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Research Paper

Factors Affecting Garlic Production in Karanganyar Regency: A Cobb-Douglas Approach

Sindy Nur Cahyaningsih[1], Fanny Widadie[2], Susi Wuri Ani[3]

Agribusiness Department, Agriculture Faculty,
University of Sebelas Maret, Surakarta, Jawa Tengah

Corresponding Author: Sindy Nur Cahyaningsih

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ABSTRACT

This study aims to analyze the costs and income of garlic farming, as well as the factors affecting garlic production in Karanganyar Regency. The research was conducted in Tawangmangu and Jatiyoso Districts, involving 110 farmer respondents selected through multi-stage sampling and purposive sampling techniques. Data were analyzed using a quantitative descriptive approach through farm cost analysis and the Cobb–Douglas production function with the assistance of STATA 17 software. The results showed that the average total production cost of garlic farming was IDR 16,198,654 per 0.15 ha, equivalent to IDR 107,991,030 per hectare. The average farmer income was IDR 11,615,087 per 0.15 ha, or IDR 77,433,918 per hectare, while the average profit was IDR 2,675,891 per 0.15 ha, or IDR 17,839,273 per hectare. The results of the Cobb–Douglas analysis indicated that seed, labor, and pesticide inputs had a significant effect on garlic production, whereas land area, manure, and chemical fertilizers did not have a significant effect. The study suggests that proper and efficient management of production inputs can improve the productivity and profitability of garlic farming.

Keywords: Garlic, production cost, Cobb–Douglas, production factors, farming.

INTRODUCTION

The horticultural sector is one of the agricultural subsectors that plays an important role in agricultural development in Indonesia. Horticultural commodities not only function as a source of food supply for the community but also contribute to increasing farmers' income and regional economic growth [1]. Horticultural crops consist of fruits, vegetables, medicinal plants, and ornamental plants that generally have higher economic value compared to other food crops. One of the horticultural commodities with consistently high demand and widely consumed by the community is garlic [2].

Garlic is a vegetable and spice commodity that plays an important role in household consumption as well as the food processing industry. The increasing demand for garlic each year has not been fully balanced by domestic production, causing Indonesia to remain dependent on garlic imports. This condition indicates that improving domestic garlic production remains both a challenge and an opportunity in the development of the horticultural subsector [3]. Karanganyar Regency is one of the regions in Central Java Province with agroecological conditions suitable for garlic cultivation, especially in highland areas such as Tawangmangu and its surrounding regions. Table 1 shows Garlic Production by District in Karanganyar Regency.

Table 1. Garlic Production by District in Karanganyar Regency (2021-2025)

District	Production (ton)				
	2021	2022	2023	2024	2025
Tawangmangu	1 602,3	3.150	2.728	1.678	2.000
Jatiyoso	298,2	745	1.378,2	210,8	76
Jenawi	128,5	0	709,8	546	870,1
Ngargoyoso	68,7	284,5	295	12	0,85

Source: BPS Karanganyar Regency (2025)

Table 1 shows that garlic production in Karanganyar Regency fluctuated during 2021–2025. Tawangmangu District consistently recorded the highest production, reaching 3,150 tons in 2022. Meanwhile, Jatiyoso and Jenawi experienced unstable production trends, while Ngargoyoso recorded the lowest production, decreasing to only 0.85 tons in 2025. These fluctuations indicate differences in land conditions and the use of production inputs among districts.

In garlic farming, production is influenced by several factors, including land area, seed usage, labor, manure fertilizer, chemical fertilizer, and pesticides. Improper use of production factors may result in suboptimal production outcomes [4]. In addition, the high production costs incurred by farmers have become another important issue because they directly affect farm profitability. Therefore, it is necessary to analyze the factors affecting garlic production as well as calculate production costs to determine the efficiency level of garlic farming [5].

Previous studies on garlic farming in Karanganyar Regency have generally focused on technical efficiency and the influence of production factors on yield. However, the results of these studies show differences regarding which variables significantly affect garlic production. Furthermore, studies combining the analysis of production factors with detailed production cost calculations are still relatively limited. This condition indicates that there is still room for further research to obtain a more comprehensive understanding of garlic farming in Karanganyar Regency.

