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Integrated farming system of duck and rice in the coast of Tondano Lake in the Regency of Minahasa

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Abstract. Farmers on the coast of Lake Tondano, mostly cultivate rice crops. In addition, duck farming also developed by farmers as the source of their income. Development of duck with rice was done with an integrated farming system. The problem was, whether integrated farming system of ducks and rice can provide benefits to farmers. This research was conducted with the aim of analyzing the benefits of the integration of duck and rice farming. Determination of research locations in Minahasa Regency was carried out by purposive sampling. This determination was carried out with the consideration that the sample location was the center of development of integrated duck rice farming. Data analysis used was RC ratio and analysis of investment criteria (BC ratio, NPV dan IRR). Farmers' income from the development of integrated duck rice farming was more than non integration. The results of the research show that the revenue of integrated of rice duck farming per year was Rp. 75,546,633 with the costs of Rp. 49,013,896. The RC value of the ratio was 1.54 which shows that integrated farming provides benefits for farmers. The results of the investment criteria analysis show that the integration of duck rice farming provides benefits to farmers. This was shown from the BC ratio which has a greater value one, the NPV was positive and the IRR was greater than the bank interest rate that applies in the study area. Based on the results of the study it can be concluded that the integration of duck and rice farming provides greater benefits for farmers. Suggestions that need to be submitted were suggestions for the government to socialize the development of ducks integrated with rice.

1. Introduction

Farmers on coast of Lake Tondano, mostly cultivate rice crops. In addition, farmers also developed a duck as source of their income. Roes¹⁰ et al [1] suggested that duck is commonly cultivated in traditional breeding conditions in rural. Duck farming increases²ly in demand as an alternative source of income for people in rural and around cities. Duck became foundation of life most people who live in area of agroecosystem wet. Agroecosystem wet areas, namely rice fields, coastal lakes and watersheds. Development of duck with rice plants have been conducted with integrated farming system. Duck¹⁶ Sari et al [2] is one alternative that can be used to support community needs nutritious food, more disease resistant and grows faster than native chicken.

Ducks in the research area were cultivated in paddy fields after rice was harvested. Duck, in this case, consumes rice residues / wastes that fall out during harvest and small animals in the fields. Farmers move ducks to other fields if feed is not available or the remaining rice that has fallen out is



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consumed. In the afternoon the duck is grounded and given snails (“renga”) as feed. Snails are obtained by farmers from Lake Tondano. Amaludin et al [3] stated that at the location of agriculture, ducks were given feed in the form of agricultural waste containing high crude fiber.

Farmers who have long developed duck farming do not yet know whether the integration of paddy and duck rice provides benefits or possible losses. Some research have shown that integrated farming is environmentally friendly farming management. Duck management in environmentally friendly farming systems can encourage farmers to manage their farming optimally. The benefits of duck farming are easy to breed and not susceptible to disease. The problem was whether duck farming integrated with rice can provide benefits to farmers. This study aims to analyze the benefits of the integration of ducks and rice on the coast of Lake Tondano.

2. Material and method

The material in this research was land, breed (DOD), laying ducks and feed. Land was the area used by farmers for the cultivation of rice crops. Duck breeds were the number of ducks, prices and sources of breeds. Laying ducks were ducks that were cultivated by sample farmers. Feed was feed material, price and source of feed ingredients. The research method used was survey method with direct observation with case study approach. The type of data collected was time series and cross section with data source was primary and secondary data. Determining location of sample was done by purposive sampling with consideration of location which was a center of production of rice and duck at Minahasa Regency. The samples of farmers in Minahasa Regency were farmers who develop ducks around Lake Tondano. Respondents were determined by purposive sampling ie farmers who do duck cultivation integrated with rice plants. The number of respondents who were sampled amounted to 10 farmers. Data analysis used is feasibility study of farming with investment criterion using formula: Net B / C, NPV and IRR.

3. Results and discussion

Total area of watershed Tondano ± 54 142 ha located in Minahasa. Watersheds Tondano, located on upstream side, average slope of 45%, topography is hilly, sloping and steep and mostly or 76.77% of area is covered by vegetation shallow roots such as coconuts, cloves, moor, fields of reeds and thicket. The rest is area of Lake Tondano, fields, settlements and forest (an area of only 5.7%) [4]. Rice planting area of 10,220 ha with a production of 50,751 tons and 4,965 tons of productivity per hectare [5].

The success of integration of duck farming depends on characteristics of farmers. Research results show respondents aged between 41-50 years were 80% and 20% aged between 31- 40 years. Based on age of respondent can be categorized as belonging to productive age. Land area is managed by farmers and number of ducks owned can be seen in table 1.

