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Efficiency of Production Factor Use in Cabbage Farming in Banyuroto Village, Sawangan Sub-District, Magelang Districts

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A B S T R A C T

Banyuroto Village is located in a hilly area in Sawangan District, Magelang Regency so it is very suitable for cabbage horticulture farming. This study was conducted to analyze the factors affecting production and the efficiency of the use of cabbage production factors in Banyuroto Village. Sampling was done by census on 3 farmer groups in Kenayan and Grintingan hamlets with a total sample of 80 farmers. The method used is a quantitative approach using Cobb-Douglas type production function analysis. The analysis of cabbage farming showed that the variables of land area, seeds, manure, phonska fertilizer, HNO fertilizer, Calcium fertilizer, solid pesticides, liquid pesticides, and labor had a significant effect on cabbage production. Partially, seeds, phonska fertilizer, and labor production factors affect cabbage production. To analyse the efficiency of the use of production factors, labor production factors in its use is efficient.

Contribution to Sustainable Development Goals (SDGS):
SDG 1: No Poverty
SDG 2: ZeroHunger
SDG 12: Responsible consumption and production
SDG 13: Climate Action

1. INTRODUCTION

1.1. Research Background

The agricultural sector has an important role in national economic development. Various regions in Indonesia produce a variety of agricultural commodities, and one of those contributing to economic growth is horticultural commodities. Horticultural commodities include fruits, vegetables, and medicinal ingredients from plants.

Among the various types of vegetables that are cultivated, one of the leading commodities is cabbage. Cabbage is one of the horticultural vegetable products that has a role in improving the welfare of farmers and national economic growth due to its high demand and production, which continues to increase from year to year.

Central Java is the fourth largest producer of cabbage in Indonesia. The abundant cabbage production makes Central Java Province contribute to cabbage production in Indonesia.

One of the districts that is the center of cabbage in Central Java is Magelang Regency, but cabbage production in Magelang Regency is still low. Sawangan District is one of the areas that contributes to cabbage production in Magelang Regency, supported by its topography, which is in the highlands and on the slopes of Mount Merbabu and Merapi, providing optimal conditions for horticultural agriculture. However, comparing the land area owned by Sawangan District is not proportional to the amount of cabbage produced, so cabbage farmers in Sawangan District need to consider it properly.

The area that contributes significantly to cabbage production in Sawangan District is Banyuroto Village. based on the results of interviews with the Sawangan Agricultural Extension Center, the village with the most harvest area and cabbage production in

Sawangan District is Banyuroto Village, with cabbage production of around 15-20 tons/hectare, the same as Sawangan District, Banyuroto Village also still faces various challenges to increase the productivity of cabbage plants. These challenges include the risk of eruptions, climate change with high rainfall, pest attacks such as caterpillars, and lack of optimization of the use of production factors.

The allocation of the use of land area production factors by cabbage farmers in the area is still not optimal, its low productivity results evidence this. Based on the problems described, it is important to use production factors efficiently to increase production yields. Therefore, it is necessary to analyze the factors affecting production yields and the efficiency level of using production factors in cabbage farming. Thus, it can analyze the efficiency of production factors in increasing cabbage yields in Banyuroto Village, Sawangan District, Magelang.

1.2. Literature Review

The horticulture subsector is a leading sector in agriculture that has the potential to encourage national economic growth [1] Vegetables are one type of agricultural product that has high economic value because demand for them is always increasing throughout the year in both the local and international markets. [2]. According to the Central Statistics Agency in 2022, vegetable horticultural crops contributed to national GDP by 1.44%, showing the important role of this sector in the Indonesian economy.