Based on these conditions, this study was conducted to analyze the factors affecting garlic production and to calculate the production costs of garlic farming in Karanganyar Regency. This research is expected to provide information regarding the efficient use of production inputs in order to improve productivity and increase farmers' income.

MATERIALS & METHODS

This study employed a quantitative descriptive approach. The research was conducted in Tawangmangu District and Jatiyoso District, which are recognized as garlic-producing areas. The study sites were determined using a multi-stage sampling technique. Furthermore, purposive sampling was applied to select the sample villages based on their status as centers of garlic production. In Tawangmangu District, the selected villages included Kalisoro Village and Blumbang Village, while in Jatiyoso District, Beruk Village and Wonorejo Village were chosen. The total number of respondents in this study was 110 farmers, selected proportionally from each village. The study utilized both primary and secondary data sources.

The data analysis methods employed in this study consisted of production cost analysis and analysis of factors affecting garlic production using the Cobb–Douglas production function model. Cost is the total amount of all expenditures incurred in farming activities. The costs referred to are the operating costs of the farm. Total cost is formulated as follows:

TC = Explicit Costs + Implicit Costs

Revenue is the result of multiplying the total production by the selling price of the product. The selling price refers to the price received by farmers, measured in rupiah per kilogram (Rp/kg). Production refers to the output of farming activities in the form of harvested products that are ready to be marketed. Revenue can be formulated as follows:

$TR = P \times Q$

Income is the difference between revenue and costs incurred in farming activities. All costs economically incurred in farm operations to purchase production factors are referred to as explicit costs. Farm income can be formulated as follows [6]:

$Pd = TR - \text{Explicit Costs}$

Profit is the return received by garlic farmers after subtracting all production costs. Farm profit can be calculated using the following formula:

$\pi = TR - TC$

The second objective of this study, which examines the factors affecting garlic production in Karanganyar Regency, was analysis using the Cobb–Douglas production function approach with STATA version 17 software. The production function model used is as follows:

$Y = a.\ X^1b^1\ .X^2b^2\ .X^3b^3\ .X^4b^4.\ X^5b^5.\ e^u$

The Cobb–Douglas production function was then transformed into a linear logarithmic form as follows:

$\text{Ln } Y = \text{Ln } \alpha + \beta^1 \text{ Ln } X^1 + \beta^2 \text{ Ln } X^2 + \beta^3 \text{ Ln } X^3 + \beta^4 \text{ Ln } X^4 + \beta^5 \text{ Ln } X^5 + \beta^6 \text{ Ln } X^6 + e$

Description:

Y = Garlic production (kg)
X^1 = Land area (ha)
X^2 = Seeds (kg)
X^3 = Labor (HOK – person-days of work)
X^4 = Manure fertilizer (kg)
X^5 = Chemical fertilizer (kg)
X^6 = Pesticides (liters)
α = Constant
βi = Regression coefficients
e = Error term

Classical Assumption Tests

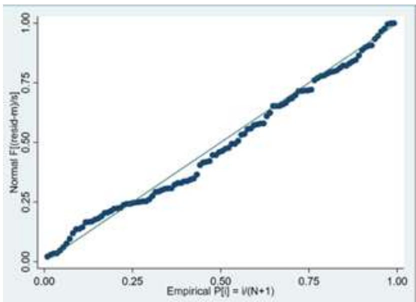
Classical assumption tests are statistical procedures conducted to ensure that a regression model satisfies the fundamental assumptions of linear regression analysis [7]. These tests are intended to ensure that the regression estimates are valid, unbiased, and suitable for drawing accurate conclusions. Classical assumption testing generally includes tests of normality, multicollinearity, and heteroscedasticity [8].

