Economic Value of Dwarf Elephant Grass and Dried Distiller Grain with Soluble as Feed of Smallholder Dairy Farm in Tulungrejo Village, Ngantang District, Malang Regency

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Abstract. The average number of lactation dairy cattle ownership in community farms in Tulungrejo Village, Ngantang District, Malang Regency ranges from 5-6 cows per household. Farmers rely on grass as the main feed for dairy cows and concentrate from local Dairy Cooperative as additional feed. Average milk production was 10-11 liters/cow/day. Changes in the use of feed types have occurred in the last two years. The use of elephant grass (Pennisetum purpureum) by farmers has slowly changed to dwarf elephant grass (Pennisetum purpureum cv Mott) until now. The amount of concentrate given was reduced and replaced by DDGS by ratio (concentrate: DDGS) 1: 4. This study analyzed the economic value of the use of dwarf elephant grass and DDGS as feed especially its impact on farmers' income. Data obtained through interview methods from 37 respondents of dairy farmers in Tulungrejo Village, Ngantang District, Malang Regency in July - September 2019. Data analysis was carried out in a descriptive quantitative manner. The results showed the average daily milk production increased by 18% or equivalent to 1.77 liters/cow/day and there was a 18.68% increase in farmer income or equivalent to IDR 7,397,160 within 2 years.

1. Introduction

Ngantang District is highly potential for dairy farming because it is supported by a suitable area and temperature for dairy cows. Most of the dairy farmer groups in the Ngantang District are members of the Sumber Makmur Dairy Cooperative. One area of Ngantang District with a population whose livelihood is as a dairy farmer is Tulungrejo Village. Geographically, Tulungrejo Village is located at 7°21′-7°31′ South Latitude and 110°10′-111°40′ East Longitude. The topography of this village is medium land, with an altitude of about 156 m above sea level. The total area of Tulungrejo Village is 780 Ha [1].

Dairy farming has an important role in the Indonesian economy, especially in contributing to the domestic milk supply. However, poor management of dairy farming by smallholder farmers has led to low milk production and quality. Milk quality affects the price of milk so that it will also have an impact on the farmers’ income. The average milk production from smallholder farming is 10 L/head/day. The poor management of smallholder dairy farming is caused by several factors, namely education, knowledge, skills, experience, age, and the main occupation of farmers. Bajrami [15] stated that the
smallholder dairy farmer still has limitations in running their business so that they did not take into account the amount of capital, production costs, and income.

Usually, smallholder dairy farmers only have a small number of dairy cows, which is between 1-5 cattle per farmer. This condition results in the low farmers’ income, which is only adequate to meet daily needs. According to Taslim [3], the diversity of business scale is influenced by differences in socio-economic conditions. The feed is a major part that contributes to the success of the livestock business. Forage is the only feed that is impossible to be imitated. One of the forages with high nutrient content is dwarf elephant grass. This forage has several advantages including fast growth, downy, soft leaves, high palatability, and fast regrowth. The application of regular defoliation on dwarf elephant grass will be able to trigger the growth of tillers. Other advantages of dwarf elephant grass are high forage production, crude protein (CP) content between 11-15%, and has a low crude fiber content [4].

Additionally, dairy farmers also use Dried Distiller Grains with Soluble (DDGS) as a feed supplement. DDGS is a good protein, fat, phosphorus, and energy source for dairy cows. The CP content of DDGS reaches 30% of the dry matter. DDGS also contains high Rumen Un-degraded Protein (RUP) or also known as protein by-pass for cattle [5]. Based on the description above, it is expected that the use of dwarf elephant grass and DDGS as feed for dairy cows could increase the milk production and quality, which then will have an impact on the increase in the farmers’ income. Therefore, this study aimed to evaluate the economic value of dwarf elephant grass and DDGS as feed of smallholder dairy farms in Tulungrejo Village, Ngantang District, Malang Regency.

2. Materials and methods

2.1. Location and methods

This study was carried out in Tulungrejo Village, Ngantang District, Malang Regency, starting from July to September 2019. This research was conducted in three dairy farmer groups in Tulungrejo Village. Dairy farmer group selection was done by purposive sampling, which was adjusted to the research objective. The respondents (n=37) were members of the Sumber Makmur Dairy Cooperative. The method used in this study was a survey using a quantitative approach. Data were collected in the form of primary data and secondary data. Primary data was obtained by direct interview using the questionnaire prepared previously. Primary data consist of costs, revenues, and income from milk production from the year before using dwarf elephant grass and DDGS (2017) and the year after using dwarf elephant grass and DDGS (2019). Secondary data were obtained from Sumber Makmur Dairy Cooperative.

