristics, legumes become expected as protein source for cattle during dry seasons.

The objective of this study was to know the responds of several legumes feeding to post weaning Bali cattle, the level of feed intake and production cost of using this method. It is expected that feeding some kind of legume on post weaning Bali cattle can prevent calf mortality, improve BWG and also improve the farmer profit.

2. Materials and Methods

The study was carried out in 2008, for seven months from May to November, and was held in Lili experimental garden, East Nusa Tenggara Food Crops Research Institute, with characteristics as follows: (1) 50 m altitude above sea level; (2) rainfall about 1,000 mm/year. Cattles used on this study were 20 post weaning Bali cattle of six to seven months old with 71.50 kg to 75.20 kg. Average of body weight were 73.50 kg.

The method used in this study was completely randomized design (CRD) using four treatments: (1) *Centrosema pascuorum*; (2) *Clitoria ternatea*; (3) *Desmodium* sp.; (4) *Leucaena leucocephala*. The parameters measured were BWG every week, daily feed intake and production cost.

The treatment started by measuring body weight, and then cattle were ranked from the heaviest to the lightest. Cattle, which included in the first to fourth rank, were collected into one group. The application of four feeding treatments was randomly given to each of individual cattle inside every live weight group. At the first week, the cattle had been gradually introduced to experimental feed as the adaptation period before the real treatment was applied. The preliminary period started with adding 10% from treatment and then increased 15% each day for one week. Then, in the second week, the cattle given *ad libitum* feed (feed intake in the previous day + 20%) for one week. As the additional information, the basal
feed used was field grass. The collected data were analyzed by covariant analysis using CRD. The equation of CRD was:

\[ Y_{ij} = \mu + \alpha_i + \beta_j + \epsilon_{ij} \]  
(1)

where,
\[ Y_{ij} \] = dependent variable (result data);
\[ \mu \] = median;
\[ \alpha_i \] = effect of feeding legume treatment;
\[ \beta_j \] = group effect of group \( j \);
\[ \epsilon_{ij} \] = experimental error of treatment \( i \), group \( j \);
\( i = 1, 2, 3, 4, 5; \)
\( j = 1, 2, 3. \)

If there is significant or very significant difference between the treatments, then it will be followed by Duncan’s multiple range test. Data were analyzed with GenStat release 12.2 [5], while financial analysis was analyzed based on revenue and real cost spent during the study.

3. Results and Discussion

3.1 Nutrient Quality

Feedstuffs are usually evaluated by proximate analysis or modification methods of proximate analysis in order to get chemical analysis data called nutrient content. This nutrient content is the potential value of feed; meanwhile, the actual value of nutrition for livestock feed can be determined [6]. Rations that have the same chemical composition may not show the same impact on livestock performance. This is due to other influences, such as palatability and digestibility. This reason makes the evaluation of feed not enough by only analyzing feed chemical composition. There are other several factors need to consider, such as consumption, digestibility and feed efficiency [7]. The nutrient content of four types of legumes used as research material is shown on Table 1.

Based on Table 1, nutrient content of crude protein (CP) in four types of legume are 15.7%-21.3%. The highest CP was Clitoria ternatea, while the lowest CP was Desmodium. CP in four types of legume are higher than that in Ref. [8], which reported that CP of Clitoria ternatea was 18.8% and Centrosema pascuorum was 18.7% at 90 days after planting (DAP), while CP of Clitoria ternatea was 18.1% and CP of Centrosema pascuorum was 18.2% at 120 DAP.

This difference could be caused by several things, such as: (1) the soil condition where the plants are grow; (2) harvesting time; (3) stem and leaf sampling for analysis is performed unevenly.

The level of CP was reported to be positively associated with the consumption of dry matter (DM) and organic matter (OM) [9, 10], but negatively correlated with neutral detergent fibre (NDF) content via physical effects or filling effect [11, 12]; the body will use carbohydrates as an energy source so that the protein as a whole can be used in accordance with its basic function.

3.2 Feed Consumption

Consumption is the amount of food that can be eaten by livestock per unit of body weight within a specified time. Consumption is an important aspect to evaluate the nutrient value of feedstuffs. Variations in livestock production are influenced by feed, whereas the feed effect depends on consumption value.