Table 2. Multikolinearitas Test

Variable	VIF	Tolerance
Land area (ha)	3.68	0,271847
Seed input (kg)	4.02	0,249051
Labor (man-days)	2.02	0,495213
Manure (kg)	1.31	0,761951
Chemical fertilizer (kg)	2.22	0,450230
Pesticide (liters)	1.62	0,616361

Source: Primary Data Analysis (2026)

Based on Table 2, the test results indicate that the Variance Inflation Factor (VIF) values for all variables are below 10, while the tolerance values for each variable exceed 0.1. These results indicate that there is no evidence of multicollinearity among the independent variables.



Picture 1. Normality Test

Based on the normal probability plot (P–P Plot), the residual points are distributed around the diagonal line and follow its direction. This indicates that the residuals in the regression model are normally distributed, meaning that the normality assumption has been satisfied.

Table 3. Heteroskedasticity Test

Test	Chi^2	$Prob>Chi^2$
White Test	31,74	0,2420

Source: Primary Data Analysis (2026)

Based on Table 3, the results of the heteroscedasticity test using the White method show a Prob > chi^2 value of 0.2420. This probability value is greater than the 5% significance level ($\alpha = 0.05$), indicating that H_0 is accepted and H_a is rejected. Therefore, the regression model does not suffer from heteroscedasticity, and the error variance can be considered constant (homoscedasticity).

RESULT

Farmer's Characteristics

The characteristics of respondents in this study aim to provide a general description showing that respondents can be distinguished based on age, education level, farming experience, number of family members, and farming conditions.

Table 4. Characteristics of Garlic Farmer Respondents in Karanganyar Regency

Characteristic	Category	Total	Percentage (%)
Age	Productive Age (15–64 years)	77	70
	Non-productive Age (>64 years)	33	30
Education level	No Formal Education	8	7,3
	Primary School	49	44,5
	Junior High School	29	26,4
	Senior High School	18	16,4
	Bachelor's Degree	6	5,5
Farming Experience	Low (<10 years)	2	1,8
	Moderate (10–20 years)	23	20,9
	High (>20 years)	85	77,3
Number of Family Members	Small Household (1–2 members)	42	38,2
	Medium Household (3–4 members)	54	49,1
	Large Household (>4 members)	14	12,7
Land Ownership Status	Owner-operated	91	82,7
	Rented	19	17,3

Source: Primary Data Analysis (2026)

Based on Table 4, most garlic farmers in Karanganyar Regency were in the productive age group, accounting for 77 respondents (70%) of the total sample. The educational level of respondents was dominated by primary school graduates, with 49 farmers in this category. In terms of farming experience, the majority of respondents (77.3%) had been cultivating garlic for more than 20 years. Regarding household size, the largest proportion of respondents belonged to the medium category, consisting of 3–4 family members (49.1%). Meanwhile, land ownership status was dominated by owner-operated farms, accounting for 82.7% of respondents.

Farm Production Costs and Income

The total cost of garlic farming represents the accumulation of all expenses incurred during the production process, including both explicit and implicit costs. Explicit costs refer to actual expenditures paid by farmers, while implicit costs are costs that are accounted for even though they are not directly paid. The total cost of garlic farming is presented in Table 5.

Table 5. Average Total Production Costs of Garlic Farming in Karanganyar Regency

No	Description	Amount	
		Per 0,15	Per ha
1.	Implicit Cost		
	Own-Input Costs	5.582.301	37.215.342
	Family Labor Costs	3.356.895	22.379.303
Average Implicit Cost		8.939.196	59.594.645
2.	Explicit Cost		
	Purchased Input Costs	3.784.054	25.227.026
	Hired Labor Costs	3.152.745	21.018.300
	Other Costs	322.658,90	2.151.059
Average Explicit Cost		7.259.458	48.396.385
Total Production Cost		16.198.654	107.991.030

Source: Primary Data Analysis (2026)

Based on Table 5, the total cost of garlic farming in Karanganyar Regency consisted of implicit and explicit costs. The average implicit cost for a farm size of 0.15 ha was IDR 8,939,196, equivalent to IDR 59,594,645 per hectare, while the average explicit cost was IDR 7,259,458, equivalent to IDR 48,396,385 per hectare. Consequently, the average total production cost amounted to IDR 16,198,654 per 0.15 ha or IDR 107,991,030 per hectare.