In Indonesia, cabbage production in 2023 was recorded at 1,399,005 tons, the high production is supported by several main cabbage-producing regions. The largest cabbage producing province is North Sumatra Province with 228,009 tons, followed by West Java Province with 211,440 tons, East Java Province with 202,577 tons, the fourth position is Central Java Province with 188,799 tons and the fifth is West Sumatra Province with 176,081 tons [3]

The ability of farmers to manage their farming can be assessed from the level of revenue and efficiency level, the increase in the ratio between revenue and cost indicates the feasibility of the business being run, while the more efficient the use of production inputs, the more optimal the production results obtained [4]

1.3. Research Objective

The objectives of this study are (1) to analyze the factors that affect production in cabbage farming in Banyuroto Village, Sawangan District, Magelang Regency, (2) to analyze the level of efficiency of the use of production factors in cabbage farming in Banyuroto Village, Sawangan District, Magelang Regency.

2. MATERIALS AND METHODS

The location of the research was conducted in Banyuroto Village, Sawangan District, Magelang Regency, with the consideration that Banyuroto Village is a village that has the largest number of cabbage farmer households in Sawangan District and is one of the cabbage centers in Magelang Regency supported by its topography, located on the slopes of Mount Merapi and Merbabu. Then from Banyuroto Village, 2 hamlets were chosen, namely Kenayan Hamlet and Grintinngan Hamlet.

The determination of respondents used in this study was censusly taken from three farmer groups**:** the Rukun Tani Farmer Group, the Melati Farmer Group and the Sumber Tani.

Table 1. Data from Kenaya and Grintingan Hamlet Farmer Groups

Hamlet	Farmer Group	Sum
Kenayan	Rukun Tani	24
	Melati	36
Grintingan	Sumber Sari	20
Sum		80

This study uses primary data types from direct interviews with farmers with questionnaire tools and secondary data types obtained from the Central Statistics Agency, Agricultural Extension Center and Banyuroto Village data. The data analysis technique is a technique used to analyze the data from farmer interviews that have been collected. The following is the analysis technique:

2.1. Production Function Analysis Cobb-Douglas

The Cobb-Douglas production function is one of the production function models used in agricultural analysis. Mathematically, the Cobb-Douglas production function can be written as follows.

$$Y = aX_1^{b1}.X_2^{b2}.X_3^{b3}.X_4^{b4}.X_5^{b5}.X_6^{b6}.X_7^{b7}.X_8^{b8}.X_9^{b9}.e^{\mu}$$

To make it easier to perform the analysis, the function can be converted into a linear function by converting it into a natural logarithm to facilitate estimation [5]. So that the function changes to:

$$Ln\,Y = Ln\,a + b_1X_1 + b_2\,Ln\,X_2 + b_3\,Ln\,X_3 + b_4\,Ln\,X_4 + b_5\,Ln\,X_5 + b_6\,Ln\,X_6 + b_7\,LnX_7 + b_8\,LnX_8 + b_9\,LnX_9 + \mu$$

Information:

Y = Cabbage Production (Kilograms)
X1 = Land Area (Hectares)
X2 = Seeds (Stems)
X3 = Manure (Kilograms)
X4 = Phonska Fertilizer (Kilograms)
X5 = HNO Fertilizer (Kilograms)
X6 = Calcium Fertilizer (Kilograms)
X7 = Pestisida Padat (Kilogram)
X8 = Liquid Pesticides (Milliliters)
X9 = Labor (People's Workday)
a = Constant
bi = Regression coefficient or elasticity of production
u = Specific errors

The test models that will be used in this study are Coefficient of Determination (R), Simultaneous Test (Test F). and Partial Test (T Test).

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2.1.1.Coefficient of Determination

The coefficient of determination is a quantity used to describe how far an independent variable (X) explains the dependent variable (Y) [6]. According to [7] the value of the determination coefficient can be calculated using the formula:

$$R^2 = 1 + \frac{\sum(Y_i - \widehat{Y})^2}{\sum(Y_i - \overline{\widehat{Y}})^2}$$

Information

R^2 = Coefficient of determination

Yi = Observation values of dependent variables

$\hat{Y}$ = Estimated value of dependent variables

$\bar{Y}$ = Average dependent variables

2.1.2. F Test

The F test determines whether the variation of independent variables such as seeds, land area, labor, fertilizers, and pesticides affects cabbage production.

