Profile and Income of Bali Cattle Farmers under Different Farming Systems in Southeast Sulawesi, Indonesia

Ahmat Endang Two Sulfiar1*, Citravia Agustin2, Tristianto Nugroho3

1 Faculty of Animal Science, Universitas Muslim Buton, Sulawesi Tenggara 93721 Indonesia
2 Budidaya Ternak, Akademi Peternakan Brahmaputra, Yogyakarta 55162 Indonesia
3 Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta 55281 Indonesia

*Corresponding author: ahmatendang@gmail.com

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ABSTRACT

The farmers in Southeast Sulawesi, Indonesia have started using the intensive farming system for Bali Cattle rearing in recent decades. This study aimed to determine the profile and income of Bali Cattle farmers under intensive, semi-intensive, and extensive farming systems in Southeast Sulawesi, Indonesia. The research was conducted using the Participatory Rural Appraisal (PRA) method. Profile and income data were collected from 105 farmers selected by purposive sampling. The analytical model used is one-way ANOVA with the farming system as a factor. The results showed that the age of intensive farmers was younger (p<0.05) and had a lower experience of raising livestock (p<0.05) than extensive and semi-intensive farmers. In addition, farmers in the intensive farming system have a higher goal of raising livestock as fertilizer producers (p<0.05) than extensive and semi-intensive. However, semi-intensive and extensive farming systems had a higher average number of cows, net body weight production yield, income, and value-added (p<0.05) than the intensive farming system. Based on the results, it can be concluded that semi-intensive and extensive farming systems generate high incomes and can be more economically sustainable than intensive systems.

Keywords: participatory rural appraisal, animal production system, farming system

INTRODUCTION

Bali cattle (Bos javanicus) are local Indonesian cattle spread all over the archipelago but have an exclusive habitat on the island of Bali. Bali cattle have a small body size and high resistance to tropical environments and low-quality feed while maintaining their performance. This advantage makes Bali cattle a driver of farmers' economy in various regions (Widyas et al., 2017). One of the areas with a large population of Bali cattle is Muna Regency, Southeast Sulawesi Province. Bali cattle population in the Muna Regency increased yearly (BPS-Statistics of Muna Regency, 2021). This increase was due to the intensification of livestock rearing, which previously raised livestock extensively and then developed to semi-intensive and intensive (Pagala et al., 2020).

The extensive Bali cattle farming system in Muna Regency has been carried out for generations. Due to intensification, 49.9% of farmers use a semi-intensive system. Meanwhile, farmers who still use the extensive system are 46.1%, and those who entirely use the intensive system are only 4% (Pagala, 2020). Parigi Subdistrict in Muna Regency has the second-largest beef cattle population after Tongkuno Subdistrict (BPS-Statistics of Muna Regency, 2021) and there are three reasonably evenly distributed farming systems (Munadi et al., 2021). The extensive system raises livestock by grazing or releasing livestock both day and night without additional feed and drinking water. In comparison, semi-intensive is done by releasing the cows in the field during the day and penning at night. In an intensive system, livestock is fully caged without being released outside, with the need for feed and drinking water provided by farmers (Rauf et al., 2015).
The extensive system has strengths in the form of low maintenance costs supported by a large amount of forage but has the disadvantage that the sales process is difficult due to wild cattle, uncontrolled livestock, and prone to theft. Cows in a semi-intensive system are easier to monitor, and feed adequacy can be met, but there are still problems prone to theft in this system. Meanwhile, the intensive system has guaranteed livestock safety and is accessible in marketing, accessing financial assistance, and handling health. However, this system requires large capital and adequate farming knowledge (Sari et al., 2016; Dung et al., 2019).

The reason farmers choose one system is closely related to the farmer's profile and their environment. Although widely used as a sideline, the livestock sector has a significant role because it is one of the pillars of their economy. Farmers refer to the motivation for raising livestock as financial security (savings), income, providing manure, utilization of agricultural by-products, increasing their social status, and cultural events and hobbies (Haq et al., 2019). However, in several studies, the most common motivation for raising livestock is savings because farmers consider selling livestock at unexpected times or large expenses, such as sending children to school, paying hospital bills for family members, or paying for weddings (Widi et al., 2015; 2020). Based on this condition, there may be differences in the profile and income of farmers in each system. Therefore, the purpose of this study was to examine the profile and income of Balinese cattle breeders in intensive, semi-intensive, and extensive rearing systems in Parigi District, Muna Regency, Southeast Sulawesi Province.

