Factors affecting the income of organic shallot farmers in Boyolali Regency

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Abstract. The consumption of organic products has become a new trend that is more environmentally friendly, healthy, and at better prices advantageous for farmers. Furthermore, organic farming reduces the greenhouse effect and global warming by absorbing carbon into the soil. This study aimed to determine the income factors of organic shallot farming and the cultivation efficiency in Boyolali Regency using the descriptive method. A simple random sampling technique was used to obtain the sample, consisting of organic shallot farmers in Cepogo District, Boyolali Regency. The R/C Ratio measured the efficiency of Shallots farming, and multiple linear regression analysis was used to determine the factors that affect farmers' income. The results showed that the efficiency of organic shallot farming was very good, as evidenced by the R/C ratio of 2,34. Farmers produce their farm inputs to reduce production costs. Factors that affect the income of organic shallot farming include land area, seeds, organic fertilizers, pesticides, and labor. Furthermore, they need improvements on the timeliness of application and how to apply a liquid organic fertilizer to create efficiency in cultivating shallots.

1. Introduction

Increased public awareness on food safety, health, environment, and nutrition influences the demand for clean and safe agricultural products. The environmental aspect is also a critical issue in the agricultural sector with food security, preservation of natural resources, and the environment at the national level for diplomacy and international trade. The latest issue was the use of pesticide, and the negative impacts include: 1) increasing resistance and resurgence of plant-disturbing organisms (OPT), 2) disturbing the balance of biodiversity, including natural enemies (predators) and other important organisms, 3) disrupting human and animal health, and 4) contamination of plant products, water, soil, and air. In Java, pesticide residues in food products, including soybeans, shallots, and garlic, have approached the maximum residue limits for organophosphates, carbamates, and organochlorines [1].

Shallots (*Allium ascalonicum* L.) is one of the horticultural crop commodities that humans widely consumed as a mixture of cooking spices after chili. Apart from being a mixture of cooking spices, shallots are sold in processed forms such as onion extract, powder, essential oil, fried onions, and even a medicinal ingredient to lower cholesterol levels and blood sugar and prevent blood clots, lower blood pressure and improve blood flow. As a horticultural commodity widely consumed by the public, the potential for development is still open for domestic needs and foreign countries[2].

Shallot production in 2014 was 1.234 million tons, which is an increase of 223.33 thousand tons (22.0%) compared to 2013. The consumption of shallots in Indonesia is 4.56 kg/capita/year or 0.38 kg/capita/month and has increased by 10% to 20% before religious holidays. The estimated demand for shallots in 2015 is 1,195,235 tons, divided into consumption needs of 952,335 tons, the seed needs 102,900 tons, industrial needs 40,000 tons, and export needs 100,000 tons [3].

The productivity of shallots is still relatively low, with a range of 9 tons/ha, while its potential can reach 17 tons/ha [4]. Therefore, it is necessary to cultivate the following standardization to obtain maximum production. In terms of cultivation, fertilization is necessary to obtain the desired result. It is carried out at two levels: organic and inorganic fertilizers [5]. The use of organic fertilizers in agriculture is known as organic farming. Onion production is increased through fertilization to increase soil

productivity by providing plant nutrients. Manure has natural properties that do not damage the soil, and it provides a macro (nitrogen, phosphorus, potassium, calcium, and sulfur) and microelements (iron, zinc, boron, cobalt, and molybdenum). In addition, it increases water resistance, soil microbiological activity, cation exchange capacity, and improves soil structure.

Shallots are one of the leading vegetable commodities that have been intensively cultivated for a long time. This vegetable commodity belongs to the unsubstituted spices that function as a food seasoning and traditional medicine. This commodity is also a source of income and employment opportunities, contributing relatively to regional economic development [6].

Most of the Cepogo Districts residents are organic shallot farmers. A suitable environment for red onion cultivation considers temperature, humidity, and water availability. Furthermore, the altitude of the place located on the mountain's slopes makes most of the population cultivate organic shallots. Shallots are vegetables in high demand, both for the domestic and export markets. They are divided into two, namely big red, and rubber bali onions. Most Indonesians consume fresh, dried, or processed shallots because they are superior national commodity and source of vitamin C.

Cepogo District is one of the areas that produce organic shallots. It was established in 2015 and is an organic red onion-producing area. Based on statistical data, it experienced a significant decrease in organic shallots' productivity from 2015 to 2019, and in 2015 the productivity reached 11.05 tons/ha, then in 2019, it fell to 6.76 tons/ha. Based on the land tenure status of farmers, the differences in income may vary widely. This is due to differences in the use of various factors of production in the region. This difference causes the land ownership to be the results of these farmers' total income.