Hypothesis formulation:

Ho: bi = 0, it is suspected that the production factor (X) has no real effect on the production of cabbage (Y).

Ha : bi ≠ 0, it is suspected that the production factor (X) together has a real effect on the production of cabbage (Y).

The formulation of the F Test can be written as follows:

$$F_{count} = \frac{R^2/(K-1)}{(1-R^2)/n-k}$$

$$F_{table} = F_{(\alpha\%,k-1,n-k)}$$

Information:

F = F count

R^2 = Coefficient of determination

k =Number of independent variables

n =Number of samples

α = Error Rate

Decision:

i. If F calculates ≥ F table, then Ho is rejected and Ha is accepted, meaning that the variable X of the production factors used by farmers in cabbage farming together has a real effect on cabbage production (Y)

ii. If F counts < F table, then Ho is accepted and Ha is rejected, meaning that the variable X the production factors used by farmers in cabbage farming together have no real effect on cabbage production (Y)

2.1.3. T Test

The t-test analysis was used to analyze the influence of each independent variable such as land, seeds, fertilizers, labor and pesticides on the dependent variable, namely cabbage production in Banyuroto Village.

Hypothesis Formulation:

Ho: bi = 0, it is suspected that the i-i production factor has no real effect on cabbage production.

Ha: bi ≠ 0 is thought to mean that the production factor i really affects cabbage production.

To find out the effect of each independent variable on the non-free variable, the t-calculated formula is used as follows:

$$T_{count} = \frac{bi}{Sbi}$$

$$T_{table} = t(\alpha\%(n-k-1))$$

Information:

bi = bi regression coefficient

Sbi = bi deviation standards

n = Number of samples

k = Number of independent variables

α = Error Rate

Decision

i. If t calculates ≥ t table, then Ho is rejected, meaning that the production factor i has a real effect on cabbage production

ii. If t calculates < t table, then Ho is accepted, meaning that the ith production factor has no real effect on cabbage production.

2.2. Analysis of the Efficiency of the Use of Production Factors

The efficiency of the use of production factors can be analyzed using price efficiency. The allocation of input usage is considered efficient if the input marginal product (NPMx) value is equal to the input price (Px). According [5], the calculation of the efficiency of the use of production factors can be formulated as follows:

$$NPM_x = P_x$$

$$\frac{NPM_x}{P_x} = 1$$

Information:

NPMx = Marginal product value of production factors

Px = Price Production factor

The provisions are as follows:

i NPMx/Pxi = 1, This means that the use of inputs is efficient.

ii. NPMx/Pxi > 1, This means that the use of inputs is not yet efficient, so it is necessary to add inputs.

iii. NPMx/Pxi < 1, This means that the use of inputs is inefficient, so it is necessary to reduce inputs.

According to [8] The level of allocative efficiency in farming can also be determined by the Ki value (efficiency index) of each production factor and can be formulated as follows:

$$k_i = b_i . \frac{Y}{X_i} . \frac{P_y}{P_{xi}}$$

Information:

bi = Regression coefficient of production factor i Y = Production (Output)

Py = Output Price

Xi = Number of production factor usage i-i Pxi = Price of the ith factor of production

In the test, it compares the value of the marginal product (NPMx) with the price of its factor of production (Px), with the following conditions:

i. k = 1, The value of marginal products is equal to the input price, so the use of production factors is efficient

ii. k < 1, The value of the marginal product is less than the price of the production factor, then the use of the production factor is inefficient

iii. k > 1, The value of marginal products is greater than the price of the factor of production, so the use of the factor of production is not efficient

The test of the t-test (partial) uses the value of k, as follows:

Ho : K = 1, This means that the use of inputs is efficient

Ha : K ≠ 1, This means that the use of inputs is not yet or inefficient.

$$T_{count} = (1 - k)/\sqrt{Var\ K}$$

Information:

Var K= (K/bi)2 . var (bi) t table= (α%, (n-k-1)

From these tests, decisions can be drawn, namely:

i. If t calculates ≥ t table (Ho is rejected), the value of K is not equal to 1. So the use of production factors has not been or is not efficient

ii. If t is < t table (Ho is accepted), then the value of K is equal to 1. So the use of production factors is efficient.

