Comparative profitability of small-scale rice and horticultural farming in South Konawe District of Southeast Sulawesi

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Abstract. Shortages in the national rice supply are attributable to several factors, one of which is crop shift from rice to other crops. This study aimed to find out the amount of net returns from rice farming and horticultural farming which could be one of the reasons for crop shifting. The respondents were former rice farmers who had left rice farming and now grown melon, watermelon, or chili. Data were analysed using cost and returns analysis and paired sample t-test. The results showed that the average net returns of rice farming per farm were IDR29,667,325/year, and the average net returns per hectare were IDR21,181,531/year. For horticultural farming, the average net returns were IDR49,309,679/farm/year or IDR122,172,194/ha/year. Net returns from horticultural production were significantly higher than that from rice production. Such a significant difference in the net returns might be one reason for the crop shifting from rice farming to horticultural farming. Horticultural production provides high income to the farmers and supports local economic growth, but abandoning rice fields in the long run may not be in line with the promotion of food security both at the local and national level.

1. Introduction

Rice is the most strategic commodity in Indonesia. It is a staple food for 97% of households in Indonesia [1]. Given the essential role of rice for food security from national until the household level, the government has implemented various policies and programs to achieve rice self-sufficiency [1,2] and, as a result, Indonesia achieved rice self-sufficiency in 1984. However, since that year domestic production has not been enough to fulfil domestic demand, so that Indonesia has to purchase rice from international markets [3]. Shortages in the national rice supply are attributable to several factors such as increased demand due to growing population, climate change [4], land conversion, and crop shift from rice to other crops [5].

In Southeast Sulawesi, rice is the first leading commodity [6] and is cultivated predominantly in low-land areas. However, in recent years, there have been an increasing number of farmers in the province who shift their crop from rice to other crops such as oil palm [7], tomato [8], key lime [9], and pepper [10]. One possible reason for rice farmers to shift to other crops is the net returns [11]. If net returns from rice farming are less than that of other crops, farmers will probably abandon rice farming and grow other crops.

In Abenggi village in South Konawe district, rice farmers left their rice farming and shifted to other crops and livelihoods. The crops that they grew included melon, watermelon, and chili. At the local...
level, some push and pull factors had driven such crop shifting. However, at the macro level, the increase of horticultural crops is mostly due to market forces and changing consumer demand. Given the importance of rice in the national food security and the implication of rice farming abandonment to domestic rice supply, this study is designed to assess the profitability of rice farming and horticultural farming in the study area. Information from this study will be useful to understand whether net returns are one of the reasons for the crop shifting from rice to horticultural farming.

2. Materials and methods

The study was conducted in Abenggi village in South Konawe district. The village is located 43 kilometres from the provincial capital. The village was selected because its farmers had abandoned rice farming and now cultivated melon, watermelon, and chili. The village is now known as a horticulture-producing village and supplies melon and watermelon to the market in Kendari, the provincial capital. Data collection was done to assess and compare the economic returns of rice farming and horticulture farming. The study population was all 153 farmers who had shifted from rice to horticulture farming. The sample size was calculated using Yamane formula [12] at 10 percent of the significance level, so 53 farmers were selected as respondents. They consisted of 20 melon farmers, 20 watermelon farmers, and 13 chili farmers. Data were collected using an interview method based on the questionnaires. Variables collected included inputs, output, price, cost and revenue. The calculation of cost and returns for rice farming was based on the results from a previous study [5] combined with the present input and output prices and the recent condition of farming operation practices in the neighbouring villages [9]. Cost and returns analysis, descriptive statistics, and paired sample t-test were used to analyse data and information [5,13]. Since the crops have different life cycle length, costs and returns were calculated for one year. In all crops, unpaid family labourers were not included in the calculation of cost. Rice can be grown twice a year, while horticultural crops can be grown twice or three times a year, depending on the weather conditions. However, for easy comparison, cost and returns was calculated in one year.