Farm income is defined as the difference between the revenue earned by farmers and the total production costs incurred during the farming process. Based on the results of this study, the income of garlic farmers in Karanganyar Regency was influenced by the level of revenue obtained and the efficiency of production cost utilization. The average income of garlic farmers in Karanganyar Regency is presented in Table 6.

Table 6. Average Farmer Income

Description	Details	Per 0,15	Per ha
Revenue	Production	943,73	6.292
	Selling price	20.000	20.000
Total Revenue		18.874.545	125.830.303
Cost	Implicit cost	8.939.196	59.594.645
	Explicit cost	7.259.458	48.396.385
Total Cost		16.198.654	107.991.030
Farm Income		11.615.087	77.433.918
Provit		2.675.891	17.839.273

Source: Primary Data Analysis (2026)

Based on Table 6, the average revenue earned by farmers was IDR 18,874,545 per 0.15 ha or IDR 125,830,303 per hectare. The average farm income, calculated as total revenue minus explicit costs, was IDR 11,615,087 per 0.15 ha or IDR 77,433,918 per hectare. Meanwhile, the average profit earned by garlic farmers was IDR 2,675,891 per 0.15 ha or IDR 17,839,273 per hectare.

Factors Affecting Garlic Production

This section presents the research results regarding the factors affecting garlic production. To assess the validity and significance of the model, several statistical tests were employed, namely the coefficient of determination (R^2), the F-test (simultaneous test), and the t-test (partial test). The coefficient of determination was used to measure the ability of the independent variables to explain the variation in the dependent variable.

Table 7. Cobb-Douglass test

Variable	Coeficient	t	P>|T|
(Constant)	2.1037		
Land Area (X1)	0.3006	0.32	0.747
Seed Quantity (X2)	0.5879	5.78	0.000***
Labor (X3)	0.3237	2.57	0.012**
Manure Fertilizer (X4)	0.0475	1.61	0.111
Chemical Fertilizer (X5)	0.0852	1.15	0.293
Pesticide Use (X6)	-0.1654	-1.75	0.083*
Prob>F	0.000		
R-Squared	0.6751		

Source: Primary Data Analysis (2026)

The Cobb–Douglas production function analysis showed that seed (X2), labor (X3), and pesticide use (X6) significantly affected garlic production. Seed had a coefficient of 0.5879 and was significant at the 1% level, indicating that a 1% increase in seed use would increase garlic production by 0.5879%, ceteris paribus. Labor had a coefficient of 0.3237 and was significant at the 5% level, implying that a 1% increase in labor input would increase garlic production by 0.3237%. In contrast, pesticide use had a coefficient of −0.1654 and was significant at the 10% level, indicating that a 1% increase in pesticide use would reduce garlic production by 0.1654%. Meanwhile, land area (X1), manure fertilizer (X4), and chemical fertilizer (X5) did not significantly affect garlic production. The coefficients of land area, manure fertilizer, and chemical fertilizer were 0.020, 0.0475, and 0.088, respectively.

DISCUSSION

Farmer's Characteristics

The predominance of farmers in the productive age group indicates favorable conditions for agricultural activities, as farmers of productive age generally possess stronger physical capacity and are more capable of carrying out farming operations effectively. This finding is consistent who reported that productive-age farmers tend to achieve better performance and efficiency in farming activities [9]

Although most respondents had only completed primary school, their extensive farming experience may compensate for limited formal education. Education remains important in supporting farmers' ability to access information and adopt agricultural innovations, which can improve the efficiency of input utilization [10].

The finding that most farmers had more than 20 years of farming experience suggests that they have accumulated substantial technical knowledge and practical skills in garlic cultivation. Longer farming experience contributes to better decision-making and farm management practices [11].

The dominance of households with 3–4 family members indicates the availability of family labor that can support farming activities, including land preparation, crop maintenance, and harvesting. This may reduce dependence on hired labor and lower production costs, thereby improving farming efficiency [12].