2. Materials and methods

The primary method used to conduct the study activities in the Utomo Jayan Farmer's Group, Gedangan Village, Cepogo District, Boyolali Regency, was the descriptive analysis. The selection of the location was carried out intentionally or purposively, based on specific considerations of the objectives. The location was selected by considering several reasons, including the need to overcome the income constraints of organic shallot farming in the Utomo Jayan farmer group. The study was conducted in the Utomo Jayan Farmer's group because this farmer group is one of the producers of organic shallots. Furthermore, it was held in August – November 2020, starting from finding and determining the location, as well as carrying out the study.

The data were analyzed using the R/C ratio to determine the cost efficiency of organic shallot farming. The greater the R/C ratio value of a commodity, the higher the profit or efficiency. The commodity is more cost-efficient when the R/C ratio is> 1, but when the R/C ratio = 1, it is neither profiting nor losing (break-even). On the other hand, the commodity is inefficient to produce when the R/C ratio is < 1[7]. Regression analysis determined the effect of land area (X1), seeds (X2), fertilizers (X3), pesticides (X4), labor (X5). The Y income of organic shallot farmers is in Gedangan Village, Cepogo District, Boyolali Regency. The multiple linear regression equation formulae are:

$$Y = a + \beta 1X1 + \beta 2X2 + \beta 3X3 - \beta 4X4 + \beta 5X5 + e \quad (1)$$

Where Y is Income (Rp), a is Constant, is Regression Coefficient, X1 is Land Area (Ha), X2 is Seeds (kg), X3 is Organic Fertilizer (kg), X4 is Pesticide (L), X5 is Labor (HOK), and e is Error.

3. Results and discussion

3.1. Analysis of efficiency and income of organic shallot farming

The cost of farming production on shallots illustrates the amount of production input and costs incurred. Production costs incurred consist of fixed (TFC) and variable costs (TVC). The calculated costs are land tax and agricultural equipment depreciation costs based on the study results. Fixed costs incurred are the depreciation of the equipment used and the average depreciation cost of the equipment, such as hoes,

sickles, and sprayers with an average economic life of 5 years. Fixed costs are incurred and have nothing to do with the number of products produced, such as the depreciation of the means of production.

Furthermore, variable costs change when farmers' production factors change. The average variable costs that farmers should pay can be seen in Table 1. Variable costs incurred for the sample are 50 farmers who use seeds, organic fertilizers and pesticides, as well as boosters.

Tabel 1. Cost usage of shallots farming business.

No	Description average land area 0.176	Physical (Kg)	Price per unit (Rp)	Average per farming business (Rp)	Total Per hectare
1	UN Tax			25,000	142045
2	Shrinkage				
	Hoe			40,000	227272
	Scythe			20,000	113636
	Sprayer			70,000	397727
3	seeds	25,334	35,000	1,266,700	7197159
	Organic fertilizer				
4	a. Manure (Kg)	983,333	2,000	1,966,666	11174238
	b. POC (L)	4.6	7,000	32,200	182954
	Organic pestiside				
5	a. PJPR (L)	4.6	7,000	32,200	182954
	b. Tricoderm (L)	5.77	3,500	20,183	114676
	c. Booster (L)	2.67	20,000	53,333	303028
6	TKLK	10	65,000	650,000	3693181
Total (Rp)				4,176,282	23,728,873

The average organic shallots per farm production are 408 kg or 2318 per hectare. Subsequently, the average income received after the product obtained is sold Rp. 9,800,000 per farm or Rp. 55,681,818 per hectare. The R/C ratio value shows 2.34, which means that organic shallot farming has been efficient in its operations. Farmers produce their farm inputs to reduce production costs. Farmers produce their seeds, organic fertilizers and pesticides to reduce production costs.

According to Suratiyah [8], multiplication between production and selling price with farmers' revenue for every rupiah spent is influenced by the number of products and the unit price of the resulting production. Therefore, the higher the amount of production and the unit price of products produced, the higher the farm income.

Income is the difference between receipts and total expenses or total costs. The average income received by farmers per farm is Rp. 5,623,718. Revenue was more significant than the total costs incurred, therefore, farmers' income can cover all costs incurred in the production process of shallot farming. This shallot farming is a promising farm for their come in the study location. The average income of farmers is large enough to cover the necessities of life and support the household finances when the prices of the primary agricultural commodities fall. R/C of shallot farming in Boyolali regency is higher than the shallot farming in Torongrejo Village, Batu City, East Java (R/C ratio of 2.09)[9], Cirebon (1.65), Brebes (1.42), and Tegal (1.68) [10].