2.2. Data analysis

In this study, the data were analyzed based on the purpose of the research. The approach of data analysis was descriptive quantitative, which described the development of dairy farming business with existing quantitative data.

3. Results and discussion

3.1. Overview of study location

Tulungrejo Village is located at 7°21’-7°31’ South Latitude and 110°10’-111°40’ East Longitude. The topography of this village is medium land, with an altitude of about 156 m above sea level. The total area of Tulungrejo Village is 780 Ha [1]. The majority of Tulungrejo Village residents work in the agriculture and livestock sectors. Dairy farmers in Tulungrejo Village are members of Sumber Makmur Dairy Cooperative. Based on data from the Central Bureau of Statistics of Malang Regency, the average rainfall in Tulungrejo village during 2010 was 2,000 mm. The highest rainfall occurred in December with 405.04 mm, which was also the highest rainfall during the period of 2009-2010.
3.2. Overview of respondent
The different characteristics of each farmer’s household could influence farm decision making. Some factors that influence livestock business include age, education, farming experience, and status of the main occupation.

3.2.1. Age
Work productivity is greatly influenced by age. According to Putri and Setiawina [6], the farmer will be able to earn more income at productive age compared to those at non-productive age. In this study, the average age of respondents was categorized as the productive age. In a study by Hertanto et al. [7], it was also found that most of smallholder dairy farmers in Yogyakarta were at productive age. It could be stated that physically, the respondents in this study had the potency to produce goods and services.

| Age (years) | Total | Percentage (%) |
|-------------|-------|----------------|
| <25         | 0     | 0              |
| 25-40       | 13    | 35             |
| 41–55       | 23    | 62             |
| >65         | 1     | 3              |
| **Total**   | **37**| **100**        |

3.2.2. Education level
The education level of respondents could influence the farmer’s well-being. Education is a benchmark for farmers' knowledge in the livestock business. Cahyono [8] stated that the level of education is one of the factors that affect income. The most dominant education level of respondents studied here was elementary school. While other respondents have education levels of junior high school, senior high school, and bachelor degree. In agreement with this finding, Nurtini et al. [9] also found that most of the smallholder dairy farmers in the Special Region of Yogyakarta and East Java had the education level of elementary school.

| Education level | Total | Percentage (%) |
|-----------------|-------|----------------|
| Elementary school | 16    | 43             |
| Junior high school | 9     | 24             |
| Senior high school | 9     | 24             |
| Bachelor degree | 3     | 8              |
| **Total**       | **37**| **100**        |

3.2.3. Farming experience
The knowledge of livestock farming in a community farming business is not only obtained from formal education, but also from the direct experience of livestock farming. The longer the farming experience, the more skilled the farmer will be. Lestari [10] stated that the farming experience makes it easier to overcome problems and make decisions, as well as determine the success or failure of someone in running a livestock business. The average farming experience of respondents in this study was quite long, around 18 years, with the shortest experience length was 2 years and the longest experience was 37 years.

3.2.4. Status of the main occupation
Basic human needs are divided into three namely, food, clothing, and shelter. To meet these needs, a person must work to earn an income. In this study, the most dominant main occupation of respondents was dairy farmers with 76% and the remaining 24% were other occupations such as other farming activities and the private sector. Previously, Nurtini et al. [9] also reported that most of the smallholder
dairy farmers in the the Special Region of Yogyakarta and East Java had the main occupation as dairy farmers.

3.3. Milk production
Table 3 shows the milk production of dairy cows before (2017) and after (2019) fed dwarf elephant grass and DDGS. The use of such feedstuffs could increase milk production by 18% or equivalent to 1.77 L/cow/day. The increase in milk production probably related to the improvement of nutrient supply after the use of dwarf elephant grass and DDGS. Dwarf elephant grass has soft stems and leaves with fine hair so that it was preferred by livestock. In addition, the CP content of dwarf elephant grass was higher than elephant grass. As previously reported by Sirait [11] that the CP content in dwarf elephant grass was 13.94%, which was higher than elephant grass with 9.79%. Although DDGS has a high price, this ingredient is still in demand by farmers due to the high CP content. Castillo-Lopez et al. [12] reported that the CP content of DDGS was 27.8% of the total dry matter. Also, the farmers believe that DDGS is still original and rarely found to be adulterated. While in concentrate, many ingredients are frequently adulterated. For example, the presence of husk in rice bran and coconut shell in copra meal, which may provide a negative impact on the productivity of dairy cows. Moreover, DDGS also had a high RUP content (56 to 72% of CP) [13,14] so that it can efficiently support milk production.

