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ANALYSIS OF PRODUCTION, INCOME AND THE DEVELOPMENT STRATEGY OF THE CRYSTAL GUAVA COMMODITY: A CASE STUDY IN KUOK VILLAGE, KUOK DISTRICT, KAMPAR REGENCY

Dini Amalia Putri[1], Tri Kurniaty[2], Yogy Rasihen[3]

[1,2,3)] *Agribusiness Management Study Program, Kampar Polytechnic, 28412*
Corresponding Author: *diniamaliaputri52@gmail.com*

Abstract
Guava Crystal (Psidium guajava L.) is a tropical-adapted guava variety with high commercial value and strong prospects for future development. Kuok District serves as a major production center for this commodity in Kampar Regency. Its substantial economic value indicates significant potential to improve farmers' income and living standards.This study aims to identify effective development strategies for increasing farmers' income through an analysis of production and income. Kuok Village, one of the main Guava Crystal–producing areas, was deliberately selected as the research site. The study employs a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis conducted in three stages to determine appropriate development strategies for Guava Crystal. The first stage is the input stage, which involves the analysis of the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices.The results show that plant density has a significant influence on production, and that optimizing existing strengths and opportunities can enhance both output and farmers' earnings. Guava Crystal farming has demonstrated high efficiency, generating an average annual income of IDR 92,537,895 per hectare with a return-to-cost ratio of 7.44. By optimizing plant population and leveraging the large market potential, development strategies can be implemented effectively, providing long-term benefits for farmers and improving their overall welfare.

Keywords: *Crystal Guava; Development Strategy; Production; Revenue*

1. INTRODUCTION

Indonesia is an agrarian country, meaning that the agricultural sector plays a vital role in the overall national economy. This is reflected in the large proportion of the population or workforce that lives from or is employed in the agricultural sector, as well as in the contribution of agriculture to national output (Tunjung in Wijaya et al., 2020).

Agribusiness refers to an integrated agricultural production system that includes the utilization of agricultural production inputs, farming activities, and the management of agricultural outputs. In the economic context and as an academic discipline, agribusiness examines strategies to achieve profitability by managing activities ranging from cultivation and input provision to post-harvest handling, processing, and marketing (Andayani, 2017). One aspect of economic development in Indonesia, particularly in agricultural development, is the promotion of horticultural products. The horticulture sector continues to grow and develop over time and plays an important role in increasing horticultural commodity production in Indonesia, with considerable development potential. One horticultural commodity with strong potential is crystal guava.

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According to Ramdhona et al. (2019), guava varieties include Crystal, Getas Merah, Mutiara, and Bangkok guava. Crystal guava is one of the most preferred fruits among consumers due to its very few seeds, relatively large fruit size, sweet and crunchy taste, clean flesh, and health benefits (Kurniawan, 2015). Crystal guava (Psidium guajava L.) is a guava variety that grows optimally in tropical regions, has high economic value, and offers strong development potential. In Indonesia, West Java is the largest guava production center, followed by Central Java, East Java, North Sumatra, South Sumatra, and Kalimantan (Putri, 2019). Crystal guava is distinctive in terms of its texture and appearance. Its advantages include medium-sized fruit, thick white flesh with few seeds, a very sweet taste, and relatively low water content, resulting in a soft yet crunchy texture similar to that of pears (Pratidina et al., 2016).

Based on data from the Central Bureau of Statistics (BPS, 2024), Indonesia’s population reached 281.6 million people in 2024. In the same year, the average monthly income increased to IDR 6.55 million, up from IDR 6.25 million per month in 2023. This growth has led to increased and more diverse food demand. In addition, public awareness of the importance of health and adequate nutrition has continued to rise, with fruits being a key source of essential nutrients. Horticultural agribusiness serves as an important source of income for small-, medium-, and large-scale farmers due to its high selling value, sustainability, product diversity, availability of land and technology, and expanding domestic and international market opportunities. Domestic horticultural products are currently able to supply approximately 107 quintals of guava to meet consumer demand through both traditional markets and export channels (BPS, 2020). However, in 2023, BPS reported a decline in crystal guava productivity from 109.84 kg per tree to 89.89 kg per tree. Therefore, efforts are needed to optimize crystal guava productivity in the coming years.

Kampar Regency is one of the potential areas for crystal guava development in Riau Province. This potential is supported by favorable environmental conditions, including adequate natural resources such as soil quality, climate, elevation, and temperature. In addition, human resources also play a role, as most farmers in Kuok Village are engaged in crystal guava farming. According to the Central Bureau of Statistics of Kampar Regency, the development of crystal guava has not been significant. In 2023, crystal guava production in Kampar Regency declined sharply to 12,365 quintals, compared to 46,805 quintals in 2022.

Kuok District is one of the main crystal guava production centers in Kampar Regency. Production increased significantly in 2022, reaching 29,983 quintals, but declined sharply to 3,050 quintals in 2023 (BPS Kampar Regency, 2024). These fluctuations reflect instability in farm management, particularly in terms of technical production practices, input utilization, and development strategies.

Table 1. Amount of Crystal Guava Production in Kampar Regency by District, 2020-2023

No	Subdistrict	Crystal Guava Commodity Production (Quintal)			
		2020	2021	2022	2023
1	Kampar Kiri	1,019	676	480	289
2	Kampar Kiri Hulu	1,200	520	480	324
3	Kampar Kiri Hilir	11,347	3697	3696	262
4	Gunung Sahilan	1,350	108	205	200
5	Kampar Kiri Tengah	154	40	40	99
6	XIII Koto Kampar	19	3	57	21
7	Koto Kampar Hulu	132	538	543	115
8	Kuok	8,010	-	29,983	3,050
9	Salo	1,648	2808	1828	1,014
10	Tapung	3,343	3704	3800	2,901
11	Tapung Hulu	390	216	413	100
12	Tapung Hilir	396	460	848	596

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No	Subdistrict	Crystal Guava Commodity Production (Quintal)			
		2020	2021	2022	2023
13	Bangkinang Kota	142	86	200	68
14	Bangkinang	243	320	534	1,547
15	Kampar	448	401	383	169
16	Kampa	120	102	176	142
17	Rumbio Jaya	49	80	80	50
18	Kampar Utara	1,211	1427	1,056	505
19	Tambang	79	418	1,240	367
20	Siak Hulu	481	171	583	434
21	Perhentian Raja	402	296	180	112
	Kampar	32,184	16,072	46,805	12,365

Source: BPS Kampar Regency, 2024

Crystal guava plants in Kuok Village are a leading commodity and a fruit group with economic value, significantly impacting the income of crystal guava farmers and improving their well-being. Many consumers purchase crystal guava directly from farmers, picking the fresh fruit themselves. Farmers also sell their produce to collectors and retailers.