3. RESULT AND DISCUSSION

3.1. Analysis Of Factors Affecting Cabbage Production

In carrying out cabbage farming, of course, farmers use production factors to support the farming that is carried out. Cabbage farmers' production factors include land area, seeds, fertilizers, pesticides, and labor. All these factors support each other to achieve optimal cabbage production results. The use of production factors can affect efficiency in farming, which can determine crop yields and productivity. The following is the use of production factors in cabbage farming in Banyuroto Village as seen in table 2.

Based on table 2 above, it can be seen that the average use factor of cabbage land area is 3,418 meters per square or 0.3418 hectares, which shows that the average land use by cabbage farmers in Banyuroto village is relatively large. The average use of cabbage seeds by cabbage farmers in Banyuroto Village is 11,587 stems per hectare. The use of these seeds is not by the recommendations for using seeds by the Sawangan District Agricultural Extension Center, which is 40,000 stems per hectare. Seeds are one of the factors for the success of cabbage production. The selection of good and quality seeds can produce quality production. The varieties of cabbage seeds that cabbage farmers commonly use in Banyuroto Village are cabbage seeds with the brands Green Nova, Grand 11 and Polaris. Most cabbage farmers in Banyuroto Village buy seeds at the nursery and do not sow their seedlings.

Table 2. The use of production factors of Cabbage Farming.

No	Production Factors	Average Score	Conversion Per hectare	Recommended Per hectare
1	Land (M^2)	3,418.00	10,000.00	10,000.00
2	Seeds (Stems)	3,961.00	11,587.00	40,000.00
3	Manure (Kilograms)	3,742.00	12,289.00	15,000.00
4	Phonska Fertilizer (Kilograms)	22.73	74.84	300.00
5	HNO_3 Fertilizer (Kilograms)	2.29	7.52	200.00
6	Calcium Fertilizer (Kilograms)	1.88	6.82	200.00
7	Solid pesticides (Kilograms)	1.62	4.70	0.00
8	Liquid pesticides (Milliliter)	1,865.00	5,456.00	0.00
9	Workforce (People's Weekdays)	41.40	121.00	0.00

Based on Table 2, the fertilizers used by cabbage farmers in Banyuroto Village are manure as a base, ponska fertilizer, HNO_3 fertilizer, and calcium. The average use of manure is 12,289 kilograms per hectare, which still does not meet the recommended dose of fertilizer used by the Sawangan District Agricultural Extension Center, which is 15,000 kilograms per hectare. The average use of phonska fertilizer by cabbage farmers in Banyutoyo Village is 74.84 kilograms per hectare, which shows that the use of phonska fertilizer has not met the recommendation for the use of phonska fertilizer by the Sawangan Agricultural Extension Center of 300 kilograms per hectare. For the average use of HNO_3 fertilizer in Banyuroto Village is 7.52 kilograms per hectare, this shows that the use of HNO_3 fertilizer by cabbage farmers in Banyuroto Village is still not following the recommended dosage determined by the Sawangan District Agricultural Extension Center, which is 200 kilograms per hectare. This is because the use of HNO_3 fertilizer is applied by spraying it mixed with water so that farmers only use a small amount of HNO_3 fertilizer. The average use of calcium fertilizer by cabbage farmers in Banyuroto Village is 6.82 kilograms per hectare, indicating that the users have not met the recommendation of 200 kilograms per hectare. Like HNO_3 fertilizer, kaslium fertilizer is applied by spraying it to plants or used as a mixture of phonska fertilizer.