**MATERIAL AND METHOD**

**Description of the Sample Area**

The research was carried out in Parigi District, Muna, Southeast Sulawesi, Indonesia, in 2020-2021. Parigi sub-district was chosen because of the high livestock population, and the number of breeders in each rearing system is quite balanced, not dominated by one system. Extensive farming system samples were taken from Walambenower Village, semi-intensive from Wapuale, Wapangkal, and Warambe villages, and intensive from Labulu bulu village.

**Data Collection Method**

Data were collected from each region using the Participatory Rural Appraisal (PRA) method. Researchers approach farmers and their families to analyze their living conditions. The approach is conducted by interview and discussion, assisted by a questionnaire (Widi, 2020). A total of 105 farmers were selected by purposive sampling as the sample in this study. The sample selection was based on four considerations, including raising more than three cattle, applying one farming system (extensive, semi-intensive, or intensive), the farmer agreed and gave permission to be the subject of observation, and the location was accessible so that it could technically be used as a location for data collection.

Farmer profile data collected were named, age, education, occupation, the experience of raising cattle, number of family members, number of livestock ownership, the purpose of rearing, and family activity in raising cattle. The purpose of raising cattle data is to provide a rating of the importance of raising cattle. The motivation for raising that was asked was related to the function of livestock as savings, leading livelihood/business, and producing manure. The ranking given consists of the first rank with a rank of 3 (very important), the second rank is given a rank of 2 (important), and the third rank is given a rank of 1 (not important). Analysis of household activity in raising farmers was carried out on a scale of importance (3 very active, 2 active, and 1 inactive).

**Collection of Production Data and Farmer Income**

This study uses an analytical approach to assess farmers' income over the past year. The calculation of total production, net income from body weight, and value-added of cattle (savings, insurance, and manure) were done using the formula used by previous researchers (Budisatria et al., 2010; Haq, 2019). Estimation of the total net production is calculated as follows:

\[ Y_k = \text{FS}_k - \text{IS}_k + \text{S}_k - \text{F}_k - \text{OT}_k - \text{IT}_k + \text{C}_k \]

Note: \( Y_k \) = total net production of beef cattle (kg) of the \( k^{th} \) flock \( (k = 1, 2, \ldots, 105) \); \( \text{FS}_k \) = final body weight (kg) of the \( k^{th} \) flock at the end of the observation period; \( \text{IS}_k \) = initial body weight (kg) of the \( k^{th} \) flock at the start of the observation period; \( \text{S}_k \) = body weight (kg) of all cattle sold of the \( k^{th} \) flock; \( \text{F}_k \) = body weight (kg) of all cattle purchased into the \( k^{th} \) flock; \( \text{OT}_k \) = body weight (kg) of all cattle transferred into the \( k^{th} \) flock; \( \text{IT}_k \) = body weight (kg) of slaughtered cattle in the \( k^{th} \) flock; Net income from body weight (NI) is calculated using the following equation:

\[ \text{NI}_k = (Y_k \times \text{price per kg}) - (\text{feed cost + medicine cost}) \]
The feed cost variable in this study was limited to the cost of rice bran feed, and medicines for a year and did not include investment costs. The value of manure (VM) is calculated based on annual sales by farmers. The manure was sold without being processed. The formula used is:

\[ VM = \text{Manure production} \times \text{price per kg} \]

The value of livestock benefits as financial or savings is an additional result from livestock that sold when needed so that it allows farmers to meet their daily needs and can be analogized as savings from transaction costs when borrowing money (Moll, 2005). These benefits are defined as follows:

\[ F_k = Y_k \times F \]

Note: \( F_k \) = the value of the economic benefit; \( Y_k \) = selling price; \( F \) = financial factors (bank interest) from the research area (5.45%) (Source: Bank BRI, Muna Southeast Sulawesi, 2021)

The value of cattle as insurance is related to the capital invested in the group as a guarantee to meet unexpected costs and can be compared to premium insurance (Moll, 2005). Intangible benefits from insurance are expressed as an amount per year. The formula is used as follows:

\[ I_k = W_k \times S \]

Note: \( I_k \) = insurance benefits; \( W_k \) = number of cows in one farmer \( \times \) price per kg; \( S \) = factors of life insurance 8% (PT Insurance Jasindo AGRI, Southeast Sulawesi, 2021).

The total value of the benefits was defined as farmer income (FI) generated in one year can be calculated based on the following formula.

\[ FI = NI + VM + F + I \]

**Statistical Analysis**

Data were analyzed using one-way ANOVA, except education level which presented descriptively. If there are any statistically different between farming system, Duncan Multiple Range Test (DMRT) will be applied.