3. Results and discussion

3.1. Socio-economic characteristics of respondents

The majority of respondents (77.4 percent) was with the age of less than 55 years old, so most respondents were in their productive ages. All respondents had completed formal education. The average length of formal schooling was nine years, or until the completion of junior high school. Slightly more than half (52.8 percent) of respondents had households with members of 2-4 persons, 45.3 percent had a household size of 5-7 persons, and 1.9 percent with a household size of more than seven persons. The average cultivated land area for rice was 1.4 ha, melon 0.36 ha, watermelon 0.43 ha, and chili 0.4 ha. Most farmers grew melon, watermelon or chili after quitting rice farming, so the average length of experience in horticultural production was less than ten years.

3.2. Net returns of rice and horticultural farming

Table 1 showed the cost and return analysis of rice, melon, watermelon, and chili farming. Net returns of rice farming were IDR29,667,325 per year, which was obtained from the revenue of IDR88,599,057 and the total cost of IDR8,931,731. Variable cost contributed 97.3 percent to the total cost, and the remaining 2.7 percent was from fixed cost. Items that constituted variable cost, in order of amount, were tractor, pesticide, labour cost, fertilizer, and seed. Depreciation of tools and equipment and land tax constituted fixed costs.

The net returns or net farm income in this study was higher than that in Watabenua, a neighboring village [9], and Konawe District [14]. However, the net returns were lower than the 2019 minimum monthly wage designated by the provincial government, which is IDR2,351,870 per month. Several main characteristics of the rice field that affect the net returns were high labour cost, low and fluctuating rice price, and low productivity. High labour cost was caused by a labour shortage and a
low number of tractors. Rice price was usually low during harvest due to high supply, an urgent need to sell produce soon after harvest, and lack of appropriate government protection. Some of the factors that lead to low productivity might include the use of non-certified seeds, lack of fertilizer use, poor soil quality, unsuitable pest and disease management practices, and inadequate water supply [11].

As found in the previous study [11], several characteristics that push farmers to leave rice farming are higher risk of failure, uncertainty in unhusked and milled rice price, reduced yield and returns, water shortage, labour shortage, and less functioning of farmer organization.

The average annual net returns of melon farming were IDR66,994,850 per farm (IDR167,487,125 per ha), which was obtained from the revenue of IDR92,198,400 and the total cost of IDR25,203,550. This level of returns is higher than that reported in several districts, such as Central Lombok [15], Banyuwangi [16], and Purworejo [17]. Variable cost contributed 98.8 percent to the total cost, and the remaining 1.2 percent was from fixed cost. Items that constituted variable cost, in order of amount, were mulch, seed, fertilizer, pesticide, bamboo sticks, and labours. Depreciation of tools and equipment and land tax constituted fixed costs.

The average annual net returns of watermelon were IDR57,123,574 per farm (IDR139,447,150/ha/year), resulting from the revenue of IDR71,400,000 and the total cost of IDR14,276,425. These net returns were higher than those reported in Central Lombok [15], Sragen district [18], and Banyuwangi district [19]. Variable cost contributed 98.8 percent to the total cost, and the remaining 1.2 percent was from fixed cost. Items that constituted variable cost, in order of amount, were mulch, fertilizer, labour and tractor, seed, and pesticides.

| No. | Crop             | Net returns (IDR/year) | Annual net returns (IDR/ha/year) |
|-----|------------------|------------------------|----------------------------------|
| 1.  | Rice             | 29,667,325             | 21,181,531                       |
| 2.  | Horticulture :   |                        |                                  |
| a.  | Melon            | 66,994,850             | 167,487,125                      |
| b.  | Watermelon       | 57,123,574             | 139,447,150                      |
| c.  | Chili            | 23,810,615             | 59,582,308                       |
|     | Horticulture (average) | 49,309,679 | 122,172,194 |

The average annual net return of chili farming was IDR23,810,615 per farm (IDR59,582,308/ha), which was obtained from the revenue of IDR32,599,057 and the total cost of IDR8,931,731. Variable cost contributed 98.6 percent to the total cost, and the remaining 1.4 percent was from fixed cost. Items that constituted variable cost, in order of amount, were mulch, fertilizer, pesticide, labour and tractor, and seed. Depreciation of tools and equipment and land tax constituted fixed cost.