In cabbage farming in Banyuroto Village, cabbage farmers use 2 types of pesticides: liquid and solid. For the average use of solid pesticides is 4.7 kilograms per hectare and for liquid pesticides it is 5,456 milliliters per hectare. The solid pesticides used are the brands Manteb, Bion, Antracol and Cozeb, which each have their function for cabbage plants. As for the liquid pesticides, they are Abacel and Brovea. For pesticides, there is no dosage or recommendation for the use of pesticides by the Sawangan District Agricultural Extension Center.

The cabbage farming workforce is divided into two parts, namely domestic workers and non-family workers. The average labor force, both in the family and outside the family, is 41.40 working days or 121 working days per hectare. The average use of labor has covered the entire series of farms, both land cultivation, planting, irrigation, weeding, embroidery, fertilization, pest and disease control, to the harvesting stage. In cabbage farming in Banyuroto Village, the family uses labor on average because land use and the number of cabbage plants are still relatively small, so it does not require a lot of labor. However, during land cultivation and harvesting, cabbage farmers need the assistance of workers outside the family because at the time of cabbage land cultivation by farmers still use manual techniques, namely hoeing. For self-harvesting, it is usually assisted by collectors or workers outside the family

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3.2. Production Function Analysis

A production function analysis of cabbage farming in Banyuroto Village was carried out to determine the factors that affect cabbage production. In this study, a Cobb-Douglas type production function model was used. The purpose of this analysis approach is to measure the influence of independent variables or production factors on cabbage farming such as land area (X1), seeds (X2), manure (X3), phonska fertilizer (X4), HNO3 fertilizer (X5), calcium (X6), solid pesticides (X7), liquid pesticides (X8) and labor (X9) on cabbage production (Y) or bound variables. These variables were obtained during direct observation and interviews with cabbage farmers in Banyuroto Village, which were then analyzed using IBM SPSS 25 software to get the analysis results.

Table 3. Results of Regression Analysis on Cabbage Production Factors in Banyuroto Village

Variable	Regression Coefficients	T-Count	Sig
Constant	3.019	3.978	0.000^{ns}
Land (X_1)	0.023	1.464	0.644^{ns}
Seed (X_2)	0.540	6.647	0.000*
Manure (X_3)	-0.060	-1.488	0.141^{ns}
Phonska Fertilizer (X_4)	0.186	2.298	0.025**
HNO_3 Fertilizer (X_5)	0.019	1.041	0.302^{ns}
Calcium Fertilizer (X_6)	0.023	1.273	0.207^{ns}
Solid pesticides (X_7)	0.006	1.093	0.926^{ns}
Liquid pesticides (X_8)	-0.056	-1.019	0.312^{ns}
Workforce (X_9)	0.284	2.180	0.033**
R Square	0.732	Information	
F Count	21.242	Significant α =1% : *	
F Table	2.672 (α=1%)	Significant α =5% : **	
Anti Ln	20.470	Insignificant: ns	

Source: Primary Data processed, 2024

Based on the results of multiple linear regression analysis using IBM SPSS 25 software, the following regression equations were obtained:

$$\text{Ln } Y = 3.019 + 0.023\ X1 + 0.540\ X2 - 0.060\ X3 + 0.186\ X4 + 0.019\ X5 + 0.023X6 + 0.006\ X7 - 0.056\ X8 + 0.284X9$$

From the above equation, it is then changed in the form of a Cobb-Douglas prediction function by replacing the Ln kan constant obtained as follows:

$$Y = 20.470.X_1.0.023.X_20.540.X_3\text{-}0.060.X_40.186.X_50.019.X_60.023.X_70.006.X_8\text{-}0.056.X_90.28$$

The determination coefficient test determines how much the independent variable (independent variable) explains the regression model's bound variable (dependent variable). Based on the results of the analysis using SPSS software, the value of R square (determination coefficient) of 0.73 means that the variation of free variables such as land area, seeds, manure, phonska fertilizer, HNO3 fertilizer, calcium fertilizer, solid pesticides, liquid pesticides and labor can explain the bound variable, namely pubis production of 73% and the remaining 27% is explained by other variables that are not included in the model such as soil fertility, climate and seed varieties.

