Analysis of rice-cattle integrated system model to support increased farmer income in Buke district, South Konawe regency, Indonesia

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Abstract. The purpose of this study was to determine the application model of the rice-cattle integrated system implemented by lowland rice farmers and to know the further acceptance of lowland rice farmers by implementing the rice-cattle integrated system. The population of this study was all lowland rice farmers or 25 people who implemented the integrated system. Determining the number of samples determined by the census. For this reason, the sample size of the survey was 25 people. The types of data used are primary and secondary data. The data analysis used is a descriptive analysis and provides an overview of the application model for rice-cattle system integration and income analysis at the study site. As a result, it is shown the integrated system application model applied by lowland rice farmers, namely cow fertilizer used as rice fertilizer and rice straw used as bran for animal feed. The income is IDR 29,068,731 / year. This income comes from the sale of cows.

1. Introduction

The integrated livestock rice system is one of the technologies used by farmers to increase their income by utilizing the potential of livestock such as cows that can be sold and their waste which can be used for paddy rice fertilizer [1]. In addition, lowland rice farming, whose waste can be used in the form of straw and bran for animal feed needs [2].

Local resources owned by Buke District have considerable potential in the development of an integrated paddy field rice system [3]. Based on data from the Badan Pusat Statistik (BPS), the area of paddy fields and the number of livestock in Buke District, Konawe Selatan Regency covers 637 ha and 3,534 beef cattle of the total land area and the number of livestock in this area are the main capital for efforts to increase rice production and livestock. However, from the planted area used, which is 637 Ha, only 540 Ha is capable of producing lowland rice production [4].

The lowland rice production conditions in the research location will certainly have an influence on the income of lowland rice farmers. Because the production costs incurred by farmers are quite high, but the production obtained is not optimal. So that farmers try to implement an integrated system with the aim of increasing lowland rice production and reducing the risk due to production failure from one type of farming, namely by having livestock products that can be used by selling, so that farmers still earn income to meet their daily needs [5].
The integrated system in its application is able to increase farm productivity, reduce agricultural waste and increase farmers' income. Based on several research results that have been conducted, the application of an integrated system between lowland rice and livestock will be able to increase farmers' income and productivity [6, 7]. In addition, the integrated system pattern is able to provide a marginal benefit cost ratio that is favorable for farmers compared to the existing pattern [8, 9]. Therefore, based on several studies, it shows that the application of an integrated system can provide economic benefits for farmers. However, research that focuses on small-scale household integration systems such as those carried out in research locations is very poorly conducted with an average land area of only 1 ha with an average of 2-3 cows [3]. This is the basis for conducting research with the aim of knowing the application model of the integration system and the income of small-scale household farmers.

2. Methods
The study was carried out in 2019 in Buke Subdistrict, South Konawe Regency, Indonesia. Respondents consisted of 25 respondents who applied the rice-cattle integrated system selected census. The data used are primary data and secondary data. The method of data analysis in this research is descriptive analysis to explain the technology application model of livestock rice integration system and income analysis according to [10], that is:

\[
\begin{align*}
\pi &= TR - TC \\
TR &= Q \times Pq \\
TC &= TVC + TFC
\end{align*}
\]

Information:
- \(\pi\) = Income (Rp)
- \(TR\) = Revenue (Rp)
- \(TC\) = Total Production Cost (Rp)
- \(Q\) = The number of products produced
- \(Pq\) = Product Price / kg (Rp)
- \(TVC\) = Total Variable Cost
- \(TFC\) = Total Fixed Cost

3. Results and Discussion
The pattern of integration between livestock and plants is to combine agricultural and livestock activities. This development pattern is known as the livestock rice integration system. This pattern is very supportive in the provision of feed and fertilizer because agricultural waste is used for beef cattle feed and livestock waste is used for fertilizer in paddy fields. The interaction between livestock and plants must be complementary, supportive and mutually beneficial, so as to encourage increased production efficiency and increase the benefits of agricultural products. This is as revealed in the research conducted by [11] which states that the application of the integrated livestock rice system results in a mutually beneficial reciprocal relationship where lowland rice plants provide animal feed needs in the form of straw and bran, while livestock raised by farmers provide organic fertilizer for lowland rice plants sourced from cow dung.
Figure 1: Integrated System of Paddy Paddy Farming and Beef Cattle