In terms of price, crystal guava has a relatively high selling value in both local and regional markets, with prices generally ranging from IDR 15,000 to IDR 19,000 per kilogram, or even higher depending on product quality and the marketing channels used. For instance, under the affordable food market program in Kampar Regency, crystal guava is offered at approximately IDR 15,000 per kilogram as part of efforts to ensure public access to affordable food. Meanwhile, on several online marketing platforms, fresh crystal guava is sold at around IDR 18,000–20,000 per kilogram.

The decline in crystal guava production amid increasing buyer interest has become a major issue in crystal guava farming. Data from the Central Bureau of Statistics (BPS) of Kampar Regency (2024) show that crystal guava production experienced a very significant decrease, falling from 46,805 quintals in 2022 to 12,365 quintals in 2023. This sharp decline in production has directly affected the availability of crystal guava supplies in local and regional markets.

On the other hand, although overall demand for fresh fruits with high nutritional value tends to increase along with rising public awareness of healthy lifestyles, the data indicate that consumer purchasing interest in crystal guava has fluctuated and declined during certain periods. According to the National Socio-Economic Survey (SUSENAS) released by BPS (2023), household per capita fruit consumption in several regions, including Riau Province, stagnated and even declined compared to the previous year, mainly due to rising food prices and weakening purchasing power among parts of the population. This condition has led some consumers to reduce the frequency of purchasing certain fruits, including crystal guava, despite increased health awareness.

In addition, the increase in crystal guava prices at the consumer level—ranging from IDR 15,000 to IDR 20,000 per kilogram in local markets in Kampar Regency—has also influenced purchasing interest. BPS (2024) notes that rising horticultural commodity prices may reduce purchase volumes, particularly among middle- and lower-income households. This indicates that increased consumer interest does not always translate into a consistent rise in actual purchases.

The imbalance between declining production, fluctuating purchasing interest, and changes in consumer purchasing power poses potential challenges to the sustainability of crystal guava farming, including market instability, price volatility, and the risk of declining farmer income. Therefore, to increase crystal guava production while maintaining and expanding consumer demand, farmers need to develop crystal guava agribusinesses to enhance competitiveness in the domestic market. This effort requires effective and efficient strategies that take into account both internal and external farming conditions. The development strategy for crystal guava commodities aims to optimally improve production quality and quantity while creating a sustainable agribusiness system.

Consumer interest in fresh fruits, particularly those with high nutritional value, continues to increase along with growing public awareness of healthy lifestyles and the rising demand for local horticultural products in both traditional and modern markets. This strong demand is reflected in the large number of consumers who visit farmers' orchards directly to purchase fresh fruit, as well as in the existence of distribution channels involving collectors and retail traders.

Another current issue is the suboptimal development of integrated crystal guava agribusiness strategies. Most farmers remain oriented toward primary production without long-term business development planning, resulting in weak product competitiveness (David, 2017). In fact, appropriate development strategies that take into account both internal and external factors can improve business efficiency and ensure agribusiness sustainability.

Based on these conditions, a comprehensive study is needed to analyze production factors, farm income, and to formulate effective and applicable crystal guava development strategies. SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is a relevant strategic tool for identifying the position of crystal guava farming and formulating alternative development strategies that are aligned with current conditions (Rangkuti, 2016).

1.1. Research Problem Formulation

Based on the background that has been described, this research aims to answer the following questions:

1. How do production input factors influence the production of Crystal Guava in Kuok Village, Kuok District, Kampar Regency?
2. How much is the income from Crystal Guava farming in Kuok Village, Kuok District, Kampar Regency?
3. What is the right development strategy for Crystal Guava commodities in Kuok Village, Kuok District, Kampar Regency?

1.2. Research Objectives

Based on the problem formulation that has been formulated, the objectives of this research are:

1. Analyzing crystal guava production by examining the effects of production factors in Kuok Village, Kuok District, Kampar Regency.
2. Analyzing farmer income in Crystal Guava farming in Kuok Village, Kuok District, Kampar Regency.
3. Developing a strategy for developing Crystal Guava commodities in Kuok Village, Kuok District, Kampar Regency.

1.3. Benefits of Research

The expected benefits of this research are as follows:

1. For Crystal Guava Farmers
   This research is expected to provide a clear overview of crystal guava farm income and the production factors that influence it, thereby serving as a basis for farmers to improve

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production efficiency, increase income, and ensure the sustainability of their farming activities.

2. For Local Government and Related Institutions
   The findings of this research are expected to serve as input for the formulation of policies and programs for the development of crystal guava agribusiness, particularly in efforts to increase production, improve farmers' welfare, and strengthen the competitiveness of horticultural commodities in Kampar Regency.
3. For Academics and Researchers
   This research is expected to serve as a scientific reference and a source of information for future studies related to production analysis, farm income, and the development strategies of crystal guava agribusiness as well as other horticultural commodities.
4. For Agribusiness Actors and the Private Sector
   This research can provide information on the potential development of crystal guava and business and marketing opportunities that can be utilized to support sustainable agribusiness development.

2. METHOD

2.1 Time and Place of Research

This research was conducted over a six-month period, from March 2025 to August 2025, in Kuok Village, Kuok District, Kampar Regency. The study analyzed crystal guava production, farmers' income, and development strategies using descriptive, analytical, and correlative approaches. Kuok Village was deliberately selected as the research location because it is recognized as one of the main centers of crystal guava cultivation in Kampar Regency and has farmers who are consistently engaged in crystal guava farming activities, making it relevant for achieving the research objectives.

The population of this study consisted of all crystal guava farmers in Kuok Village. From this population, a sample of 10 crystal guava farmers was selected using purposive sampling, based on their active involvement and experience in crystal guava farming. Primary data were collected through open-ended questionnaires and direct interviews with the respondents, while secondary data were obtained from related institutions, reports, and literature.