Table 1  The nutrient content of four types of legumes used as research material.

<table>
<thead>
<tr>
<th>Legume</th>
<th>DMI</th>
<th>OMI</th>
<th>CPI</th>
<th>Crude fat</th>
<th>Crude fiber</th>
<th>N-free extract</th>
<th>Gross energy (kcal/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrosema pascuorum</td>
<td>80.2</td>
<td>93.4</td>
<td>19.6</td>
<td>2.9</td>
<td>11.8</td>
<td>59.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Desmodium sp.</td>
<td>76.3</td>
<td>93.7</td>
<td>15.7</td>
<td>3.9</td>
<td>10.6</td>
<td>63.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Clitoria ternatea</td>
<td>82.3</td>
<td>92.5</td>
<td>21.3</td>
<td>2.7</td>
<td>10.9</td>
<td>57.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Leucaena leucocephala</td>
<td>49.1</td>
<td>90.3</td>
<td>18.3</td>
<td>3.5</td>
<td>13.5</td>
<td>55.0</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Sources: chemical feed analysis results from Chemical Feed Laboratory, Animal Husbandry Faculty, Nusa Cendana, 2008.
[13] stated that the amount of feed consumed by livestock would affect the livestock productivity. The main source of ruminant feed is forage. Forage in tropical area usually has high fiber content that will limit feed intake and digestibility. The average of feed consumption for four kinds of legumes applied on post weaning Bali cattle was presented in Table 2.

In Table 2, legume consumption of post weaning Bali cattle increased from the third week to the ninth week except *Clitoria ternatea* (decreased from the fifth week to the eighth week). The consumption of *Centrosema pascuorum* tended to be stable (slightly increased every week except at the ninth week).

Analysis result of *Leucaena leucocephala* consumption at the second, fifth, eighth and ninth week showed significantly different ($P < 0.05$) compared with other legume feed consumption. On average result, *Leucaena leucocephala* showed the highest average than the other legume (0.71 ± 0.19 kg/head/day). This can happen because of feed consumption diversity. In addition, it is also due to individual factors of cattle, species or breeds of cattle, cattle physiological status, energy requirement for cattle, feed quality and environmental conditions.

Ginting and Tarigan [14] reported that DM consumption of *Capsicum pubescens* to goat were the highest (0.493 kg/day; $P < 0.05$). At the same subject, DM consumption of *Arachis pintoi* (0.466 kg/d) was not significantly different from *Arachis glabrata* (0.453 kg/d). Hartutik et al. [15] reported that the usage of cassava leaf silage added with tapioca byproduct as concentrate replacement on goat feed showed no significantly different for DM, OM and CP. Furthermore, Hartutik et al. [16] reported that the treatment of feed silage, corn stalks and corn leaves which there was the higher silage substitution level, made DM consumption, OM, and CP lower.

Groovum [17] explained that the level of feed intake of ruminants was influenced by the cattle physiological needs. Cattle physiology needs included basic need for life and production need. Cattle physiological need depends on the capacity of the cattle digestive tract itself.

### 3.3 BWG of Post Weaning Bali Cattle

Care and Barlet [18] explained that the growth is a manifestation of a change in the smallest units (cells) that have added number (hyperplasia) and increase in size (hypertrophy). It is said that growth is a combination of the growth of the various components that experienced different growth rates. BWG is the difference between body weights at a given time and the initial body weight. BWG can be used as an indication of the growth of cattle at any given time.

Based on covariance analysis result, the treatment from the first week to the third week show no significantly different effect ($P > 0.05$) on BWG, but on the other hand, the treatment show significantly different effect ($P < 0.05$) on BWG at the fourth week to the eighth week. Specifically at the fourth week to the eighth week, the feeding of *Leucaena leucocephala* shows the highest result on BWG, compared with *Centrosema pascuorum*, *Clitoria ternatea* and *Desmodium* sp.. This is due to the higher average

<table>
<thead>
<tr>
<th>Legume</th>
<th>Consumption (kg/head/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Centrosema pascuorum</em></td>
<td>0.21 ± 0.24a</td>
</tr>
<tr>
<td><em>Desmodium</em> sp.</td>
<td>0.23 ± 0.21a</td>
</tr>
<tr>
<td><em>Clitoria ternatea</em></td>
<td>0.36 ± 0.27a</td>
</tr>
<tr>
<td><em>Leucaena leucocephala</em></td>
<td>0.71 ± 0.19b</td>
</tr>
</tbody>
</table>

Superscript indicates a significant difference in the same column ($P < 0.05$).

