Factors Affecting of Shallot Production in Nganjuk District

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ABSTRACT

Shallots are among the strategic commodities prioritized by the government to ensure national food security. Shallot farming is notably seasonal, with the rainy season marking the off-season and the dry season marking the in-season, during which farmers generally achieve high yields. This research aims to assess the production levels and the factors influencing them. The study was conducted in Nganjuk District, selected due to its position as the largest shallot-producing area in East Java, with a total of 60 samples. Data analysis included descriptive analysis and multiple linear regression. Findings indicated high shallot production levels, averaging 14 tons per hectare. Key factors significantly impacting shallot yields include farming experience, land area, seed quality, and pesticide usage. Based on these insights, it is recommended that farmers optimize their use of production inputs to enhance yields and increase income.

Keywords: *shallot farming, in-season, production analysis*

INTRODUCTION

Shallots are one of the strategic commodities in supporting food needs and important spices for the people of Indonesia. Not only that, shallot commodities are classified as commodities that cannot be substituted and must be sufficiently fulfilled [1]. The opportunity for the existence of this commodity will increase along with population growth. This is also relevant to data from [2] which shows that the national demand reaches 898.27 thousand tons and will increase to 927.57 thousand tons. Meanwhile, the national consumption of shallots in the last three years reached 669.88-728.55 thousand tons. National shallot production has yet to fully meet the demand in Indonesia.[3], stated that almost all regions in Indonesia have the potential to become centers of shallot. However, it is dominated by Central Java, East Java, West Nusa Tenggara, and West Java which make the main contribution reaching 81.94% of the national total.

East Java is the second main province that produces the most shallot production in Indonesia. The total of East Java shallot production was about to 22.49%. The main center of shallots in East Java is in Nganjuk. The high rate of shallot production in Nganjuk district is a great potential that must be developed. However, in recent years the development of shallot productivity in Nganjuk District has continued to decline and is not in line with the increase in the harvest area in the area, as can be seen in Table 1.

Table 1. Harvested Area, Production and Productivity of Shallot in Nganjuk 2019-2023

Year	Harvested Area (Ha)	Production (ton)	Productivity (ton/Ha)
2019	13.541	152.408	11,71
2020	14.505	177.232	12,21
2021	16.780	193.652	11,54
2022	17.345	193.988	11,18
2023	16.918	183.757	10,86

Source: [4]

The decline in shallot productivity in Nganjuk District thought to be due to the inappropriate use of production factors in the farm. The decline in productivity and production of a farm can be caused by climate change, seeds, fertilizer availability and technical inefficiency factors in the form of education, age, farmer group participation, farmer experience, land tenure and technology that is still simple [5]. [6] stated that the farming problems faced by shallot farmers are related to the influence of climate/weather, pest, lack of land management skills, capital controlled by farmers, non-optimal farm management and the level of technology adoption. The productivity of agricultural products is largely determined by the number of combinations of production factors used. In addition, a decrease in product quality can cause a decrease in selling prices and have an impact on the income of shallot farmers [7].

Increasing shallot productivity can be done through intensive cultivation systems so that important factors in improving farming in Nganjuk are identified. Studying productivity issues is closely related to farm performance. This is because productivity essentially affects the performance of farms carried out by farmers. The level of performance will be greatly influenced by the managerial capabilities of farmers in applying cultivation and post-harvest technology and the ability to process information relevant to their farms so that decision making can be done appropriately [8]. Previous studies on shallots have been conducted related to production aspects [9], production risk[10]; income [11], [12], [13]; farming efficiency [8], [14]. However, there hasn't been much research have focused on shallot farming in Nganjuk District. Therefore, the purpose of this study is to analyze the factors that influence shallot farming in Nganjuk District, East Java.

METHODS

This research was carried out in Nganjuk District, East Java, chosen due to its status as the top shallot-producing region in East Java, with a yield of 183,757 tons in 2022, representing 38.72% of the province's total shallot production. Specifically, the sampling in this study was conducted in two sub-districts, Bagor and Wilangan sub-districts, because these sub-districts are the centers of shallot production in Nganjuk District. This research was conducted in August-September 2024.

The sampling method used in this study is using the Multistage Sampling method through the following stages: (1) determining the District that can represent the province of East Java, namely Nganjuk District, (2) selecting sub-districts namely Nganjuk, Bagor, Wilangan and Rejoso Sub-districts as shallot producing centers in Nganjuk District, (3) selecting villages in each sub-district, the selected villages are Banaran Kulon Village (Bagor Sub-district) and Sukoharjo Village (Wilangan Sub-district), and (4) randomly selecting samples from each village that has been determined by the criteria that have been determined. The samples used in this study are farmers who are or have been doing shallot farming in randomly at the selected locations.

