The feasibility of environmentally friendly and conventional shallot farming in Bantul Regency

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Abstract. This study analyses the differences in costs, profit, and feasibility of environmentally friendly and conventional shallot farming in Bantul Regency. Data were collected from 128 farmers taken by cluster sampling and analyzed quantitatively using profit analysis and R/C ratio. The results showed that the total production cost of environmentally friendly shallot farming was 12.29% higher than conventional shallot farming, but conventional shallot farming had a higher profit of 4.194%. Both environmentally friendly and conventional farming is feasible, but the R/C ratio of conventional shallot farming is higher by 0.7.

1. Introduction

Shallots (Allium oscalonicum L) are strategic commodities that drive the national development of horticultural crops. Shallot production in Indonesia in 2015 was in four production center areas, namely Central Java, East Java, West Java, and West Nusa Tenggara. Shallot production in production centers applies a conventional agricultural system with intensive use of fertilizers and pesticides. Data from the Indonesian Organic Agriculture System in 2017 shows that there is no organic shallot production in production centers.

Selopamioro village farmers do not use toxic chemical pesticides that are harmful to human health or the environment. In June 2018, shallot farmers from Nawungan Hamlet, Selopamioro Village, had their first harvest of environmentally friendly shallot farming. Farmers in Selopamioro Village, especially Nawungan Hamlet, are different from other farmers in Bantul Regency. They have used chemical pesticides excessively, which causes lindan organochlorine residues to exceed the maximum residue limits.

Yogyakarta Special Region is not the largest shallot production center in Indonesia, but Bantul Regency, especially Selopamioro Village, Imogiri District, has implemented an environmentally friendly agricultural system. In addition, production growth was higher than the production centres of Central Java, West Java, and East Java, reaching 39.12% in 2016 [2]. Selopamioro village farmers do not use toxic chemical pesticides that are harmful to human health or the environment. In June 2018, shallot farmers from Nawungan Hamlet, Selopamioro Village, had their first harvest of environmentally friendly shallot farming. Farmers in Selopamioro Village, especially Nawungan Hamlet, are different from other farmers in Bantul Regency. They have used chemical pesticides excessively, which causes lindan organochlorine residues to exceed the maximum residue limits.

The term "environmentally friendly system" is deemed more appropriate than "organic system" because farmers have not fully implemented the organic farming system. It is only limited to the use of...
organic fertilizers and vegetable pesticides, but the land is not yet free from chemical residues from fertilizers and pesticides. This is because farmers still apply conventional farming systems to rice plants' cultivation, which are planted before shallots. The cropping pattern implemented by farmers in Selopamioro Village is rice-shallots-shallots. Shallots are planted in April / May for the first planting season and July / August for the second planting season. An environmentally friendly or conventional agricultural system implemented by farmers in the Bantul Regency affects production facilities, costs, and shallots' production.

From the above explanation, it is important to know the differences in costs, profits, and feasibility of environmentally friendly shallot farming with conventional shallot farming in Bantul Regency. The results of this study will be very useful as a material for consideration in making decisions about the use of shallot farming technology, given that there are not many onion cultivation systems that are organic or environmentally friendly, especially in Indonesia. In addition, there are not many scientific publications related to shallot farming that do not use chemical pesticides.

2. Methods
This research was conducted in Bantul Regency, Yogyakarta Special Region, Indonesia. The location of this research was determined purposively by the research objectives. An environmentally-friendly system is found in Selopamioro Village, Imogiri Districts, a hilly area, while the conventional method is in Parangtritis Village, Kretek District, which is in the lowlands. The two locations are shallot production centers in Bantul Regency. The determination of the sample of farmers was carried out using the cluster sampling technique. Data collection was conducted on 128 respondents using a survey method in August-October 2020 during the harvest season. Data analysis using descriptive analysis.

The differences in costs, revenues, profits, and feasibility of green and conventional shallot farming, using the cost, profit, and feasibility formula (R / C Ratio) as follows:

\[ TC = TEC + TIC \]

TC is the total cost, TEC is the total explicit cost, and TIC is the total implicit cost.

\[ \pi = TR - TC \]

\[ TR = P \cdot Q \]

Where \( \pi \) is profit, TR is total revenue, TC is the total cost, P is product price, and Q is the amount of production (kg) calculated on a land area of 1,000 m².

\[ R/C Ratio = \frac{TR}{TC} \]

Where TR is total revenue, and TC is the total cost. With the following criteria: if \( R/C > 1 \), then shallot farming is feasible to cultivate, if \( R/C <1 \), then shallot farming is not feasible to cultivate, and if \( R/C = 1 \), then red onion farming is not profitable or not loss [3].