Net farm income of chili farming is the lowest among horticultural crops being investigated. This amount is lower than those reported in Tabanan [20] and Deli Serdang North Sumatera [21]. These net returns were the lowest compared to melon and watermelon. However, it is still higher than per ha net returns from rice farming.

The result of paired sample t-test for per ha net returns is t(52) = 18.512, p = 0.001. The p-value 0.001 is less than 0.05, meaning that there is statistically significant difference between net returns from horticulture and that of rice farming. The result of the study showed that horticultural production was profitable. As indicated in Table 1, the average net returns for the three horticultural crops were IDR49,309,679, or IDR122,172,194/ha/year. The gap is IDR19,642,354/farm, or IDR100,990,663/ha/year. This result indicated that horticultural crops were much more profitable than rice. Thus, horticulture production is an important source of income for growers in the study area.

Despite high potential of net returns, farmers grew melon and watermelon in a small scale. The reason most cited by farmers was because the two crops were highly labour-intensive and required much capital, while there existed some risks that they had to anticipate. The main risk was related to...
the weather conditions that could bring both production and market risks. Pest and disease occurrence was the main production risk, while price fluctuation was the main market risk. Besides, since they are not staple foods, their demand does not increase proportionally with population growth. Therefore, the land area devoted for their production may decrease or increase depending on the price fluctuation.

Unlike melon and watermelon, chili is much needed in most Indonesian dishes, so consumer demand tends to be stable and shows a small response to price fluctuation [22]. However, stable consumer demand will create a price increase when the supply is low due to, among others, weather conditions. Therefore, chili is one of the few commodities that often create inflation. A sharp increase in price usually occurs during Ramadhan holy month when there is an increase in consumption.

Melon and watermelon are labour- and knowledge-intensive crops and are grown mostly in small-scale settings. Therefore, they might be preferred for the reasons for poverty alleviation and rural development. This preference is especially true as the relative price of rice has decreased and eroded its farm profitability. However, despite their rich content with vitamins and micronutrients, melon and watermelon are higher-value crops so that they often remain out of the reach of poor people. This means that the increase in horticultural production does not automatically lead to an increase in food and nutrition security. In fact, in the long term, abandoning rice fields could threaten food security at the local and national level as rice is still an essential staple food in Indonesia.

Farmers’ decision to leave rice farming and enter horticultural farming was driven by push and pull factors [11]. Net farm income is one of the pull factors that attract farmers to grow horticultural crops. Other factors may include a lower risk of failure than rice, shorter crop duration, mastery of skills in farming practices, reasonable market demand, and agro-climate suitability. These factors need to be investigated further to understand the trade-off between growing rice and horticultural crops so that the local government and all stakeholders can take appropriate policies to rightly balance the development objectives of rural economic development, poverty alleviation, and food security.

4. Conclusions
The results showed that the average net returns of rice farming per farm were IDR29,667,325 per year and the average net returns per hectare were IDR21,181,531 per year. Annual net returns of melon were IDR66,994,850 per farm (IDR167,487,125/ha), watermelon IDR57,123,574 (IDR139,447,150/ha), and chili IDR23,810,615 (IDR59,582,308/ha). The average net returns for the three horticultural crops were IDR49,309,679 (IDR122,172,194/ha). Horticultural farming was much more profitable than rice farming and the difference in net returns was statistically significant. The large difference in the net returns was one reason for the crop shifting from rice to horticultural production. Horticultural production provides high income to the farmers and supports local economic growth. However, in the long run, abandoning rice fields might not be in line with the development objective of promoting food security at the local and national level. The government and stakeholders need to take appropriate policies and programs to address the development objectives of rural development, poverty alleviation, and food security to achieve sustainable development.

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