The F test determines the influence of independent variables on dependent variables together. Based on Table 3 above, the analysis results show that the F count is 21.242. The F count of the table is 2.672, which means that the F count is calculated as 21.242 > 2.672 (α=1%) or probability value (0,000<0,01) (α=1%), then Ho was rejected.i was accepted, which means that together the variables of land area, seeds, manure, phonska fertilizer, HNO3 fertilizer, calcium fertilizer, solid pesticides, liquid pesticides and labor have a real effect on cabbage production in Banyuroto Village at an error rate of 1% or a confidence level of 99%, this is in line with research conducted by [9] which tests the use of production factors in cabbage farming, such as land area, seeds, labor, fertilizers and pesticides in Indonesia. The study results show that production factors such as land area, seeds, fertilizer labor and pesticides together affect cabbage production, which shows that all production factors contribute to the ongoing farming.

The t-test analyzes the influence of each partially bound variable on the independent variable. This test is done by comparing the t-calculated value with the table's value or through its probability analysis. The t-test showed that not all production factors affected cubic acid production in Banyuroto Village with significant levels of 10%, 5% and 1%.

3.2.1. Land

The results of the t-test analyzed using SPSS software obtained a probability value of land area (0.518) > (0.10) (α=10%), then Ho was accepted, and Ha was rejected. This means that the production factor of land area has no real effect on cabbage production at an error rate of 10%. The value of the regression coefficient of the land area variable is 0.032 so that if the land area is increased and other production factors are fixed, there is a tendency to increase cabbage production in Banyuroto Village. The results align with research conducted by [10] who analyzed the production factors in cabbage, stating that the land area variable did not really affect cabbage production in the study area.

3.2.2. Seed

The results of the t-test analyzed using SPSS software obtained a probability value of the seed variable of (0.00) < (0.01) (α=1%), then Ho was rejected, and Ha was accepted. This means that the seedling production factor has a real effect on cabbage production at an error rate of 1%. The value of the regression coefficient produced by the seed variable is 0.540, which means that if the use of seeds is added 1% and other production factors are a fixed state, cabbage production will increase by 0.540%. This shows that the addition of seeds for cabbage farming in Banyuroto Village will affect increasing production yields. The seeds used by cabbage farmers in Banyuroto village are purchased; they do not sow their own seeds. The seed varieties used are Grand Nova, Polaris and Green 11 varieties.

The results of the analysis are in line with the research conducted by [11]. who analyzed the influence of factors on cabbage farming in Indonesia, which shows that the seed production factor has a real influence on cabbage production in the area, which means that the quality and quantity of seed use influences the amount of production produced.

3.2.3. Manure

Based on the t-test analyzed using SPSS software, the probability value of the seed variable was obtained as (0.14) > (0.1) (α=10%) then Ha was rejected, and Ho was accepted. This means that the manure production factor has no real effect on cabbage production at a 1% error rate. The value of the variable regression coefficient of manure is -0.060, which means that if manure is added and other inputs are in constant condition, there is a tendency to decrease cabbage production. Cabbage farmers in Banyuroto Village make manure a basic fertilizer mixed with soil when tillage.

The results of the analysis are in line with the research conducted by [12. Analyzing factors that affect cabbage production, the study showed that the manure or organic fertilizer variables did not significantly affect cabbage production in the study area.

3.2.4. Phonska Fertilizer

Based on the t-test analysed using SPSS software, the probability value of the phonska fertilizer variable was obtained as (0.025) <(0.05) (α=5%) then Ho was rejected, and Ha was accepted. This means that the production factor of phonskat fertilizer has a noticeable effect on cabbage production at an error rate of 5%.