3. Results and discussion
3.1. Characteristics of Shallot Farming in Bantul Regency
Shallot farming in Bantul Regency is generally cultivated in narrow land measuring 1,000-2,000 m² by farmers over 50 years of age with more than 20 years of experience running their farms. About 31% of conventional shallot farmers are elementary school graduates for education level, and 46.88% for environmentally friendly shallot farmers. Most of the farmers are landowners, and a small proportion of them are farmers who rent other people's land.
Table 1. Characteristics of shallot farming in Bantul Regency

| Items                  | Environmentally Friendly Shallot Farming | Conventional Shallot Farming |
|------------------------|----------------------------------------|------------------------------|
| Age (year)             | 50.91                                  | 52.58                        |
| Farming experience (year) | 20.77                                 | 23.42                        |
| Land area (m²)         | 1.453                                  | 1.824                        |
| Seeds (kg/1.000 m²)    | 105                                    | 99                           |
| Manure (kg/1.000 m²)   | 1.844                                  | -                            |
| Chemical fertilizer (kg/1.000 m²) | 108                  | 245.51                      |
| Liquid fertilizer (ml/1.000 m²) | 119.9                             | 163.34                      |
| Solid fertilizer (kg/1.000 m³) | 0.51                          | 1.019                       |
| Labor (HKO/1.000 m²)   | 46.04                                  | 31                           |

The average land tenure for environmentally friendly shallot farmers in Bantul Regency is 1,453 m², narrower than the land tenure for conventional shallot farmers which is 1,824 m² (Table 1). However, the average use of environmentally friendly shallot seeds is higher than traditional because the spacing is tighter, which is about 15 x 15 cm. In comparison, the spacing of conventional shallots is 15 x 20 cm. The main characteristic of environmentally friendly shallot farming is the use of manure. The high use of manure on environmentally friendly shallots is 1,844 kg/1,000 m², which is 84.4% more than ecologically friendly shallots in Tegal Regency [4]. Meanwhile, conventional shallot farming does not use manure. The use of chemical fertilizers in environmentally friendly shallot farming is 43.99% lower than traditional shallot farming. Less use of chemical fertilizers because farmers have used manure. However, the use of labor is higher than conventional shallot farming.

3.2. Shallot farming costs

Farming costs are all expenses or sacrifices used in farming activities, including labor value in the family and interest on own capital. Two kinds of prices in the production process must be incurred, namely explicit and implicit costs [5]. The explicit cost is the expenditure incurred by farmers to buy production factors, which refers to real spending regarding the purchase or procurement of input needs. Meanwhile, implicit costs are the opportunity costs of using production factors owned by farmers in the production process.

Table 2. The cost of shallot farming in Bantul Regency

| Cost Items (Rp/1.000 m²) | Environmentally Friendly Shallot Farming | Conventional Shallot Farming |
|--------------------------|-----------------------------------------|------------------------------|
|                          | Cost (Rp) | Percentage (%) | Cost (Rp) | Percentage (%) |
| Seeds                    | 4,798,844,30 | 40.42          | 4,009,741,63 | 37.93          |
| Fertilizer               | 1,188,645,30 | 10.01          | 956,706,49  | 9.05           |
| Pesticide                | 48,272,17   | 0.41           | 218,065,28  | 2.06           |
| Irrigation               | 1,011,431,33 | 8.52           | 829,074,87  | 7.84           |
| Labor                    | 3,246,551,20 | 27.35          | 2,797,879,28 | 26.47          |
| Depreciation             | 316,944,64  | 2.67           | 553,523,89  | 5.24           |
| Land rent                | 508,398     | 4.28           | 694,119     | 6.57           |
| Other cost               | 752,052,16  | 6.34           | 512,191,26  | 4.85           |
| Total cost               | 11,871,139,53 | 100            | 10,571,301,84 | 100           |

The results showed that the largest proportion of costs in environmentally friendly shallot farming in Bantul Regency was the seed production factor of 40.42%. The same results can also be seen in conventional shallot farming, where the seeds occupy the largest portion of production costs, which is...
According to many other research results, this finding states that the cost of sources generally occupies the largest amount of the fees of farming shallots [6,7,8]. However, this is different from the Central Java Province Agricultural Technology Research Center’s findings, which states that the cost of fertilizer occupies the largest proportion, which about 42.77%, followed by seed costs of 35.25% for environmentally friendly shallots in Tegal Regency [4].

The second-largest cost is the labour cost for both environmentally friendly and conventional, but the proportion is greater for environmentally friendly shallots. This result is different from the labour cost in shallot farming in Batu City occupies the largest position, which is 47.31% [9]. It also happens for environmentally friendly shallot in Tegal Regency, where labour cost is in the third position with 23.68% in number [4] and other shallot research [10]. It shows that shallot farming is quite labour-intensive.