To examine the influence of production factors on crystal guava output, multiple linear regression analysis was employed. Prior to conducting the regression analysis, classical assumption tests were performed to ensure the accuracy and reliability of the regression model. These tests included a normality test to assess whether the residuals followed a normal distribution, a heteroscedasticity test to identify the presence of unequal variance in the residuals, a multicollinearity test to detect correlations among independent variables, and an autocorrelation test to determine whether residuals were correlated across observations. The fulfillment of these assumptions indicates that the regression model is appropriate for further analysis.

The hypotheses tested in this study were formulated as follows:
H_0: Production factors do not have a significant effect on crystal guava production in Kuok Village, Kuok District, Kampar Regency.
H_1: Production factors have a significant effect on crystal guava production in Kuok Village, Kuok District, Kampar Regency.

2.2 Method of collecting data

Quantitative techniques based on primary and secondary data were employed in this study. Primary data were collected directly from crystal guava farmers through open-ended questionnaire interviews and field surveys. The primary data included crystal guava farm production (kg and revenue/IDR), land area (hectares), number of plants (trees), plant age (years), amount of organic fertilizer used (kg), and amount of inorganic fertilizer used (kg). These data were used to analyze the production performance and the influence of production factors on crystal guava output.

Secondary data were obtained from relevant institutions such as the Department of Agriculture and the Central Statistics Agency (BPS), as well as from books, scientific journals, and previous research studies. The secondary data included information on the number of crystal guava farmers, regional production statistics, harvested area, price trends of crystal guava, population data, and agricultural development policies related to horticultural commodities in Kampar Regency.

2.3 Data analysis

To identify factors influencing crystal guava production, this study analyzed qualitative and quantitative data. The qualitative analysis used the Cobb-Douglas production function to identify limitations in crystal guava cultivation. The following is the formula for the Cobb-Douglas production function:

$$Y = a\ X1^{b1}\ X2^{b2}\ X3^{b3}\ X4^{b4}\ X5^{b5}$$

Description:
Y = Crystal guava production (kg) X1 = Land area (ha) X2 = Number of plants (trees) X3 = Age of plants (years) X4 = Organic fertilizer (kg) X5 = Inorganic fertilizer (kg) X6 = Labor (HOK) a = Constant tab1-b6 = Regression coefficient e = Disturbance or error (disturbance term)

To determine the profitability of crystal guava cultivation, this study used income analysis. This analysis is conducted by calculating the amount of income generated, which is obtained from the difference between total revenue (TR) and total costs (TC). The income formula can be expressed as follows:

Income (π) = TR − TC

Where total revenue (TR) is calculated as the product of price and quantity of output, formulated as:

TR = P × Q

Where:
P = selling price of crystal guava (IDR/kg)
Q = quantity of crystal guava produced (kg)

Total cost (TC) is the sum of total fixed costs (TFC) and total variable costs (TVC), which can be formulated as:

TC = TFC + TVC

Based on the decision-making criteria, crystal guava cultivation is considered profitable if TR > TC. It is considered to have reached the break-even point (BEP) if TR = TC. On the other hand, crystal guava cultivation is considered unprofitable if TR < TC.

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Furthermore, by comparing total revenue with total costs, this study applies the Revenue-Cost Ratio (R/C Ratio) method to evaluate the cost efficiency of crystal guava cultivation. The R/C ratio is calculated using the following formula:

R/C Ratio = TR / TC

The decision-making criteria for the R/C ratio are as follows:

- If R/C > 1, crystal guava farming is efficient and profitable;
- If R/C = 1, crystal guava farming reaches the break-even point;
- If R/C < 1, crystal guava farming is inefficient and incurs losses.

In addition, this study uses a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis consisting of three stages to determine the development strategy for crystal guava cultivation. The first stage is the input stage, which involves analyzing the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices. The second stage is the matching stage, which involves formulating strategic alternatives using the SWOT matrix. Finally, the decision-making stage employs the Quantitative Strategic Planning Matrix (QSPM) to determine strategic priorities.

Through these analyses, this study aims to identify the optimal and most appropriate development strategy for crystal guava cultivation in Kuok Village, Kuok District, Kampar Regency.

3. RESULT AND DISCUSSION

Located in Kuok District, Kuok Village borders Salo District and covers an area of over 6,000 hectares. The Kampar River divides the hilly and plain areas that make up the hamlet. There are approximately 8,485 people and 2,515 households living in the six hamlets that make up Kuok Village. Kuok Village is located in Salo District and borders Empat Balai Village to the north, Bukit Melintang Village to the south, Pulau Terap Village and Lereng Village to the west, and Ganting Village to the east. Among the several village heads who have led Kuok Village since its founding in 1978 is Khairisman, SH, whose term began in 2018 and will end in 2026.

Located in Kuok District, Kampar Regency, Kuok Village spans approximately 6,600 hectares and is 43 meters above sea level. Temperatures typically range between 22 and 30 degrees Celsius. The closest major cities to Kuok Village are the provincial capital (75 km away) and the district capital (approximately 10 km away). The official boundaries of Kuok Village are as follows:

- North: Kampar River (Empat Balai)
- South: Simauang River (Bukit Melintang Village)
- West: Pulau Terap Village and Lereng Village
- East: Titian Toghe (Ganting Village)

Inefficient land use can be made efficient without affecting productivity, income, and community welfare, while minimizing negative impacts on the environment.

Kuok District, which covers an area of approximately 473.80 km², has significant potential for agricultural development, including the cultivation of crystal guava. Kuok Village, with an area of approximately 60 km², has ample land, fertile soil, and a climate conducive to the growth of crystal guava. Developing crystal guava in Kuok Village can increase local incomes and open up new job opportunities. Therefore, Kuok Village has significant potential to increase production and income through crystal guava cultivation.

Population is a crucial asset for development, particularly as a potential workforce in the agricultural sector. Population conditions encompass demographic and socioeconomic aspects, such as population size, age structure, education level, livelihoods, and geographic distribution. Based on village potential data for 2024, Kuok District has a total population of 26,816, with a breakdown of the population of Kuok Village as follows: 7,181 people, consisting of 3,776 males and 3,405 females. For more details, see Table 3 below.

Table 2. Distribution of the Population of Kuok Village, Detailed by Age Group and Gender

No	Age Group (Years)	Gender		Number (of people)	Percentage (%)
		Man	Woman		
1.	0 - 14	3.776	3.405	7.181	29,71
2.	15 – 59	8.679	8.307	16.986	70,29
	Amount	12.455	11.712	24.167	100,00

Source: Kuok Village Monograph, 2024

The productive age of the population in Kuok Village, Kuok District, is between 15 and 64 years old, and based on data, approximately 70.29% of the population is within the productive age range (15-59 years). This finding indicates that the village's human resources are sufficient for development through education and training to improve the quality and productivity of the productive population.