**RESULT AND DISCUSSION**

**Farmers Profile**

The profiles of Bali Cattle farmers with different farming systems in the Parigi Sub-district are presented in Table 1. The results showed that farmers who applied intensive systems had a lower age and experience in keeping cattle (p<0.05) than those who used extensive and semi-intensive systems. The family size in each system does not differ, ranging from 2-10 people with an average of 6 people. Education in the extensive and intensive farming system is dominated by junior high school graduates, while senior high school education dominates the semi-intensive system. Farmers consider “saving” as the most important motivation for raising cattle in all farming systems. Nevertheless, in the second place, farmers with intensive systems are more concerned with producing manure than as their main job or business. So that the motivation for raising livestock as manure producers were significantly different (p<0.05). Livestock rearing participation did not differ across all farming systems. The husband's role is the most active, followed by the role of the wife and children.

The farmer profile is one of the essential factors in the livestock farming system. The farmer's characteristics and living conditions can influence decision-making (Widi et al., 2014; Indrawirawan et al., 2021). Cattle farming with an intensive system is something new and different from the tradition of the people in Muna. Young farmers with low experience prefer intensive farming systems because they are easier to adopt an innovation. Old and experienced farmers find it difficult to change their farming system because they are comfortable with the extensive method. This finding was confirmed by the results of a previous study (Haq et al., 2016; Sulfiar et al., 2020b), which stated that it was easier for a young farmer to obtain information from various sources than older ones. In addition, inexperienced farmers are more concerned with business calculations and farm efficiency. Farmers with intensive systems prioritize livestock fattening because of faster cash flow, optimal feeding, and better management (Soraya et al., 2014). Meanwhile, farmers who apply extensive and semi-intensive prioritize breeding with a long keeping period but do not require high capital and maintenance skills (Budisatnia et al., 2021). In addition to age and experience, education is one of the things that can influence perspectives and ways of thinking. In this study, the education level of extensive and intensive farmers was dominated by junior high school graduates, while senior high school graduates dominated semi-intensive farmers. This level of education is likely why farmers choose one type of rearing system. Farmers with a high level of education tend to be more receptive to technology, financial support, information, and markets (Haq, 2016). However, the consideration of resources and the economic value of each farmer can be another consideration.
The motivation for raising livestock in a smallholder farming system is often as 'savings'. As confirmed in the present study, the three farming systems choose 'savings' as the most important motivation. It is quite relevant because the main job is as an agricultural farmer while raising cattle is only a sideline. However, from the farmers’ explanation, what they meant by “saving” is that the farmer can sell his cattle whenever they need much cash. Therefore, besides being “savings”, livestock can also be assessed as 'insurance' (Widi, 2015; Budisatricia et al., 2019). Breeders who use an intensive system make manure production a motivation for raising livestock in second place, while those with extensive and semi-intensive systems are in the third or last order. This condition is natural because the extensive and semi-intensive systems cannot collect manure optimally. In addition, the small number of livestock causes farmers not to take manure processing seriously (Sulfiar et al., 2020a). Family participation in livestock rearing is dominated by the head of the family (husband). The role of the wife on the farm is not very active because she has the primary task as a housewife and has been involved in other economic activities such as farm laborers, traders, and selling agricultural products. Children have the lowest participation because they do not yet have the burden of the family economy.

Cattle ownership is highly dependent on the farmer’s resources, including capital, land, and labor. The number of cattle in the extensive and semi-intensive systems was higher because the cattle were free to look for feed. So the farmers can raise more cattle without spending more on feed. Intensive farming systems require cages, feed resources, and more maintenance time, affecting the number of livestock adjusts to the farmer's ability. The total net production in the intensive system is lower because the goal is for fattening with a slight but fast increase in body weight. Fertilizer production in extensive and intensive systems cannot be calculated because it is not collected in cattle pens (Rauf, 2015).

**Farmers Income**

The production and economic income of Bali Cattle farmers in different farming systems are shown in Table 2. The results showed that farmers who applied extensive and semi-intensive systems raised more cattle ($p<0.05$) and produced higher ($p<0.05$) net body weight compared to farmers who applied intensive systems. The high production of body weight was also followed by income from body weight in the extensive and semi-intensive systems, which were higher ($p<0.05$) than the intensive system. In addition, differences in cattle ownership caused the added value of the insurance function in the extensive and semi-intensive systems to be higher ($p<0.05$) than in the intensive system. In the end, the total income in the intensive system is the lowest compared to other systems. Manure production calculations cannot be applied to extensive and semi-intensive systems because livestock is not always in cages. Therefore, manure production and added value can only be calculated in the intensive system.