The number of samples used was 60 samples. The data analysis method used in this study consists of multiple linear regression analysis. Multiple linear regression analysis is used to analyze the factors that affect production and income of shallots farming. The production function is written with a multiple linear regression equation, which is written as follows:

$$Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + e \quad (5)$$

Where :

Y = shallot production (kg)
α = intercept
$\beta_1 \ldots \beta_7$ = regression coefficients
X_1 = level of education
X_2 = age (year)
X_3 = farming experience (year)
X_4 = area (ha)
X_5 = seeds (kg)
X_6 = fertilizer (kg)
X_7 = liquid pesticide (ml)
e = error term

The regression analysis testing method is carried out in two stages, the first is the classical assumption test including normality, multicollinearity and heteroscedasticity tests, the second is the goodness of fit test including the F-test, t-test and coefficient of determination [15], multicollinearity test is used to find out the highest error in the model. Decision making on each variable is seen from the sig value, if the sig value is greater than 0.05 then H_0 is accepted, and vice versa if the sig value is smaller than 0.05 then H_1 is accepted.

Hypothesis testing in this study, as follows:

H_0 accepted : $\beta i = 0$ (there is no effect of Xi on Y)

H_1 accepted : $\beta i \neq 0$ (there is effect of Xi on Y)

RESULT

Respondent Characteristics

This study was conducted among 60 shallot farmers in Nganjuk District as respondent. The characteristics of farmers consisted of age, formal education, land ownership status, land tenure area and farming experience. These farmers are considered important because they can influence the implementation of farming and the decisions made by farmers in running their farms.

Farmer age is one of the factors that can affect performance in farming. In the data obtained, the age of shallot farmers in Nganjuk District is 26-77 years. In addition to age, the level of formal education is one of the characteristics that can affect the level of knowledge and information of farmers in running their farms. Respondents in this study were grouped based on their education, which was based on the ability of respondents to complete the formal education level. The highest percentage of formal education of respondent farmers is at the level of elementary school (SD) equivalent to 43 percent, followed by the level of junior high school (SMP) equivalent to 33 percent and senior high school (SMA) or equivalent to 22 percent.

A person's experience is usually related to the time a person has spent doing something. The experience a person has will encourage the emergence of skills in carrying out a job. Likewise, farmers who have longer experience running a farm are expected to provide better performance and abilities for their farms. Farmers in the research location have a variety of farming experience, ranging from 8-52 years. Most farmers have been farming for 17-25 years with a percentage of 35 percent.

Table 2. Respondent Characteristics

Respondent Characteristics		Farmers	Percentage
Age (year)			
1	30–39	6	10%
2	40–49	12	20%
3	50–59	22	37%
4	60–69	13	22%
5	70–77	7	12%
Total		**60**	**100%**
Formal education			
1	SD	26	43%
2	SMP	20	33%
3	SMA	13	22%
4	Diploma/S1	1	2%
5	S2/S3	0	0%
Total		**60**	**100%**
Farming experience (year)			
1	8–16	12	20%
2	17–25	21	35%
3	26–34	11	18%
4	35–43	14	23%
5	44–52	3	5%
Total		**60**	**100%**
Land ownership status			
1	Rent	46	71%
2	Owned	14	29%
Total		**60**	**100%**
Area (Ha)			
1	0,070–0,168	42	70%
2	0,169–0,266	6	10%
3	0,267–0,364	10	17%
4	0,365–0,462	0	0%
5	0,463–0,560	1	2%
Total		**60**	**100%**

Source: primary data (processed)

Table 2 shows that most shallot farmers' land ownership status is leased with a percentage of 46 percent and 14 percent are self-owned. Assessed from the area of cultivated land, all farmers are smallholders, farmers who have cultivated area <0.5 ha. Most of the respondent farmers is 0.070-0.168 ha with a percentage of 70 percent.

Factors Affecting Shallot Production

The level of farm production determines the success of the farm. The average production rate generated from shallot farming in the study area is 14.2 tons/ha. The level of farm production determines the success of the farm. The average production rate generated from shallot farming in the study area is 14.2 tons/ha. Compared between the level of shallot productivity in the study area is greater than the national shallot productivity level in 2023 which is 10.9 tons/ha, meaning that the shallot productivity rate in the study area is quite high.