The agricultural sector in Kuok Village, Kuok District, plays a vital role in the village economy, thanks to its vast and fertile agricultural land, ideal for agricultural activities. Kuok Village produces a variety of agricultural products, including Crystal Guava, vegetables, and other fruits, with Crystal Guava being one of its mainstay commodities. The agricultural sector in Kuok Village holds significant economic potential to boost community income and the village economy. Therefore, the government and stakeholders continue to strive to improve agricultural production and quality through technology, training, and innovation.To begin the study of crystal guava development in Kuok Village, Kuok District, and analyze output and income, data collection is a crucial first step. Field surveys, conversations with farmers, and review of relevant documents all contributed to the dataset. Production, land area, quantity, quality, selling price, expenses, and net income are all part of this dataset. The income of crystal guava farmers in the village was calculated using this data.

Analysis of Factors Affecting Crystal Guava Production

Crystal guava is a flagship commodity in Kuok Village, Kuok District, with significant potential to increase farmers' incomes and support the local economy. However, crystal guava production is influenced by various factors that need to be analyzed to improve efficiency and productivity. These factors include plant age, number of plants, land area, the use of organic and inorganic fertilizers, and labor. The analysis was conducted using SPSS with the Cobb-Douglas production function model.

The use of the Cobb-Douglas production function in this study aligns with neoclassical production theory, which states that agricultural output is influenced by a combination of production inputs such as land, labor, capital, and technology (Soekartawi, 2003). This model is widely used in agricultural research because it can illustrate the elasticity of each production factor.

The F-test results show that all input variables simultaneously have a significant effect on crystal guava production. This finding is consistent with Rahman et al. (2020), who stated that horticultural production is the result of the interaction of multiple production inputs, rather than being influenced by a single factor.

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The model's validity was tested using classical assumption tests, including normality, multicollinearity, heteroscedasticity, and autocorrelation tests. The F-test was used to determine the simultaneous effect of production factors, while the t-test was used to assess the partial effect of each production factor.

The F-test results indicate that production factors together significantly affect crystal guava production, as shown by the calculated F-value of 29.330, which is greater than the F-table value of 3.22, and a significance value of 0.009, which is smaller than $\alpha = 0.05$.

Regression analysis shows that 98.3% of the variation in crystal guava production can be explained by land area, number of plants, plant age, organic fertilizer, inorganic fertilizer, and labor. The total elasticity value of 1.335 (>1) indicates Increasing Returns to Scale, meaning that small changes in inputs will produce proportionally larger changes in output.

Partially, land area does not have a significant effect on production, although it has a positive relationship. Theoretically, land area is an important factor in increasing production (Mubyarto, 1989). However, the results of this study indicate that land area is not significant. This finding is consistent with Putri et al. (2021), which stated that in intensive farming systems, productivity is more determined by the quality of land management than by land area alone.

The number of plants has a significant and positive effect on crystal guava production. This aligns with production theory, which states that an increase in key inputs will increase output (Nicholson, 2005). Hidayat et al. (2020) also found that optimal plant density directly increases total fruit production.

Plant age has a negative and non-significant effect, due to the decline in physiological capacity as plants age. Biologically, older plants experience reduced productivity due to lower photosynthetic ability and increased susceptibility to diseases (Gardner et al., 1991). This finding is consistent with Sari & Wahyudi (2018) on perennial fruit crops.

Organic fertilizer has a negative and non-significant effect due to excessive use. The negative effect of organic fertilizer on production indicates suboptimal application. According to Hardjowigeno (2007), excessive organic fertilizer can cause nutrient imbalance and degrade soil structure. Lestari et al. (2022) also found that excessive doses of organic fertilizer reduce horticultural crop yields.

Inorganic fertilizer has a positive but non-significant effect. The positive relationship aligns with theory, as inorganic fertilizer provides macronutrients quickly (FAO, 2006). However, the non-significance indicates that fertilizer effectiveness depends heavily on dosage, application timing, and soil conditions, as explained by Sutanto (2014).

Labor has a negative and non-significant effect on crystal guava production. This supports the theory of diminishing returns, where excessive labor without technological improvements reduces efficiency (Samuelson & Nordhaus, 2010). Yuliana et al. (2019) also found that unskilled labor can decrease horticultural farm productivity.

The normality test aims to determine whether the residuals are normally distributed. Normally distributed residuals indicate that the regression model satisfies a key classical assumption and allows for valid statistical inference, while also helping to detect the presence of outliers.
Theoretically, land area is an important factor in increasing production (Mubyarto, 1989). However, the results of this study indicate that land area does not have a significant effect. This finding aligns

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with the study by Putri et al. (2021), which stated that in intensive farming systems, productivity is more determined by the quality of land management rather than by land area alone..

The multicollinearity test is used to examine whether there is a high correlation among the independent variables. Severe multicollinearity can cause instability in regression coefficients and make it difficult to interpret the individual effect of each variable. This condition is commonly assessed using tolerance values and the Variance Inflation Factor (VIF).

The heteroscedasticity test is conducted to assess whether the variance of the residuals is constant across all levels of the independent variables. If heteroscedasticity is present, the estimates become inefficient and the standard errors inaccurate, leading to less reliable hypothesis testing.

The autocorrelation test aims to determine whether there is a relationship among residuals across observations. Autocorrelation can result in biased standard errors and misleading conclusions. Therefore, the absence of autocorrelation strengthens the validity of the regression model.

Through the application of all these classical assumption tests, this study ensures that the multiple linear regression model used meets statistical requirements and produces reliable results to support decision-making and policy recommendations.

The normality test indicates that the data are normally distributed. The heteroscedasticity test shows no signs of heteroscedasticity. The multicollinearity test reveals a fairly strong relationship among the independent variables, as indicated by VIF values greater than 10 for several variables. The autocorrelation test, with a Durbin-Watson value of 2.977, indicates the absence of autocorrelation.