3.1. Integration System Model through Rice Fields
The rice and livestock integration system technology model applied by farmers at the research location is to use lowland rice plants to change straw and bran as additional animal feed. The conditions in the field indicate that the use of rice straw as animal feed is only used as additional feed (mixture) of forage, such as forage elephant grass and forage beans on garden land, forage is obtained by farmers looking for forage by mowing and then giving it to beef cattle in the pen. Rice straw is not a staple food for cattle, this is because farmers in the research location think that other forages are also needed for livestock growth, so that rice straw is only used as mixed feed with an irregular frequency of administration. The provision of straw is adjusted to the size of the cow's body, adult cows are generally given an amount of 8-12 kg of dry straw per day and sprinkled with salt water to increase the cows' appetite. In addition, farmers also use additional animal feed in the form of bran. Farmers use bran as a mixture to drink livestock, with the amount of giving 1-2 Kg of bran, a little salt (¼) for 20 liters of water per day per one cow.

Based on the results of the research conducted, it is known that the average production of fresh straw is 34.4 tons / ha / year, while according to research [12] stated that rice fields capable of producing dry straw were 13.76 tonnes / ha / year, with the fulfillment of 1 livestock feed from dry straw, namely 2.25 tonnes / ha. So if the respondent has an average of 4.08 adult cows, the need for dry straw is 9.13 tons / ha / year. Therefore, with the potential possessed by the respondent farmers, namely the production of BK Straw, which is 13.76 tons / ha / year, the availability of straw for animal feed is very sufficient with the difference in the availability of animal feed, namely 4.63 tons / ha / year.

3.2. Integration System Model through Beef Cattle
Based on observations in the research location, it shows that the use of manure by farmers with integrated systems for lowland rice plants is one of the efforts made in optimizing the use of resources owned by the farmers themselves, with the aim of being able to save on purchasing organic fertilizers and minimize the scarcity of inorganic fertilizers for paddy fields. owned by farmers, so that it can reduce the cost of purchasing fertilizers and is useful in reducing environmental pollution because cow manure is not dumped anywhere. The way for farmers to produce organic fertilizer from cow's fases which is used to fertilize rice fields is still very simple and manual. As for how it is made, the cow dung obtained is then dried.

According to Budiyanto's research, one adult cow per day is able to produce feces in the amount of about 8-10 kg / day, where with this amount, farmers are able to produce organic fertilizer as much as
1.5-2 tons [13]. So based on the results of research in the field in table 4 it is known that the average livestock ownership of the respondent is 4, so the organic fertilizer production that can be produced is 6 tons / year by taking organic fertilizer production per year, namely 1.5 tons. Meanwhile, the need for organic fertilizer used by respondents in their lowland rice business is only 2.1 tons per year. So that the availability of organic fertilizer from cattle that you have is still very sufficient, with the difference in the availability of organic fertilizer by 3.9 tons per year. Based on this amount, the respondent will be able to save on fertilizer costs in lowland rice production. So that this cost reduction will be able to increase the income of lowland rice farmers.

3.3. Analysis of Farmer's Income on Animal Rice Integration System in Buke District

The application of the integrated livestock rice system is one way that can provide increased income to farmers [14, 15]. Because farmers initially only source of income, namely lowland rice, but with the application of this integrated system model, farmers’ income can also come from the sale of cows [5, 16]. Following are the results of the analysis of income obtained by lowland rice farmers who apply an integrated system.