The average cost of fertilizers used in environmentally friendly shallot farming is 0.06% higher than conventional shallot farming. It is quite interesting because environmentally friendly shallot farming only uses organic fertilizers and does not use chemical fertilizers. However, it turns out that the cost value is higher than conventional shallot farming that uses chemical fertilizers. It is the price that farmers with environmentally friendly systems must pay because their agricultural land quality will continue to improve in the long run. Meanwhile, conventional systems that use chemical fertilizers in large doses, in the long run, will reduce the quality of the soil and its environment.

The field findings show that environmentally friendly shallot farming still uses chemical pesticides, although in small amounts. It is seen in the very small proportion of pesticide costs, only 22.14% of the price of conventional shallot pesticides. Overall, the total cost of environmentally friendly shallot farming was 12.29% higher than traditional farming of shallot, and the results of t-test analysis showed a significant difference.

### 3.3. Profits of shallot farming

Profits are generally an indicator of the success of a farm [11]. Farming profits are closely related to several factors, including technology application, land tenure, input prices, and output prices [12]. If the increase in output prices received by farmers is not proportional to the rise in input prices that must be paid and is accompanied by inefficient farm management, it will result in low farm profits [13].

| Items                        | Environmentally Friendly Shallot Farming | Conventional Shallot Farming |
|------------------------------|-----------------------------------------|------------------------------|
| Production (kg)              | 1.116,97                                | 927,02                       |
| Price (Rp)                   | 23,335                                  | 34,086                       |
| Total revenue (Rp/1.000 m²)  | 26,627,866                              | 31,516,592                   |
| Total implicit cost (Rp/1.000 m²) | 3,018,457                              | 1,646,518                    |
| Total explicit cost (Rp/1.000 m²) | 8,852,683                              | 8,924,784                    |
| Total profit (Rp/1.000 m²)   | 14,756,726                              | 20,945,290                   |

The results showed that the profit of conventional shallot farming in Bantul Regency is 41.94% higher than environmentally friendly shallot farming, as shown in Table 3. The low profitability of environmentally friendly shallot farming is due to the low selling price and the relatively high implicit costs, although environmentally friendly shallots production are higher. The low selling price of ecologically friendly shallot farming happens because the harvest season coincides with the national shallot production center’s main harvest season in Brebes Regency in June-August. Meanwhile, the conventional shallot harvest season is after the national shallot production center’s main harvest in Brebes Regency in October 2020, so the selling price is higher.

The profit of environmentally friendly shallot in Bantul Regency is lower than the ecologically friendly shallot in Tegal Regency [4] but is higher than the profit of conventional shallot in Batu City [14]. The result shows that environmentally friendly shallot farmers are quite successful in managing
their farming and can still be improved. The difference in the profit value of shallot farming in various regions in Indonesia is generally caused by differences in planting seasons, seed varieties, allocation of fertilizers and pesticides, selling prices, and technology application by farmers.

3.4. Feasibility of shallot farming
The results showed that the R/C ratio for environmentally friendly and conventional shallot farming were 2.22 and 2.92, respectively, as shown in Table 4.

| Item                  | Environmentally Friendly Shallot Farming | Conventional Shallot Farming |
|-----------------------|-----------------------------------------|------------------------------|
| Total revenue (Rp/1.000 m²) | 26,627,866,02                           | 31,516,591,71                |
| Total cost (Rp/1.000 m²)   | 11,871,139,53                           | 10,571,301,84                |
| R/C ratio               | 2.22                                    | 2.92                         |

Based on the criteria for the R/C ratio value, a value greater than one is obtained so that it can be interpreted that shallot farming is environmentally friendly and conventional is feasible to be cultivated, although conventional farming is 0.7 greater than environmentally friendly shallot farming. This result is different from environmentally friendly shallot farming in Tegal Regency [4], which stated that the R/C ratio of environmentally friendly shallot farming is higher than conventional ones. It can be explained that with the capital of Rp. 11,871,139.53 (environmentally friendly) and Rp. 10,571,301.84 (conventional) can get sales results of 2.22 times and 2.92 times the total capital. The value of this R/C ratio is higher than the shallot production areas in Junrejo District [9], Cirebon Regency [10], and Majalengka Regency [15].

4. Conclusion
The results showed that the total production cost of environmentally friendly shallot farming was 12.29% higher than conventional shallot farming, but conventional shallot farming had a higher profit of 40.48. Both of two farming methods are feasible, but the R/C ratio of conventional shallot farming is higher by 0.7. Environmentally friendly shallot farming can be developed in other regions by observing the planting season, which does not coincide with the planting season at the national shallot production centers for a better selling price so that higher profits can be obtained.

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