Table 3. Analysis of Factors Affecting Crystal Guava Production in Kuok Village, Kuok District, Kampar Regency

Model	Sum Of Square	Mean Square	F	Sig (0.05)
Regression	2,240	.373	29,330	.009
Residual	.038	.013		
Total	2,278			
Adjusted R²	0.950			

Primary Data Sources Processed in 2025

Crystal guava production is significantly influenced by production factors such as land area, number of plants, plant age, organic and inorganic fertilizers, and labor. This is supported by the fact that the calculated F value (29.330) is greater than the F table value (3.22) and the significance value (0.009) is smaller than α= 0.05.

Table 4. Linear Regression Analysis of Factors Affecting Crystal Guava Farming Production in Kuok Village, Kuok District, 2025.

No.	Variables	Regression Coefficient	Standard Error	T_{count}	Sig.	Note
1	Land Area (X_1)	0.113	0.585	0.194	0.859	*
2	Number of Trees (plants) (X_2)	1,163	0.154	7,566	0.005	***
3	Plant age (X_3)	-0.037	0.080	-0.459	0.677	*
4	Organic fertilizer (X_4)	-0.776	0.560	-1,386	0.260	*
5	Inorganic fertilizer (X_5)	0.963	0.832	1,157	0.331	*
6	Labor (X_6)	-0.091	0.134	-0.681	0.545	*

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9	Amount	1,335
10	Intercept (bo)	2,890
12	R	0.992
13	R^2	0.983
14	F_{count}	29,330
15	F_{table}	3.22
16	T_{table}	2.35
17	F Sig	0.009

Source: Primary Data Analysis (2025)

From Table 5, the production function for crystal guava farming is as follows:
Y = $2{,}890 X1^{0{,}585} X2^{0{,}154} X3^{0{,}080} X4^{0{,}560} X5^{0{,}832} X6^{0{,}134}$

Information:
Y : Crystal Guava Farming Production (Kg/Rp)
X1 : Land Area (Ha)
X2 : Number of Plants (Trees/stems)
X3 : Plant Age (Years)
X4 : Organic Fertilizer (Kg)
X5 : Inorganic Fertilizer (Kg)
X6 : Labor Force (HOK)

A total of 98.3% of the variation in Crystal guava output is due to model-independent inputs such as land size, number of plants, plant age, organic and inorganic fertilizers, and labor. Crystal guava production is highly elastic, with a regression value of 1.335 (>1) indicating that small changes in inputs will result in large changes in output, a phenomenon called Increasing Returns to Scale. Therefore, input modification has a significant impact on Crystal guava production. At the 10% significance level, the calculated t-value (0.194) is smaller than the tabulated t-value (2.35), indicating that land area does not have a significant impact on Crystal guava output. However, Crystal guava output is positively correlated with land area, with a 1% increase in land area causing a 0.113 percent increase in production. Other more important variables, such as seed quality, cultivation methods, and poor land quality, may explain why land area does not appear to significantly affect Crystal guava yield.

At a significance level of 10%, the calculated t-value (7.566) is greater than the calculated t-value (2.35), so the findings of the t-test study indicate that the number of plants significantly affects the production of Crystal guava. An increase in plant density by 1% can increase the yield of Crystal guava by 1.163%, which indicates a positive relationship between the two variables. The reason is that higher yields are expected from a larger plant population , because Crystal guava plants are the main source of Crystal guava fruit.

Plant age does not significantly affect Crystal guava production, according to the t-test analysis, because the calculated t-value (-0.459) is smaller than the t-value (2.35) at the 10% significance level. A 1% increase in plant age can reduce Crystal guava production by 0.037%, indicating a negative correlation between plant age and productivity. This is due to decreased fruit production related to decreased photosynthetic capacity, which occurs naturally in aging plants. Due to their increased susceptibility to pests and diseases, older plants also produce lower quality fruit.

In the t-test analysis, the calculated t value (-1.386) is lower than the t-table value (2.35) at a significant level on the yield of Crystal guava. The addition of 1% organic fertilizer reduces the yield of Crystal guava by 0.776%, indicating a negative relationship between the two variables. Excessive use of organic fertilizer can cause excess nutrients, plant stress, and degradation of soil structure, which in turn limits water and nutrient absorption.

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Organic fertilizer does not have a significant effect on the production of Crystal guava because excessive addition can cause nutrient overdose, stress on plants, and damage to soil structure which reduces the soil's ability to absorb water and nutrients, so that production decreases by 0.776% for every 1% addition of organic fertilizer.

Since the calculated t-value (1.157) is smaller than the tabulated t- value (2.35), at the 10% significance level, inorganic fertilizers had no visible effect on the yield of crystal guava. However, a 1% increase in the yield of crystal guava was achieved with the addition of inorganic fertilizers, indicating a beneficial relationship between the two. The high nutrient concentration of inorganic fertilizers allows them to have a direct impact on plant growth, including fruit size and quality. calculated t- value (−0.681) is smaller than the table t- value (2.35) at a significance threshold of 0.10 % , indicating that labor has no significant impact on crystal guava yield. Crystal guava production is inversely proportional to labor, with a 1% increase in labor causing a decrease in production of 0.091 % .

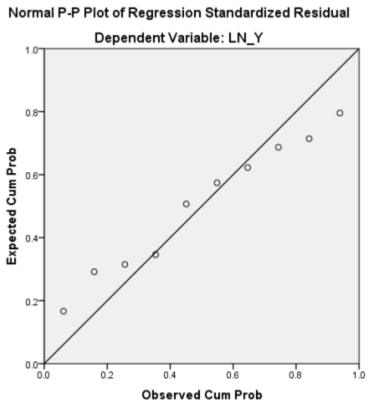

Figure 3. Normality regression diagram pattern

Since the points are distributed around the diagonal line, the data is assumed to be normal according to the diagram. The next step is to run a heteroscedasticity test to see if the regression model has missed any changes. The regression results show the equation Y = 7.289 + 0.585X1 + 0.154X2 + 0.080X3 + 0.560X4 + 0.832X5 + 0.134X6 with an **R value** of 0.992, **R** square of 0.983, and **Fsig** of 0.009.

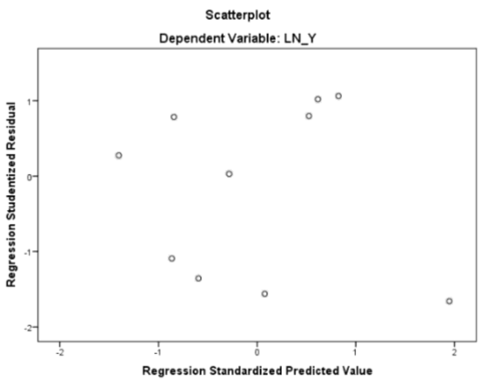

Figure 4. Heteroscedasticity Regression Diagram Pattern

scatterplot pattern indicates that the points are randomly distributed; therefore, heteroscedasticity is not observed in the regression. To check whether the independent variables in the regression

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equation are closely related to each other, a multicollinearity test is run. If there is multicollinearity among the independent variables, it can be indicated by the regression results in Table 5.