Classical assumption testing is done with normality test, multicollinearity test, and heteroscedasticity test. Normality test with Kolmogorov-Smirnov test obtained asymp value. Sig (2-tailed) of 0.680> 0.05 means that the data is normally distributed. The multicollinearity test results of all variables show a Tolerance value> 0.1 and the VIF value of each variable < 10, meaning that there is no multicollinearity in the model. The heteroscedasticity test using the scatter plot diagram forms points spreading randomly and does not form a certain or regular pattern, meaning that the estimated regression model does not occur heteroscedasticity.

Table 3 presents the results of multiple linear regression analysis with statistical tests, revealing that each variable affects shallot production in Nganjuk District differently, the model equation can be written as follows: $Y = 424{,}346 - 79{,}369X_1 - 9{,}017X_2 + 10{,}514X_3 + 6960{,}651X_4 + 4{,}693X_5 – 0.059X_6 + 0{,}408X_{7+} e$

Table 3. Results of Analysis of Factors Affecting Production of Shallot Farming in Nganjuk District

Variables	Coefficient	t-Value	Sig
(Constant)	424.346	1.092	0.280
Level of education (X_1)	-79.69	-1.084	0.283
Age (X_2)	-9.017	-1.469	0.148
Farming experience (X_3)	10.514	2.039	0.047*
Area (X_4)	6960.651	3.312	0.002*
Seeds (X_5)	4.693	4.163	0.000*
Fertilizer (X_6)	-0.059	-0.044	0.965
Liquid pesticides (X_7)	0.408	2.208	0.032*
Dependent Variable	Production		
Adj R^2	0.909		
F-value	85.104		
F-table (α = 0,05)	2.006		
F-table (α = 0,1)	2.678		
Significance	0.000		

Source: *Primary Data (Processed), 2024*
*) significant at 95% (α = 0,05)

The coefficient of determination or Adj R2 value of 0.909 indicates that all independent variables in the model (education, age, farming experience, land area, seeds, fertilizers and pesticides) are able to explain 90.9% of the variation in the independent variable, while the remaining 9.1% is explained by other variables outside the model. The simultaneous F test results show the value of F-value (85.104) > F-table at the 0.05 significance level. This indicates that together the independent variables (education, age, farming experience, land area, seeds, fertilizers and pesticides) have a significant effect on production.

Based on the results of the partial t-test, it is known that the variable farming experience (X_3), area (X_4), seeds (X_5) and liquid pesticides (X_7) has a significant effect on shallot production at the 0.05 significance level, while the variable education (X1), age (X2) and fertilizer have no significant effect on shallot production with the following explanation:

DISCUSSION

Level of Education (X_1)

Education has no effect on production, seen from the sig value (0.283) > 0.05. Education variables have no effect on shallot farm production because experience and skills are more important in shallot farming, technical skills and practical experience are often more important than formal education. Farmers who have years of experience in growing shallots may be more skilled in managing land, dealing with pests, or determining optimal planting times, compared to formal education that does not directly teach specific agricultural skills. This is in line with the farming experience variable, in which the farming experience variable in this study has a significant effect. In line with the research from [16], which states that farming experience affects production, the higher the experience in a farm it will have an impact on one's knowledge getting better in the farm.

Age (X_2)

Age has no significant effect on shallot production, as seen from the sig value (0.148) > 0.05. Production capability often depends more on technical knowledge, access to technology, and adoption of modern agricultural practices. Farmers of different age groups can have equal access to information and technology, especially with agricultural extension programs and technological advances.

Research supporting this result shows that technical variables such as level of education, application of technology and adoption of modern farming practices are more relevant in influencing production outcomes than farmer age. Research conducted by [17] on the effectiveness of agricultural technology shows that the success of production is more determined by the adoption of technology than the age of farmers. In addition, research by [18], shows the importance of innovation and access to information in increasing agricultural production. It can be said that farmer age has no direct effect on production because other factors, such as technical factors, access to technology and managerial skills, determine the success of shallot farming.