<table>
<thead>
<tr>
<th>Legume</th>
<th>BWG (kg/head/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Centrosema pascuorum</em></td>
<td>0.26 ± 0.11a</td>
</tr>
<tr>
<td><em>Desmodium</em> sp.</td>
<td>0.16 ± 0.07bc</td>
</tr>
<tr>
<td><em>Clitoria ternatea</em></td>
<td>0.11 ± 0.06c</td>
</tr>
<tr>
<td><em>Leucaena leucocephala</em></td>
<td>0.21 ± 0.09ab</td>
</tr>
</tbody>
</table>

Superscripts indicate a significant difference in the same column ($P < 0.05$).
consumption of *Leucaena leucocephala* compared with others (Table 2). On the average result, the high average result was *Centrosema pascuorum* (0.26 ± 0.11 kg/head/d) and *Leucaena leucocephala* (0.21 ± 0.09 kg/head/d). This was due to the high stability of BWG each day recorded in every week, even the consumption not so high for *Centrosema pascuorum* and high result of BWG on *Leucaena leucocephala* on the fourth and eighth week.

![Table 4](image)

Ratnawaty et al. [19] reported that feeding of *Clitoria ternatea* and *Centrosema pascuorum* to fattening bull by 10% of body weight, with composition of 60% nature grass and 40% herbaceous legume, could increase bull BWG by 0.36 kg/head/d to 0.45 kg/head/day. Based on covariant result analysis at the fifth, sixth, seventh and ninth week, initial body weight shows that the feeding of legume give significantly different effect (*P* < 0.05) on BWG. This is due to the high organic content of *Leucaena leucocephala* in the form of the fermented propionic acid.

Pimentel et al. [20] reported that hay feeding added with *Leucaena pallyda* as feed supplement during the dry season gave the highest BWG (0.4 kg/head/d) followed by *Glirisidia sepium* (0.340 kg/head/d) and *Amoreira alba* (0.3 kg/head/d).

### 3.4 Financial Analysis

Financial analysis of farmer income from post weaning Bali cattle fed with legumes was shown in Table 4.

Based on Table 4, the average income received by farmer varied in four kind of legume feeding treatment. Variations in average income are an added value to farmers. In addition, it is becoming a reference for investors who want to invest for the development of early weaning Bali bull business. This is because legume feeding becomes feasible and profitable (return/cost (R/C) > 1 for all treatment). R/C > 1 indicates that the livestock farming is profitable, although the benefit of farmers is still low.

Several socioeconomic studies of traditional cattle farming reported quite various. Hartono and Rohaeni [21] reported that the contribution of traditional cattle farming in South Borneo was varying from 15% to 26%. Further, Nugroho et al. [22] reported that farmer income from livestock farming was Rp 1.699.606. Ratnawaty et al. [23, 24] reported that technological assistance of cattle fattening in Tobu village, Timor Island, made R/C value increasing gradually (1.10; 1.36 and then 1.60). The shorter time of cattle fattening makes maintenance cost lower, which impacts on higher revenue received by farmer.
4. Conclusions

Legume feeding of *Centrosema pascuorum*, *Clitoria ternatea* and *Desmodium* sp. on post weaning Bali cattle on Timor Island, East Nusa Tenggara in dry season showed higher consumption, followed by higher BWG especially on *Leucaena leucocephala* treatment. Legume supplementation with native grass forages can better improve cattle growth. This is because legume can give energy to increase the native grass forage digestibility. The responds of digestibility is shown in better BWG of post weaning Bali cattle.

Acknowledgments

The study was conducted in cooperation with Institute for Agricultural Technology of East Nusa Tenggara and Australian Centre for International Agricultural Research (ACIAR) Project.

References