Table 1. Land area and number ducks

No	Description	Number of Respondent	Percentage (%)
1	Land Area of Paddy (ha)		
	a. < 1	0	0
	b. 1-2	8	80
	c. >2	2	20
	Total	10	100
2	Number of Duck (Heat)		
	a. < 100	0	0
	b. 100 - 200	1	10
	c. 201 - 300	6	60
	d. 301 - 400	2	20
	e. 401 - 500	1	10
	Total	10	100

Data table 1 shows land area of rice which was cultivated generally (8 respondents or 80%) between 1-2 ha and > 2 ha by 2 respondents (20%). Land area cultivated affect productivity of rice produced. Number of duck maintained by 1 (one) of respondents (10%) respectively numbered 100-200 duck and > 400 duck. 6 (six) of respondents (60%) had a 201-300 duck, and two (2) of respondents (20%) who had a 301-400 duck.

Research results show total revenue from duck farming, non integration, amounting to Rp 51,726,300 per year, at a cost of Rp 34,891,750. Revenue from rice farming, non integration, amounting to Rp 23,820,333 per year, with cost of Rp 14,122,146. Rohaeni and R [2] [6] reported income of ducks farming 20.65% of total family income, with labor supplied by 11.35% of total labor of family in a year. Production costs in this study are classified into fixed costs and variable costs, such as in research of Taufik et al [7]. Ducks have potential business processes to be developed and marketed, either as a main or sideline business, so it is very helpful in increasing income and standard of living of farmers [8].

Farmer who develop integrated ducks with rice will receive higher revenues. Revenue from integrated duck farming is based on the results of research per year of Rp. 75,546,633 with production costs of Rp. 49,013,896. The value of the RC ratio of 1.54 indicates that integrated farming has an impact on increasing farmers' profits. Adiyoga et al [9] suggested that the benefits of plant-livestock combinations are directly related to increased productivity, income, and improved sustainability. If farmers cultivate more than one commodity, the risk of farming can be reduced. This is because crop failure for one commodity can be covered by other commodities. In addition, falling prices for one commodity can be covered by the prices of other commodities. The efficiency of the use of costs and the comparison between the total revenue and the total cost shows that farming is feasible. The duck farming developed not integrated shows the value of the RC ratio of 1.42 [10]. Elly et al [11] suggested that based on the potential of integrated duck farming, it could also be developed with agribusiness orientation. The results of the investment criteria analysis for integration of rice ducks are shown in table 2.

Activities ducks in paddy fields was also able to increase oxygen levels in soil and minimize growth of grass and other weeds and pests, such as insects, slugs and snails. On Integration of rice farming and duck is directed to maximize use of resources. Benefits derived from system integration of duck-rice was reduction of production costs (due to decreased use of fertilizers, pesticides and herbicides, as well as labor costs for grass weeding), rice produced was organic with selling prices higher, an increase in quality and condition of land, due to use of inorganic fertilizers was minimal, and cost of production of ducks was lower (because most of feed source derived from local materials).

Table 2. Analysis of investment criteria of duck-rice integration

No	Net B/C	NPV	IRR (%)
1	1.23	20,078,260.00	29.97
2	1.24	120,554,413.00	29.98
3	1.24	13,198,912.00	29.88
4	1.24	131,989,112.00	29.88
5	1.14	7,495,651.30	24.74
6	1.11	7,385,671.00	23.08
7	1.15	7,613,461.25	24.85
8	1.14	7,343,213.00	24.67
9	1.15	9,104,211.75	24.30
10	1.13	4,750,652.45	23.66

Farmers who apply farming systems livestock are integrated according to Risdiono [12] can gain several benefits, among others: diversification of use of production resources, risk can be reduced, an efficient use of labor, efficient use of production components, dependence of chemical and biology

energy, as well as other outside resources can be reduced, ecological system more sustainable and does not cause pollution to protect environment, increase output, and more stable farm household is more developed.

The data in table 2 shows that farmers who integrate rice-duck farming are feasible to develop. This was seen from the value of the investment criteria that shows the feasibility based on positive values for Net BC ratio and NPV, with IRR value greater than the interest rate of the bank. This means that if farmers borrow money at the value of their investment then they were able to repay loans with interest rates above 15% per year. But duck farming should be directed from traditional to more advanced farming by utilizing technology [13]. According to Perwati et al [14] and Sa'diyah et al [15] that to increase duck productivity it must be developed intensively.

3 Conclusion

Based on the results of this study concluded that the integration of duck and rice, provide benefits greater for farmers. The integration of duck-paddy farming is feasible to be observed from the value of $R / C > 1$, Net B / C and NPV positive, and IRR greater bank interest rate. Suggestions should be submitted to the government, to promote the development of the integrated duck with rice.

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