### Table 1. Profile of Bali Cattle farmers under different farming systems in Parigi sub-district, Muna, Southeast Sulawesi, Indonesia (mean ± standard deviation)

<table>
<thead>
<tr>
<th>Farmers Profile</th>
<th>Extensive</th>
<th>Semi Intensive</th>
<th>Intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farmer (n)</td>
<td>19</td>
<td>41</td>
<td>45</td>
</tr>
<tr>
<td>Age (years)</td>
<td>$46.58 ± 10.28^b$</td>
<td>$47.07 ± 7.50^b$</td>
<td>$39.44 ± 7.37^a$</td>
</tr>
<tr>
<td>Experience in cattle keeping (years)</td>
<td>$12.53 ± 2.14^a$</td>
<td>$12.53 ± 2.14^b$</td>
<td>$6.00 ± 4.12^a$</td>
</tr>
<tr>
<td>Family size (n)</td>
<td>$5.98 ± 3.87$</td>
<td>$6.12 ± 4.42$</td>
<td>$6.36 ± 4.32$</td>
</tr>
<tr>
<td>Education (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary School</td>
<td>5.26</td>
<td>19.51</td>
<td>17.78</td>
</tr>
<tr>
<td>Junior High School</td>
<td>47.37</td>
<td>29.27</td>
<td>66.67</td>
</tr>
<tr>
<td>Senior High School</td>
<td>21.05</td>
<td>43.90</td>
<td>15.56</td>
</tr>
<tr>
<td>Bachelor</td>
<td>26.32</td>
<td>7.32</td>
<td>0</td>
</tr>
<tr>
<td>Motivations for keeping cattle *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Savings</td>
<td>$2.78 ± 0.62$</td>
<td>$2.88 ± 0.40$</td>
<td>$2.51 ± 0.69$</td>
</tr>
<tr>
<td>Main job and business</td>
<td>$1.45 ± 0.75$</td>
<td>$1.44 ± 0.67$</td>
<td>$1.76 ± 0.69$</td>
</tr>
<tr>
<td>Manure</td>
<td>$1.16 ± 0.37^a$</td>
<td>$1.01 ± 0.47^a$</td>
<td>$2.07 ± 0.65^b$</td>
</tr>
<tr>
<td>Participation of family members**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Husband</td>
<td>$2.68 ± 0.48$</td>
<td>$2.48 ± 0.64$</td>
<td>$2.60 ± 0.50$</td>
</tr>
<tr>
<td>Wife</td>
<td>$2.00 ± 0.88$</td>
<td>$2.37 ± 0.58$</td>
<td>$2.27 ± 0.59$</td>
</tr>
<tr>
<td>Child</td>
<td>$1.95 ± 0.78$</td>
<td>$1.17 ± 0.50$</td>
<td>$1.24 ± 0.65$</td>
</tr>
</tbody>
</table>

*The rank of motivation is 1 = not important, 2 = important and 3 = very important; **The rank of participation is 1 = inactive, 2: active and 3 = very active; *Different superscripts on the same line show significant differences ($p<0.05$).
The economic value of net production, in semi-intensive and extensive, is higher than intensive. The high economic income of semi-intensive and extensive farmers is influenced by the number of cows and the net production produced. The net economic value in the proportion that contributed the highest to total income was 88.38% and 88.37%, respectively. This result is in accordance with previous research that found that the clean production economy contributed highly to farmers' total income by 86.1% in the semi-intensive system (Sulfiar, 2020b). The high insurance value in the semi-intensive and extensive systems is due to the higher livestock ownership than the intensive system. Insurance value affects the total profit obtained by farmers (Moll, 2005). Insurance value does not provide actual benefits but becomes an important added value in raising livestock (Ouma et al., 2003). In terms of proportions, the economic value of semi-intensive and extensive system insurance contributed relatively high to the total income of 4.91% and 4.92%, respectively. Furthermore, the total income value generated by semi-intensive and extensive farmers is higher than intensive. This is influenced by the respective economic contribution of net production and livestock function as savings and insurance. Even though the scale of livestock farming is small, raising cattle can provide socioeconomic benefits for survival only by raising livestock (Ouma, 2003). These benefits can help farmers improve their agriculture's sustainability (Moll, 2005).

CONFLICT OF INTEREST

The author declares that there is no conflict of interest with other parties regarding funding and research objects.

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