Table 3. Average daily milk production and number of lactating dairy cows before (2017) and after (2019) using dwarf elephant grass and DDGS

| Items                        | Year  |
|------------------------------|-------|
|                              | 2017  | 2019  |
| Total milk production (L/day)| 60.55 | 59.32 |
| Number of lactating dairy cows| 6     | 5     |
| Average milk production (L/cow/day) | 10.09 | 11.86 |
| Increase in milk production | 18 %  |       |

3.4. Analysis of farmers’ income
The results of the analysis of farmers' revenue, costs, and income before and after using dwarf elephant grass and DDGS are presented in Table 4. Revenue of smallholder dairy farms consisted of selling milk and cows. It was also reported that selling milk is a major revenue in smallholder dairy farming, which represented about 76-90% of total revenue [7,15]. As expected, after 2 years of the use of elephant grass and DDGS, revenue from selling milk was increased by IDR 23,658,106/year. Such improvement was strongly associated with the increase in milk production after using dwarf elephant grass and DDGS.

Production costs in this study include feed cost, cows purchasing, artificial insemination, electricity, forage tax, labors cost, and land rent for forage. The feed cost represented as the biggest factor affecting livestock business. Table 4 shows that feed costs accounted for the largest cost. This result was in accordance with Wardani [16], who stated that the feed cost was the largest cost of the entire livestock production. Yusdja et al. [17] stated that the feed cost in dairy farming could reach 62.5% of the total production cost. During 2 years period of 2017 to 2019, the forage and concentrate prices were increased by 40% and 25%, respectively. However, the use of dwarf elephant grass and DDGS slightly lower the proportion of feeding costs. As can be seen in Table 4, the proportion of forage and concentrate cost was decreased by 0.12% and 0.83%, respectively.

Income is the difference between revenue and total costs [18]. To make a profit, the amount of revenue must be greater than the total costs. As can be seen in Table 3, the use of dwarf elephant grass and DDGS could increase farmers’ income than before using such feedstuffs. During the two years, there was an increase in income of IDR 7,397,160/year (18.68%) from the previous income. It could be stated that the high nutrient content of dwarf elephant grass and DDGS led to improve milk production, thus increasing profit for dairy farmers.
Table 4. Average value of revenue, cost, and income of dairy farming before (2017) and after (2019) using dwarf elephant grass and DDGS

| Items                        | Year       | 2017       | Percentage (%) | 2019       | Percentage (%) |
|------------------------------|------------|------------|----------------|------------|----------------|
|                              | (IDR/year) |            |                | (IDR/year) |                |
| Total revenue                |            | 115,898,612| 83.88          | 141,656,162| 85.33          |
| - Milk                       |            | 97,218,056 | 83.88          | 120,876,162| 85.33          |
| - Cows                       |            | 18,680,556 | 16.11          | 20,780,000 | 14.66          |
| Total cost                   |            | 76,318,683 |                | 94,679,073 |                |
| a) Variable Cost             |            |            |                |            |                |
| - Forage                     |            | 9,375,000  | 12.28          | 11,514,524 | 12.16          |
| - Concentrate                |            | 47,906,250 | 63.00          | 58,867,658 | 62.17          |
| - Cows                       |            | 14,583,333 | 19.10          | 18,000,000 | 19.01          |
| - Artificial insemination    |            | 202,365    | 0.26           | 203,378    | 0.21           |
| - Transportation             |            | 2,954,167  | 3.87           | 4,348,000  | 4.59           |
| - Vitamin and mineral        |            | 330,000    | 0.43           | 360,000    | 0.38           |
| - Drugs                      |            | 197,027    | 0.26           | 274,378    | 0.28           |
| - Electricity                |            | 770,541    | 1.01           | 1,111,135  | 1.17           |
| b) Fixed Cost                |            |            |                |            |                |
| - Tax                        |            | 129,928    | 0.17           | 296,943    | 0.31           |
| - Housing and equipment      |            | 3,875,000  | 5.08           | 5,252,000  | 5.55           |
|   depreciation               |            |            |                |            |                |
| - Labors                     |            | 4,827,515  | 6.33           | 5,793,018  | 6.12           |
| - Land rent                  |            | 5,343,750  | 7.00           | 6,412,500  | 6.77           |

Income 39,579,929 46,977,089
B/C ratio 0.51 0.50
Income difference (IDR/year) 7,397,160
Increase in income during 2 years (%) 18.68

4. Conclusion
This study provides evidence that the use of dwarf elephant grass and dried distiller grain with soluble during two years is beneficial to increase nutrient supply for dairy cows, thus improving milk production by 18%. Such improvement also supports the increase in income for smallholder dairy farmers by 18.68%. Therefore, the use of dwarf elephant grass and DDGS is highly recommended to improve income for smallholder dairy farmers.

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