Furthermore, the high proportion of owner-operated farms suggests that farmers have greater autonomy in managing their farming activities. Land ownership enables farmers to make independent decisions regarding input use, cropping patterns, and cultivation practices, while also encouraging long-term investment aimed at increasing land productivity. The positive role of land ownership in promoting sustainable agricultural investment and productivity improvements [13].

Farm Production Costs and Income

The relatively high production cost of garlic farming indicates that garlic cultivation requires substantial input use, particularly for production inputs and labor. This finding is consistent, who reported that seed costs and labor costs, including both family and hired labor, constitute the largest components of garlic farming expenses [14]. The large share of these costs reflects the labor-intensive nature of garlic cultivation and the importance of quality seed in achieving optimal production.

The revenue obtained by farmers is closely related to production levels and selling prices. Higher yields and favorable market prices contribute directly to increased farm revenue. Higher revenue levels for certain garlic varieties due to differences in productivity and market prices. This suggests that variations in production performance and price conditions can substantially influence farmers' earnings [15].

Farm income is determined not only by the amount of revenue generated but also by the efficiency of production cost utilization, particularly explicit costs. The income level differences may occur due to variations in production costs, input use, and farm management practices. Efficient allocation of production inputs can help farmers maximize income while maintaining production performance [16].

The positive profit obtained by garlic farmers indicates that garlic farming in Karanganyar Regency remains economically feasible and profitable. Because profit calculations include both explicit and implicit costs, the positive profit value reflects a genuine economic return to farmers. Garlic farming in Indonesia remains profitable from both private and social profitability perspectives. Therefore, garlic farming continues to be a viable agricultural enterprise that can contribute to farmers' livelihoods and rural economic development [17].

Factors Affecting Garlic Production

The positive and significant effect of seed use indicates that seed is one of the most important factors determining garlic production. The coefficient value suggests that increasing the quantity and quality of seed can substantially improve production performance. This finding is consistent, who reported that the use of healthy and high-quality seeds enhances vegetative growth and increases garlic yield. Technically, quality seeds improve germination rates, crop uniformity, and bulb development, which ultimately contribute to higher production [18].

Labor also had a positive and significant effect on garlic production. Garlic cultivation requires intensive labor throughout the production process, including land preparation, planting, maintenance, and harvesting. Therefore, an increase in labor availability can improve the effectiveness of farming operations and support higher production levels. This result supports the findings of [19], who identified labor as a significant production factor in garlic farming in Karanganyar Regency.

In contrast, pesticide use had a significant negative effect on garlic production. This result suggests that excessive pesticide application may reduce production efficiency rather than improve it. Overuse of pesticides can disrupt agroecosystem balance, decrease soil quality, and contribute to pest resistance, thereby negatively affecting crop productivity. Similar observations were reported by [20], these findings indicate the importance of applying pesticides according to recommended dosages and actual pest management needs.

Although manure fertilizer had a positive coefficient, its effect on garlic production was not statistically significant. This may be because nutrients from organic fertilizers are released gradually and their effects are often realized over a longer period. In addition, differences in application rates and farmers' reliance on inorganic fertilizers may reduce the observable contribution of manure to production. This finding is in line with [21], who emphasized that manure improves soil fertility but does not always have an immediate significant effect on crop yields.

Similarly, chemical fertilizer did not significantly affect garlic production. This result may indicate that fertilizer application has not been conducted at optimal rates or that fertilizer use among farmers has already reached a level where additional inputs no longer generate substantial yield increases. Suggested that inappropriate fertilizer application can limit the effectiveness of chemical fertilizers in increasing production [22].

Land area was also found to have no significant effect on garlic production. This finding suggests that production is influenced more by the effectiveness of input utilization and farm management practices than by farm size alone. Larger landholdings do not necessarily produce higher yields if production inputs are not managed efficiently. This result is consistent with [23], who reported that agricultural productivity is often determined by input intensity and management quality rather than land area itself.