Farming experience (X_3)

Farming experience has a significant effect on shallot production, seen from the value of sig (0.047) < 0.05, with a regression coefficient of 10.514, meaning that every additional 1 year of experience will increase shallot production by 10.514 kg, assuming other variables are considered fixed. Experience in farming greatly affects shallot production, as more experienced farmers usually have better knowledge of cultivation techniques, land management, and pest and disease control. Long experience allows farmers to learn from previous mistakes and find best practices that can improve yields. They are better able to adapt to changes in environmental conditions and make more effective decisions related to fertilizer use, seed selection, planting and harvesting timing. Research shows that farmers with more experience tend to be more skilled in managing risks, such as climate change, and are more efficient in using agricultural inputs, such as water and fertilizer, which can enhance overall productivity.

According to [19], the experience of farming is also related to the ability to access new information and technology, which can significantly impact the harvest results. Additionally, [20] state that experienced farmers are better to manage limited resources and capital efficiently, allowing them to optimize production even in less than ideal conditions.

Area (X_4)

The area has a positive influence on production, as indicated by the significance value (0.002) < 0.05, with a regression coefficient of 6960.651. This means that every increase of 1 hectare of land will increase production by 6960.651 kg, assuming other variables remain constant. These research findings align with the results of the study conducted by [22], [23], [24], [22], [23], [24], which indicates that land area has a positive influence on shallot production. The larger the land area, the higher the shallot production. Increasing land area means an increase in plant population, thus production increases along with the number of plants.

Seeds (X_5)

The use of shallot seeds in Nganjuk District generally involves the variety Tajuk (Thailand-Nganjuk) during the dry season and Bauji during the rainy season. The selection of the Tajuk variety is due to its suitability for the characteristics of the soil, making it suitable for planting during the dry season, while the Bauji variety is more resistant when planted during the rainy season compared to other varieties. Statistical test results indicate that seed usage has a positive impact on production, as evidenced by the significance value (0.000) < 0.05, with a regression coefficient of 4.693. This means that every addition of 1 kg of seeds will increase production by 4.693 kg. The results of the study are in line

with the results of the research by [21], [23], [25], [26], [27][21], [22], [23], [26], [27], which stated that seeds have a positive influence on shallot production. The more seeds planted, the more likely the plants to grow, so the production of shallots is also high.

Fertilizer (X_6)

Fertilizer has no significant effect on shallot production, seen from the sig value (0.965) > 0.05. One of the factors causing fertilizer to have no effect on productivity is the use of fertilizer that is not in accordance with plant needs. Excessive or inappropriate use of fertilizer, both in terms of type and dosage, can reduce the effectiveness of fertilizer in increasing production. Shallots have specific nutritional needs, and the use of fertilizers that are not suitable for the growth stage or soil conditions can make them not optimal. This imbalance causes the plant to be unable to absorb nutrients efficiently. The type and composition of fertilizer is also an important factor. Not all fertilizers contain the right or sufficient nutrients to support optimal growth of shallot plants.

Research shows that a balance between nitrogen, phosphorus and potassium content is essential, but if any of these elements are used excessively or disproportionately, the effect can be minimal. Research by [28], showed that in some cases, soil nutrient imbalances or errors in fertilizer application can cause fertilizer use to have no significant effect on increasing production. Another study conducted by [19], also highlighted that land management and environmental conditions often have a greater influence than fertilizer application on shallot plants.

Liquid pesticides (X_7)

Liquid pesticides have a significant impact on production, as indicated by a sig value of 0.032, which is less than 0.05., with a regression coefficient of 0.408, meaning that every additional amount of liquid pesticide of 1 ml will increase production by 0.408 kg. Liquid pesticides affect shallot production because it can control pest and disease attacks that usually damage shallot plants. Liquid pesticides are also more easily absorbed by plants and spread more evenly on leaves and other plant parts compared to pesticides in solid form. This provides faster and more efficient protection against pests, so that plants can grow without much disturbance from pest insects.

[29] stated that the proper and measured use of liquid pesticides can increase shallot production by up to 20%, especially when applied at the right time according to the plant growth cycle. In addition, the regular and recommended use of liquid pesticides can prevent the spread of diseases caused by pathogens such as fungi and bacteria, which often hamper growth and yield [30], found that farmers who used liquid pesticides effectively were able to significantly increase shallot productivity as their crops were protected from the threat of damaging pathogens.

CONCLUSION

This study concludes that farming experience, land area, seeds, and liquid pesticides are the factors that significantly and positively impact shallot production in Nganjuk District. In contrast, education, age, and fertilizer show no effect on production levels. It is essential for various stakeholders, including the government, agricultural extension officers, and shallot farmers, to focus on optimizing the use of these key production factors to support sustainable shallot production.

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