The value of the variable regression coefficient of phonskat fertilizer is 0.186, which means that if the use of phonska fertilizer production factors is added by 1% and other production factors in fixed conditions, then cabbage production in Banyuroto Village will increase by 0.186%, which makes phonska fertilizer can increase cabbage production in Banyuroto Village.

The analysis results alignith the research conducted by [13] which examines factors that affect the production of red chili horticultural commodities. The results of the study stated that the production factor of phonska fertilizer has a positive effect on the production of red chili horticultural commodities, which means that the increase in the use of phonska fertilizer will increase the production of red chili in the study area.

3.2.5. HNO_3 Fertilizer

Based on the t-test analyzed using SPSS software, the probability value of the HNO3 variable was obtained as (0.302 > (0.10) (α=10%) then Ho was accepted, and Ha was rejected. This means that the HNO_3 fertilizer production factor has no real effect on cabbage production at a 10% error rate. The value of the regression coefficient in the production factor of HNO3 fertilizer is 0.019, which means that if the use of HNO fertilizer production factors is added and other production factors are in a fixed condition, there is a tendency to increase cabbage production in Banyuroto Village

3.2.6.Calcium Fertilizer

Based on the t-test analyzed using SPSS software, the probability value of the Calcium variable was obtained as (0.207) > (0.10) (α=10%), then Ho was accepted, and Ha was rejected. This means the calcium fertilizer production factor has no real effect on cabbage production at a 10% error rate. The value of the regression coefficient in the calcium fertilizer variable is 0.023 which means that if the use of calcium fertilizer production factors is added and other production factors are under constant conditions, there is a tendency to increase cabbage production in Banyuroto Village

3.2.7. Solid Pesticides

Based on the t-test analyzed using SPSS software, the probability value of the seed variable was (0.926) > (0.10) (α=10%) then Ho was rejected, and Ha was accepted. This means that the production factor of solid pesticides has no real effect on cabbage production at a 10% error rate. The value of the regression coefficient produced by the solid pesticide variable is 0.006, which means that if solid pesticide production factors are added and other production factors are under constant conditions, there is a tendency to increase cabbage production in Banyuroto Village.

The results of the analysis are in line with the research conducted by [14] which examined the factors that affect the horticultural production of red chili, the results of the study revealed that the variable of solid pesticides did not have a real effect on the production of red chili and the value of the coefficient produced by the production factor of solid pesticides had a negative value, which means that if the addition of solid pesticides and other production factors in a fixed state would not necessarily reduce the production of red chili, Because it has no real effect on red chili production in the study area.

3.2.8. Liquid Pesticides

Based on the t-test analyzed using SPSS software, the probability value of the seed variable was (0.319) < (0.10) (α=10%) then Ho was rejected, and Ha was accepted. This means that the liquid pesticide production factor has no real effect on cabbage production at an error rate of 10% and the coefficient value produced by the liquid pesticide variable is -0.056 which means that if the use of liquid pesticide production factors is added and other production factors are in a fixed condition, there is a tendency to reduce cabbage production in Banyuroto Village.

3.2.9. Workforce

Based on the t-test analyzed using SPSS software, the probability value of the seed variable was (0.033) < (0.01) (α=5%) then Ho was rejected, and Ha was accepted. This means that the factor of labor production has a real effect on cabbage production at an error rate of 5%. The value of the regression coefficient of the labor variable is 0.284, which means that if the use of labor is added 1% and other inputs are in a fixed condition, cabbage production will increase by 0.284%. This shows that adding labor for cabbage farming in Banyuroto Village will affect the increase in production output.

These results are in line with research conducted by [6] who analyzed the use of cabbage production factors in Purwodadi, Pasuruhan stated that labor production factors have a significant effect on cabbage production.