CONCLUSION

The average production cost of garlic farming in Karanganyar Regency was IDR 16,198,654 per 0.15 ha or IDR 107,991,030 per hectare. The average revenue of farmers was IDR 18,874,545 per 0.15 ha or IDR 125,830,303 per hectare, while the average income was IDR 11,615,087 per 0.15 ha or IDR 77,433,918 per hectare. The profit earned by farmers in one planting season was IDR 2,675,891 per 0.15 ha or IDR 17,839,273 per hectare. These results indicate that garlic farming in Karanganyar Regency remains profitable and feasible to cultivate. The results of the Cobb-Douglas production function analysis showed that the variables of seed (X2), labor (X3), and pesticides (X6) affected garlic production. Seed and labor had a positive effect on production, while pesticides had a negative effect on production. Meanwhile, the variables of land area (X1), manure (X4), and chemical fertilizer (X5) did not have a significant effect on garlic production in Karanganyar Regency.

Declaration by Authors

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REFERENCES

1. Purnama, E., Amin Firdaus, L., & Setiawan, F. (2024). Pengembangan Kawasan Pertanian Tanaman Hortikultura Kabupaten Bangka Selatan dengan Analisisis Quantum Geographic Information System (QGIS). *Jurnal Mimbar Agribisnis, 10*(1), 1303–1319.
2. Chavez, M. S. N., & Franco, J. A. A. (2025). Production and Marketing of Ecological and Standardized Garlic Powder: A Technical-Economic Analysis. Proceedings on Engineering Sciences. 7(3), 1407–1414. https://doi.org/10.24874/PES07.03.002
3. Melni, Y. S., Evaliza, D., & Sari, R. (2023). Analisis Perbandingan Pendapatan dan Keuntungan Usahatani Petani Karet di Nagari Padang Laweh Kecamatan Koto VII Kabupaten Sijunjung Sebelum dan Pada Saat Covid-19. Journal of Socio-Economics on Tropical Agriculture, 4(3), 118-127.
4. Suminartika, E., Sulistyowati, L., & Kusno, K. (2019). Efisiensi Faktor-Faktor Produksi Usahatani Kedelai. *Jurnal Sosiohumaniora*, *21*(2), 194–199. https://doi.org/10.24198/sosiohumaniora.v21i2.14879
5. Danasari, I. F., Suryadi, D., Nurminda, E., Mandalika, D., & Komang Suparyana, P. (2023) Profitabilitas Usaha Tani Bawang Putih pada Berbagai Tingkat Efisiensi di Kecamatan Sembalun. *Jurnal Agro Ekonomi*, *41*(2), 129–146.
6. Noer, S. R., Wan, A. Z., & Ktut, M. (2018). Analisis Efisiensi Produksi Usahatani Padi Ladang di Kecamatan Sidomulyo Kabupaten Lampung Selatan. *JIIA, 6*(1), 17-24.
7. Berk, R., Buja, A., Brown, L., George, E., Kuchibhotla, A. K., Su, W., & Zhao, L. (2021). Assumption Lean Regression. *Journal American Statistician*, *75*(1), 76–84. https://doi.org/10.1080/00031305.2019.1592781
8. Nastiti, E., Damayanti, T., & Madina, S. A. (2023). Dampak Pelanggaran Asumsi Klasik Terhadap Estimasi Model Ekonometrika. *Jurnal Pijar, 2*(1), 150–158. https://e-journal.naureendigition.com/index.php/pmb
9. Gusti, I. M., Gayatri, S., & Prasetyo, A. S. (2022). The Affecting of Farmer Ages, Level of Education and Farm Experience of The Farming Knowledge About Kartu Tani Beneficial and Method of Use in Parakan Distric, Temanggung Regency. *Jurnal Litbang Provinsi Jawa Tengah, 19*(2), 209–221. https://doi.org/10.36762/jurnaljateng.v19i2.926
10. Resmianto, A. H., Sambodo, R., & Mildaryani, W. (2025). Pengaruh Tingkat Pendidikan, Pengalaman Bertani dan Luas Lahan Terhadap Pendapatan Petani Kakao di Kecamatan Girimulyo, Kabupaten Kulon Progo. *Proceedings Series on Physical & Formal Sciences*, 8, 235–242.
11. Seran, K. I., Kapa, M. M. J., & Pudjiastuti, S. S. P. (2020). Efisiensi Produksi Usahatani Bawang Putih Lokal di Kecamatan Miomaffo Barat, Kabupaten Timor Tengah Utara. *Jurnal Buletin Ilmiah, 21*(3), 245–252.
12. Putra, W. E., Utama, S. P., & Purwoko, A. (2020). Family Labor Contribution to Vegetable Farming Income of Rainfed Lowland Fields in Central Bengkulu