Table 1. Average Income of Respondent Farmers who Implement Animal Rice Integration System

| Characteristics          | Unit      | Score    |
|--------------------------|-----------|----------|
| Lowland rice farming costs | Rupiah / year | 5,752,099 |
| Beef cattle farming costs | Rupiah / year | 868,558   |
| Lowland rice production  | Kg / year  | 5456.01  |
| Beef cattle production   | Tail / Year | 2        |
| Lowland rice prices      | Kg         | 5,000    |
| Price of beef cattle     | Tail       | 5,372,000 |
| Rice Paddy Reception     | Rupiah / year | 27,280,050 |
| Cow Reception            | Rupiah / year | 10,744,000 |
| Total income             | Rupiah / year | 29,068,731 |

Based on the results of the income analysis, it was found that the income of lowland rice farmers after implementing the integrated system of livestock rice was Rp. 29,068,731 / year or Rp. 2,422,394 / month. The amount of income earned by respondents is because the costs incurred for livestock production are very small, this is different from the research conducted by Rp 2,540,862 / year. This is because types of costs such as feed, drug costs can be reduced by utilizing the output of the paddy field rice integration system. In addition, beef cattle maintenance efforts use more personal materials from farmers such as making stables and others that do not incur costs. Additional feed sourced from green grass is also obtained free of charge by utilizing wild plants around the respondent's residence. If the income of farmers who apply this integrated system is compared with the income of rice farmers or beef cattle breeders in the same location, namely in South Konawe district, then the income of farmers who are integrated systems is still higher, this is as in research [17] for lowland rice farmers Rp 5,569,154.30 / planting season as well as research on beef cattle breeders conducted by [18] that the income earned is Rp. 7,246,035. - / year. So it can be concluded that the application of the integration system for small-scale livestock rice at the research location is able to contribute to increasing farmers' income [2, 6, 19].

4. Conclusion

The model for the application of integrated system technology by farmers is to use rice straw for beef cattle feed and beef cattle manure to be used as fertilizer for paddy fields and an integrated system with a model like this is able to provide farmers with an income of Rp. 29,068,731 / year or Rp. 2,422,394 / Month.
5. References

[1] Yuliani D 2014 *J. Agrotek* **4** 15-26
[2] Kurniati N, Efrita E and Damaiyanti D 2019 *J. Agrikan* **12** 64-9
[3] Fyka S A, Limi M A, Zani M and Salamah S 2019 *Jitro* **6** 375-81
[4] BPS 2017 *Konawe Selatan dalam Angka*: BPS Konawe Selatan
[5] Parulian L, Munthe K P S and Haloho R D 2019 *J. Agrimor* **4** 23-5
[6] Kusumayana P and Arlina A 2017 *J Zira. Maj. Ilm. Pert* **42** 150-7
[7] Basuni R, Muladno M, Kusmana C and Suryahadi S 2015 *J Iptek Tan. Pangan* **5** 31-48
[8] Elly F H 2008 *J. Pert dan Peng. Pertanian* **27** 63-8
[9] Ahmed N and Garnett S T 2011 *J Food Secu* **3** 81-92
[10] Soekartawi 2002 *Prinsip Dasar Ekonomi Pertanian*: (Jakarta PT Raja Grafindo Persada)
[11] Mukhlis M, Noer M, Nofialdi N and Mahdi M 2018 *Inter. J. of Scie: Bas.App. Res* **42** 68-82
[12] Syamsu J A, Ali H M and Yusuf M 2013 In: *Inter. Conf. on Agriculture and Biotechnology IPCBEE*, pp 43-6
[13] Budiyanto M A K 2013 *J. Gamma* **7** 42-9
[14] Jayanthi C, Rangasamy A and Chinnusamy C 2000 *Mad. Agric. J* **87** 411-4
[15] Singh K, Singh S, Kumar H, Kadian V and Saxena K 1993 *Har. J. of Agro* **9** 122-5
[16] Boonyanuwat K and Wongsri M 2016 *Raj. Agric* **15** 22-6
[17] Salwia S, Dirgantoro M A and Rosmawaty R 2019 *Jia* **4** 106-10
[18] Hasiruddin H, Hafid H and Malesi L 2015 *Jitro* **2** 88-105
[19] Tipraqsa P, Craswell E T, Noble A D and Schmidt-Vogt D 2007 *J. Agri. Syst* **94** 694-703