Table 5. Multicollinearity Test Regression Output

No	Variables	Regression Coefficient	Standard Error	T	Sig	VIF
1	Land area	0.113	0.585	0.194	0.859	36,645
2	Number of Plants	1,163	0.154	7,566	0.005	3,666
3	Plant Age	-0.037	0.080	-0.459	0.677	1,361
4	Organic fertilizer	-0.776	0.560	-1,386	0.260	78,847
5	Inorganic Fertilizer	0.963	0.832	1,157	0.331	94,431
6	Labor	-0.091	0.134	-0.681	0.545	6,163

Source: Primary Data 2025

ranged from 1.361 to 94.431 , according to the results of the multicollinearity test. The regression model showed multicollinearity , which indicates a significant relationship between the independent variables, because six of them had VIF values greater than 10 .

was examined for the presence of autocorrelation interference using the autocorrelation test . The results of the investigation produced a Durbin Watson (DW) value of 2.977 . With a dL value of 0.43 and dU of 2.29 at α = 0.05 , it can be concluded that because the calculated DW > dU , then the regression model does not experience autocorrelation , but DW is calculated > dL and greater than dU so that there is no autocorrelation disturbance in the regression model, more precisely there is no positive autocorrelation and there is a possibility of negative autocorrelation , but because DW is calculated approaching 2 then there is most likely no autocorrelation , or more simply, no autocorrelation interference occurs

Analysis of Crystal Guava Farming Income in Kuok Village, Kuok District, Kampar Regency

Crystal guava farming income analysis was conducted to identify the level of income obtained by farmers and examine the factors that influence it, so that it can help farmers and policy makers make the right decisions to increase income. Crystal guava farming income is influenced by production , sales , and farm management , including production costs and commodity prices at harvest. High productivity can also increase income, and can be influenced by seed quality , land management , climate , weather , and the use of appropriate technology .

The income from crystal guava farming is considered high, with an R/C ratio of 7.44. According to Soekartawi (2006), an R/C ratio greater than 1 indicates that a farming business is economically feasible and profitable. Kurniawan et al. (2020) also found that high-value horticultural commodities, such as crystal guava, have significant profit potential when managed efficiently.

Cost

Farm production costs are generally classified into two types, namely fixed costs and variable costs. Fixed costs are expenses whose amounts remain relatively constant regardless of whether the level of production increases or decreases. In contrast, variable costs are expenses whose magnitude is influenced by the level of output produced (Soekartawi, 1995).

In this study, the farm production costs considered include all expenses incurred during the crystal guava farming process. These costs consist of seed (planting material) costs, fertilizer costs (both organic and inorganic), equipment costs, and labor costs, including both family and hired labor. A more detailed breakdown of cost usage in crystal guava farming is presented in Table 7.

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Based on the results of the study on crystal guava farming in Kuok Village, Kuok District, farmers incur varying levels of production costs, ranging from Rp6,251,500 per year to Rp29,594,000 per year. The average total production cost incurred by farmers is Rp16,262,105 per year.

When examined by cost category, the average fixed cost incurred by farmers in crystal guava farming amounts to Rp220,800 per hectare per year, which mainly consists of depreciation costs for equipment and other production facilities. Meanwhile, the average variable cost reaches Rp16,041,305 per hectare per year, covering expenditures for planting materials, organic and inorganic fertilizers, and labor. The dominance of variable costs indicates that most production expenses in crystal guava farming are influenced by the intensity of production activities and the scale of farming operations undertaken by the farmers.

Production

Production is one of the most important aspects of economic activity. In this context, production refers to the output obtained by farmers from cultivating crystal guava. This study involved 10 crystal guava farmers as respondents. Production analysis is a crucial process in crystal guava farming aimed at improving efficiency and productivity. Through production analysis, farmers can identify the factors that influence crystal guava production. In the production process, farmers incur production costs for each production cycle. Crystal guava is harvested twice a week. Based on data from the 10 sampled farmers, the annual production per plant ranges from 219 to 1,111 fruits, while total production reaches approximately 2,450–12,000 kg per cultivated area per year, with an average of 5,400 kg per cultivated area per year. The level of production is closely related to farmers' income; higher production levels lead to increased farmers' income.

of crystal guava farmers varies widely, ranging from Rp49,000,000 to Rp240,000,000, with an average of Rp108,800,000, or Rp2,092,307.3 per week, according to this study. The average annual production cost of crystal guava is Rp16,262,105, resulting in a net income of Rp92,537,895 (or Rp1,779,574.9) per week. For information on average production costs, see Table 7 .

Table 6. Average Economic Indicators of Crystal Guava Farming in Kuok Village, Kuok District, Kampar Regency in 2025: Production, Selling Price, Costs, Revenue, and Income .

No	Description	Unit	Mark
1.	Average Production Quantity (Q)	Kg/Ha/Year	5,440
2.	Average Market Price (P)	Rp/Kg	20,000
3.	Average Nursery Costs	Rp/ha/Year	10,668,700
	Average Fertilization Cost	Rp/ha/Year	431,200
	Average Fixed Operating Cost (FC)	Rp/ha/year	220,800
	Average Internal Labor Usage Average External Labor Usage	Rp/ha/year	2,565,075
	Average Variable Operating Cost (VC)	Rp/ha/year	2,807,530
	Average Total Cost of Production (FC+VC)	Rp/ha/year	16,041,305
	Average Gross Income (Qx P)	Rp/ha/year	16,262,105
	Average Net Income	Rp/ha/year	108,800,000
		Rp/ha/year	92,537,895

Primary data sources processed in 2025

Data from Table 8 shows that crystal guava cultivation in Kuok Village generates an average income of Rp92,537,895 per hectare per year, after deducting the average total cost of Rp16,262,105 per hectare per year. According to this study, crystal guava cultivation is a very profitable business. With seedling costs of Rp10,668,700/ha/year , production costs are the largest component, followed by labor costs of Rp2,807,530/ha/year .