Regency. *Journal of Agri Socio-Economic and Business, 2*(2), 85–98. https://doi.org/10.31186/jaseb.02.2.85-98
13. Schling, M., Saenz Somarriba, M., Mattos, J. de D., & Chang Huaita, R. (2026). Land Regularization and Technical Efficiency in Agricultural Production: An Empirical Study in Andean Countries. *Journal of Rural Studies, 1*(121), 1–121. https://doi.org/10.1016/j.jrurstud.2025.103912
14. Kurniawan, A. D., Ferichani, M., & Fajarningsih, R. U. (2023). Analisis Komparatif Usahatani Bawang Putih (Allium sativum L.) Varietas Lumbu Hijau dan Tawangmangu Baru di Kecamatan Tawangmangu, Kabupaten Karanganyar. *Jurnal Agrista*, *11*(3), 56–67.
15. Wardianto, A., Siti Rahayu, E., & Kunto Adi, R. (2022). Analisis Usahatani Bawang Putih di Kabupaten Karanganyar. *Jurnal Agrista, 10*(3), 85–92.
16. Lima, M. F. P., Lopes, W. D. A. R., Negreiros, M.Z., Resende, F. V., Bessa, A. T. M., & Grangeiro, L. C. (2021). Clove-Seed Size and Health and Plant Spacing on the Viability of Garlic Crops. *Journal Revista Caatinga*, *34*(3), 559–569.
17. Rohmawati, I., Suryantini, A., & Masyhurii. (2023). Analisis Efisiensi Ekonomi Bawang Putih (Allium sativum L.) di Kabupaten Karanganyar Menggunakan Pendekatan Stochastic Frontier. Seminar Nasional Dalam Rangka Dies Natalis Ke-47 UNS Tahun 2023, *7*(1), 780–788.
18. Rinaldy, R., & Pahira, S. H. (2025). Long-Term Effects of Agropharmaceutic (Pesticide Category) Use on Soil Microbial Communities and Water Resources. *International Journal of Environmental Quality, 69*(1), 87–95. https://doi.org/10.6092/issn.2281-4485/21556
19. Yasir, M., Hossain, A., & Pratap-Singh, A. (2025). Pesticide Degradation: Impacts on Soil Fertility and Nutrient Cycling. *Journal Environments MDPI, 12*(8), 1–35. https://doi.org/10.3390/environments12080272
20. Pudjiastuti, A. Q., Kaluge, D., & Widowati. (2023). Reallocation of The Use of Chemical Fertilizers and Pesticides to Increase The Income of Vegetable Farmers and Prevent Land Degradation. *Journal of Degraded and Mining Lands Management, 11*(1), 5095–5103. https://doi.org/10.15243/jdmlm.2023.111.5095
21. Pasaribu, P. S., Fitrawaty, & Rahmadana, M. F. (2024). The Effect of Land Area, Labor, Fertilizer Subsidyon Agricultural Production in Indonesia. *Journal Randwick International of Social Sciences, 5*(2), 216–221. https://doi.org/10.47175/rielsj.v5i2.950
22. Tang, M., Wang, C., Ying, C., Mei, S., Tong, T., Ma, Y., & Wang, Q. (2023). Research on Cultivated Land Quality Restriction Factors Based on Cultivated Land Quality Level Evaluation. *Journal Sustainability MDPI, 15*(15), 1–12. https://doi.org/https://doi.org/10.3390/su15097567

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