Table 2. Total cost, revenue, and income of shallot farming.

No	Description average land area 0.176	Per farming business	Per hectare
1	Total cost (Rp)	4,176,282	23,728,873
2	Production (kg)	408 kg	2,318 kg
3	Price (Rp)	24,000	24,000

4	Revenue (Rp)	9,800,000	55,681,818
5	Income (Rp)	5,623,718	31,952,945
	R/C ratio	2.34	2.34

3.2. Factors affecting the income of organic shallot farmers

The coefficient shows the independent contribution to the dependent variable or the variation of Y explained by the linear effect of X. The independent variable gets more significant when the value of the determination coefficient given the symbol R2 is close to 1. Therefore, the relationship can be approached using the dependent variable to justify the model. Based on the table above, the Adjusted R Square value of 0.933 means that the variation of changes in the cost of organic shallot products was 93.3% and can be explained by production factors of land area, seeds, organic fertilizers, pesticides, labor costs, and revenues. In comparison, other factors outside this study model explain the remaining 6.7 %.

Table 3. Regression results of factors affecting shallots' income.

Variable	coefficient	Std. Error	t-Statistic	Prob.
Ln X1	-0.029^{ns}	0.037	-0.801	0.431
Ln X2	0.139^{ns}	0.089	1.556	0.133
Ln X3	0.408*	0.188	-2.174	0.060
Ln X4	-0.257*	0.091	2.832	0.099
Ln X5	0.005	0.020	0.228	0.821
C	2.048*	1.004	2.040	0.052
R-squared		0.947		
Adjusted R-squared		0.933		
F-statistic		68.317		
Prob (F-statistic)		0.000*		
Durbin-Watson stat		1.835		

note: * significant at the 90% confidence level, ns is not significant.

The simultaneous F test shows whether all independent variables included in the model combined with the dependent variable. The F test compares the calculated results with the F table to accept the alternative hypothesis, which states that all independent variables affect the dependent variable simultaneously and significantly. The simultaneous test aims to determine the effect of the factors of land area, seeds, organic fertilizers, pesticides, labor costs together (simultaneously) on the income of organic shallots (Y) by looking at the calculated F value or p-value (sig column). Furthermore, the calculated F value is 68.317 with a significance of (0.000) < 0.01 and 0.05, meaning that the selected model has a very significant effect on the production cost of organic shallots.

A partial test or t-test aims to determine the effect of production factors (X) separately (partial) on the income of organic shallots (Y). Based on the results of the t-test in Table 3 above, the fertilizer and pesticide variables have a significant effect on the income of organic shallot farmers. Organic fertilizers given to plants will increase crop production. However, they can reduce the rate of increase to achieve optimal production when given in excess. Organic pesticides significantly affect farmers' income because each use reduces crop losses due to plant pests on shallots.

The use of biopesticides, specifically vegetable pesticides, is the local wisdom of the Indonesian people. The use of botanical pesticides has received significant attention and the emergence of negative impacts of synthetic pesticides on health and the environment. Demand for plant-based pesticides increased with the development of organic farming and the prohibition of synthetic chemical pesticides [11]. Indonesia is the second-largest country globally after Brazil, with rich biodiversity, including plant pesticide ingredients. Multiple pesticide formulas Vegetables for controlling pests have been produced, and some are exported to neighboring countries. However, the development of botanical pesticides faces several obstacles, including (1) slow-acting, unlike synthetic pesticides, where action can be seen

quickly [12]; (2) the number of synthetic pesticides circulating in the market creates many selections and the ease of obtaining pesticides [13]; (3) the difficulty to obtain raw materials in large quantities because people are reluctant to develop them and rely solely on nature [14]; and (4) the difficulty of the registration and licensing process [15].

4. Conclusions

The main finding is that using costs in the production of organic shallots is efficient, as proved by the R/C ratio of 2.34. Factors that significantly affect the income of shallot farmers are the use of organic fertilizers and pesticides. Furthermore, they produce their farm inputs to reduce production costs. Factors that affect the income of organic shallot farming include land area, seeds, organic fertilizers, pesticides, and labor. Farmers need improvements on the timeliness of application and how to apply a liquid organic fertilizer to have high efficiency in cultivating shallots.

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