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The utilization of company resources can be better understood with the help of efficiency studies. R/C ratio analysis is used in crystal guava cultivation to determine the level of cost-effectiveness in production. Crystal guava cultivation in Kuok Village can be considered cost-effective or inefficient depending on the R/C ratio . See Table 8 for information on the productivity of crystal guava cultivation in Kuok Village .

Table 7. Analysis of Average Production, Revenue, Total Cost, and Economic Efficiency of Crystal Guava Farming in Kuok Village, Kuok District, Kampar Regency in 2025.

No	Description	Unit	Mark
1	Average Output (Q)	Kg/ha/Year	5,440
2	Average Price (P)	Rp/Kg	20,000
3	Average Revenue (Q x P)	Rp/ha/year	108,800,000
4	Average Fixed Cost (FC)	Rp/ha/year	220,800
5	Average Variable Cost (VC)	Rp/ha/year	16,041,305
6	Average Total Cost (FC+VC)	Rp/ha/Year	16,262,105
	R/C Ratio		7.44

Source: Primary Data Processed in 2025

With an average cost of Rp 16,262,105/ha/year and an average revenue of Rp 108,800,000/ha/year, the average crystal guava production is 5,440 kg/ha/year in 2025, as shown in Table 8. With an R/C ratio of 7.44, the efficiency analysis shows that the crystal guava farming business in Kuok Village is very efficient, because the R/C ratio is more than 1. So, you can expect a profit of Rp 7.44 for every rupiah you invest.

Crystal Guava Agribusiness Development Strategy in Kuok Village, Kuok District, Kampar Regency.

Crystal guava is a superior fruit commodity with high economic value and is in high demand due to its combination of sweet taste, crunchy texture, and complete nutritional profile. As a source of income, crystal guava can be an option for farmers and communities who want to cultivate high-value fruits. However, the development of crystal guava farming in Kuok Village faces several challenges, such as limited market access, unstable selling prices, poor seed quality, suboptimal land management, pest and disease attacks, inadequate infrastructure, limited farmer skills and knowledge, and limited access to funding sources. Therefore, these problems need to be addressed to increase the potential for crystal guava commodity development and increase farmer income in Kuok Village.

SWOT analysis is used to formulate development strategies based on internal and external conditions (Rangkuti, 2015). The IFAS and EFAS results indicate that Kuok Village has internal strengths that outweigh its weaknesses, as well as external opportunities that remain widely available.

According to David (2011), this position represents an aggressive strategy (SO strategy), which involves leveraging internal strengths to seize market opportunities. This strategy is highly relevant for the development of the crystal guava agribusiness through improving product quality, strengthening market access, and utilizing technology.

Internal Factor Analysis of Crystal Guava Commodity

Based on observations, crystal guava farming in Kuok Village faces various challenges that vary from farmer to farmer. Internal factors influencing crystal guava farming can be identified as strengths

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and weaknesses. A company's competitive advantage can be influenced by internal characteristics such as strengths and weaknesses, as stated by Nur'azkiya et al. (2020). Meanwhile, external factors such as opportunities and threats can significantly change the situation.

Table 8. Internal Factor Analysis Summary/IFAS on the agribusiness development strategy for the Crystal guava commodity in Kuok Village, Kuok District, Kampar Regency.

No	Internal Factors	Weight	Rating	W x R
1	**Strengths**			
1.1	Large Market Demand for Crystal Guava (local and regional market potential ~500 tons/year)	0.20	4	0.80
1.2	Availability of Fertile Land (~60 ha suitable for crystal guava cultivation)	0.18	4	0.72
1.3	Access to Agricultural Technology (modern irrigation, organic and inorganic fertilizers, pest control tools)	0.15	3	0.45
	Total Strengths	0.53		1.97
2	**Weaknesses**			
2.1	Limited Farmer Knowledge and Skills (lack of training in intensive crystal guava cultivation, post-harvest handling, and marketing)	0.18	3	0.54
2.2	Infrastructure Limitations (poor irrigation, limited storage and processing facilities)	0.15	2	0.30
2.3	Seasonal Dependency (production heavily dependent on rainy season and limited water availability during dry season)	0.14	2	0.28
	Total Weaknesses	0.47		1.12
	Total Weighting	1.00		3.09

Source: Primary Data Processed in 2025

External Factor Analysis of Crystal Guava Commodity

External factor analysis of crystal guava commodities in Kuok Village involves identifying and evaluating external factors that can influence its development and success. These external factors include economic conditions, inflation, and price fluctuations that affect supply and demand; changes in lifestyle, public awareness, and consumer preferences that influence demand; technological advances that affect production, processing, and marketing; and climate change, weather, and environmental damage that affect the productivity and quality of crystal guava.

Table 9. *External Factor Analysis Summary/EFAS* for Crystal Guava Commodity Farming Development Strategy in Kuok Village, Kuok District, Kampar Regency.

No	External Factors	Weight	Rating	W x R
1	**Opportunities**			
1.1	Increasing Market Demand (local and regional demand for crystal guava ~500 tons/year with growing consumer preference)	0.22	3	0.66
1.2	Cooperation with Investors (potential partnership with 3 local agribusiness companies for processing and distribution)	0.17	2	0.34
1.3	Processed Product Development (possibility to produce crystal guava chips and preserves with estimated market size of 200 tons/year)	0.15	3	0.45
	Total Opportunities	0.54		1.45
2	**Threats**			

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2.1	Market Competition (competing with 5 neighboring villages producing guava and imported guava products)	0.20	3	0.60
2.2	Pest and Disease Disturbances (average of 2–3 pest outbreaks per year affecting 15–20% of production area)	0.16	3	0.48
2.3	Climate Change (irregular rainfall and temperature fluctuations affecting 10–15% of crop yield annually)	0.10	2	0.20
	Total Threats	0.46		1.28
	Total Weighting	1.00		2.73

Source: Primary Data Processed in 2025

The development strategy for a crystal guava cultivation company can be formulated through IFE and EFE analyses, which involve analyzing internal and external aspects using a SWOT matrix. The four approaches presented in this SWOT analysis are as follows: leveraging internal strengths and external opportunities (SO), minimizing weaknesses (WO) by capitalizing on opportunities, leveraging strengths (ST) to overcome threats (ST), and avoiding threats (WT) while minimizing weaknesses (SM). See Figure 5 for a SWOT analysis of potential approaches in developing crystal guava cultivation.