3.3. Analysis of the Efficiency of the Use of Production Factors

The efficiency of the use of production factors in this study was used to determine the value of the relationship between cost and output (Y) that can be achieved if profit is maximized by calculating the comparison between the marginal product value (NPM) of inputs that have a real effect on the price. The following are the results of calculating the allocative efficiency of cabbage farming in Banyurto Village.

Based on Table 4, it can be seen that the results of the analysis of the efficiency of the use of production factors in cabbage farming on the seed variable obtained an NPMx/Px value of 14.03. From the t-test test, it was obtained that the t-count value was smaller than the t-table, which was 6.191 > 2.642 with a significance of 1%, then Ho was rejected and Ha was accepted so that the use of seed production factors was not efficient. So the use of seeds needs to be increased

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to make their use efficient. The use of seed production factors in Banyuroto Village is 11,587 stems per hectare or 3,961 stems per 3,418 M2, and this is not follow the recommendations of the Sawangan District Agricultural Extension Center, which is 40,000 stems per hectare.

Table 4. Results of Cabbage Farming Efficiency in Banyuroto Village

Variable	Px	NPMx	NPMx/ Px	T-Count	Infor-mation
Seed	105.00	1,468.00	14.03	6.19	Inefficient yet
Phonska Fertilizer	3,091.00	88,124.00	28.51	2.79	Inefficient yet
Workforce	100,000.00	73,611.00	0.74	1.42	Efficient
T table : α 10%		1.665			
T table : α 1%		2.642			

Source : Primary Data processed, 2024

The results of the analysis of the efficiency of phonska fertilizer production factors were obtained NPMx/Px of 28.51. The results of the T-test test obtained a T count that is greater than the T table, namely 2.787 > 2.642 with a significance of 1%. Ho was rejected and Ha was accepted, which means that using Phoska Fertilizer production factors is inefficient. The use of phonska fertilizer in cabbage farming in Banyuroto Village of 66 kilograms per hectare is not under the recommendations or dosage given by the Sawangan District Agricultural Extension Center, which is 300 kilograms per hectare. The use of phonska fertilizer tends to be small, so the use of phonska fertilizer production factors needs to be increased to achieve optimal use of ponska production factors to increase the yield and profit of cabbage production.

The results of the analysis of the efficiency of the use of labor production factors are determined by the value of NPMx/Px of 0.74 The result is close to 1. The results of the T-test test are obtained a t<t value of the table, which is 1.420 < 1.665 with a significance of 10%, then Ho was accepted and Ha was rejected so that the factor of using labor was efficient. So that there is no need to add or subtract the use of labor production factors, the labor production factor in Banyuroto Village is optimal and can provide positive cabbage production results. The use of labor production factors in Banyuroto Village is 121 Working Days per hectare or 41.40 Working Days per 3,418 M2.

These results are in line with research by [11] which tested the efficiency of the use of production factors in cabbage farming in Kajoran, The results of the study stated that the labor production factors used were efficient, so there was no need to add or reduce the number of labor production factors.

4. CONCLUSION

The use of seed production factors, phonska fertilizer and labor significantly affects cabbage production in Banyuroto Village, Sawangan District, Magelang Regency. Meanwhile, the aspects of land area production, manure, solid pesticides, liquid pesticides, HNO3 fertilizers, calcium fertilizers have no effect on cabbage production in Banyuroto Village, Sawangan District, Magelang Regency. The results of the analysis of the efficiency of the use of cabbage production factors in Banyuroto Village, Sawangan District, Magelang Regency are efficient while the use of seed production factors and phonska fertilizers is not efficient.

Based on the research results on the efficiency of the use of cabbage production factors in Banyuroto Village, the production factor of phonska seeds and fertilizers shows inefficient results in their use. Therefore, it is recommended for farmers to increase the use of phonska fertilizer and seed production factors. With the increase in the number of uses of phonska fertilizers and seeds, it is expected to increase production and the profits of cabbage farmers in Banyuroto Village, Sawangan District, Magelang Regency.

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