Faktor Internal / Faktor Eksternal	Strengths	Weaknesses
	1. Huge Market Prospects 2. Land Availability 3. Technology Availability	1. Limited knowledge and skills of farmers 2. Infrastructure Limitations 3. Dependence on the season
Opportunities 1. Increasing Market Demand 2. Cooperation with investors 3. Processed product development	SO Strategy 1. Increasing Crystal guava production by utilizing large market potential (S1,O1) 2. Developing a wide distribution network to increase the availability of crystal guava in domestic and international markets (S1,O1) 3. Developing mutually beneficial cooperation to increase production and marketing of Crystal guava (S1, O2) 4. Improving the quality of processed products, can develop innovative and highly competitive processed crystal guava products, with sophisticated technology so that it can improve the quality of processed crystal guava products to be safer, healthier and tastier and increase farmers' income (S3)(O3) 5. Develop the necessary infrastructure to support agricultural projects, such as irrigation and storage. (S2)(O2)	WO Strategy 1. Providing training and counseling to farmers on good Crystal guava cultivation techniques, post-harvest management, and product marketing (W1)(O1) 2. Developing partnerships with investors to improve crystal guava farming infrastructure, such as building roads, warehouses, and other facilities. (W2)(O2) 3. Product Diversification: developing a variety of processed Crystal guava products to meet the needs of different consumers. (W3)(O3) 4. Developing collaboration with experts in the field of processing Crystal guava products to improve farmers' knowledge and skills. (W1)(O3)
Threats 1. Market competition	ST Strategy 1. Improving the quality of Crystal guava products to differentiate	WT Strategy 1. Collaboration with other institutions, such as

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2. Pest and disease disturbances 3. Changes in climate conditions	themselves from competitors and increase consumer confidence. (S1)(T1) 2. Developing cooperation with business partners to increase market power and face competition.(S1)(T1) 3. Developing climate-resistant Crystal guava varieties (S1)(T3) 4. Using technology to monitor and control pests and diseases, such as weather monitoring systems and the use of drones for pest control. (S1)(T2)	educational and research institutions, to improve farmers' knowledge and skills (W1)(T1) 2. Developing an effective and sustainable pest and disease control system (W1)(T2) 3. Develop mitigation strategies to reduce the impact of climate change on Crystal guava production.(W2)(T3) 4. Using an efficient irrigation system to reduce dependence on the rainy season. (W3)(T1)

Figure 5. SWOT Matrix in Crystal Guava Farming Development in Kuok Village.

From the SWOT analysis integrated with the IFAS and EFAS tables, it shows that the intrinsic factors, the development of crystal guava farming business has a total value of 3.09, with strengths (1.97) greater than weaknesses (1.12). Meanwhile, external factors have a total value of 2.73, with opportunities (1.45) greater than threats (1.28). This shows that internal strengths can be the main strategy in the development of crystal guava farming business, while external opportunities must be maintained and threats minimized to achieve effective and efficient development.

The next analysis was carried out by calculating the difference between the total scores of the strengths (1.97) and weaknesses (1.12) to obtain an X-point value of 0.85. Then, the difference between the total scores of the opportunities (1.45) and threats (1.28) was calculated to obtain a Y-point value of 0.17. These X and Y values can be used to determine the strategic position for developing crystal guava farming.

Based on the x and y values, both points will be plotted in one coordinate as shown in figure 6.

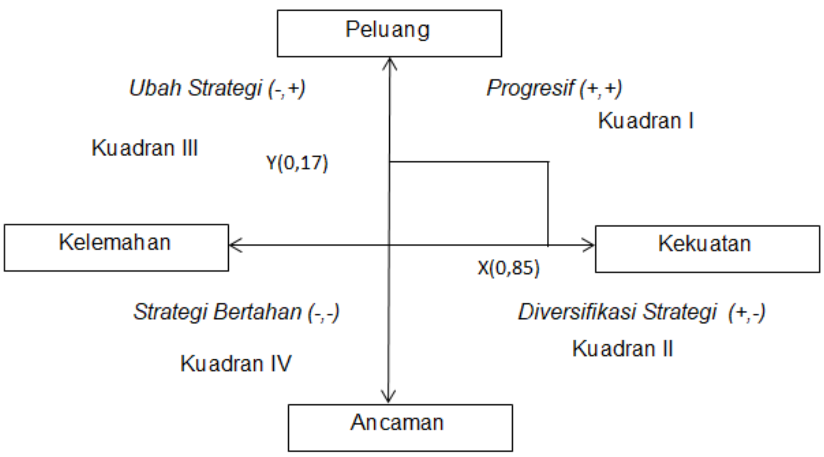

Figure 6. SWOT Coordinates for Crystal Guava Farming Development in Kuok Village, Kuok District, Kampar Regency.

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A very favorable condition is indicated by the placement of the crystal guava farming development plan in quadrant I , namely the SO Strategy (Strengths-Opportunities), based on a SWOT analysis. The approaches that can be applied are strong and progressive approaches, such as: increasing crystal guava production to take advantage of large market potential, developing a wide distribution network, establishing mutually beneficial cooperation, improving the quality of processed products with advanced technology, and developing agricultural support infrastructure such as irrigation and storage warehouses. These strategies can increase farmers' income and develop crystal guava farming in Kuok Village.

4. CONCLUSION

Based on research, crystal guava has high production potential and can provide significant income for farmers in Kuok Village. Production factors such as land area, number of plants, plant age, fertilizer, and labor collectively have a significant influence, but only the number of plants has a significant impact. Income analysis shows that crystal guava cultivation is profitable, with an income of Rp. 92,537,895/ha/year and R/C ratio 7,44. Crystal guava development in Kuok Village is located in quadrant I (SO), which focuses on utilizing strengths and opportunities with strategies such as increasing production, developing marketing networks, improving product quality, and building agricultural infrastructure. This strategy can increase farmer income and develop crystal guava farming in Kuok Village.

Suggestion

The following recommendations can be made: Crystal guava farmers are advised to improve product quality by selecting good seeds, proper plant care, and effective post-harvest management. Furthermore, farmers need to develop effective marketing skills through social media, product exhibitions, and other means. Agricultural technology development is also necessary to increase efficiency and productivity. Institutions are advised to improve infrastructure support, farmer skills through training, and effective market access through the development of marketing networks and product promotion. Thus, it is hoped that Crystal guava farming in Kuok Village can become more effective and profitable.

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