

Factors Affecting Farmers in Purchasing Grafted Orange Seeds in Tolitoli Regency

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Abstract

Oranges are a horticultural commodity that is high in vitamin C and very easy to cultivate, and because of this, the demand for orange seedlings continues to increase. Grafting is a breeding technique that involves attaching a bud to the bark of a tree in order to obtain the superior characteristics of both indicators. The demand for orange seedlings in Tolitoli Regency is quite high. With the development of the times, the distribution process is not only carried out conventionally but can also be done digitally. Therefore, the purpose of this study is to see the tendency of farmers to purchase grafted orange seedlings digitally and conventionally and the factors that influence it. The method used in this study is Multiple Linear Regression Analysis. The regression analysis results found that the variables of price, convenience, ease of access, and security influence farmers' preferences in purchasing grafted orange seedlings, while the variable of seedling quality does not influence it.

Key words: Orange Grafting Seeds, Farmer Preferences, Digital, Conventional

INTRODUCTION

Tolitoli is one of the districts in Central Sulawesi Province that is famous as the city of cloves. This name came about because the Tolitoli area is one of the largest producers of cloves (Kurniasi et al., 2020) In addition to being a clove producer, Tolitoli is an area with diverse agricultural potential due to its tropical climate, which supports the growth of various types of crops such as rice, corn, coconut, cocoa, vegetables, and fruit crops like

oranges. Tolitoli Regency is one of the developing centers for orange production.(Reza & Alamsyar, 2023; Salviah et al., 2024)

Data from the Central Sulawesi Statistics Agency (2025) shows that the production of siem oranges was 67,393 quintals and large oranges was 959.70 quintals. Oranges are one of the most popular commodities in Indonesia, including in Tolitoli Regency. The demand for oranges continues to increase in line with the growing population and public awareness of the importance of consuming fruits. To meet the increasing demand for citrus fruits, the availability of quality citrus seedlings is an important factor in the development of citrus cultivation businesses. The method of purchasing grafted citrus seedlings has evolved in line with technological advances and changes in consumer behavior, such as conventional and digital seedling purchases.

Agricultural product marketing plays an important role in increasing farmers' income and facilitating consumer access to quality products.(Putra et al., 2023; Sarasvananda et al., 2025) . The increasing popularity of online shopping has led to an increase in the use of e-commerce in the agricultural sector.

Marketing activities are divided into two methods, namely digital marketing and conventional marketing. Digital or online marketing is a form of promoting goods or services through the internet to meet the needs of consumers at large(A et al., 2020) , while conventional or offline marketing is marketing that is carried out outside the digital world and the internet. Traditional marketing usually uses print media such as brochures and billboards.

However, conventional concepts often result in high marketing costs, as they require a lot of resources and time. In this concept, internet marketing has begun to be introduced through web-based online platforms, but its development has not been very good because internet technology and its use have not developed as they have today, where technology has become commonplace(Lestari et al., 2023)

The agricultural sector plays an important role in the economy and food security, especially in citrus cultivation. One of the factors that determines the success of citrus cultivation is the selection of quality seeds. Currently, grafted orange seedlings have become a popular choice in Tolitoli due to their superior quality and productivity. With the rapid development of digital technology, there have been changes in the methods of accessing and purchasing agricultural products, especially grafted orange seedlings. The hope for the development of technology and information for farmers, especially citrus farmers, is that it can increase efficiency and farmers' access to quality citrus seedlings. The digital system is expected to provide more complete information, enable easier price comparisons, and expand market reach. Technology is also expected to facilitate direct communication

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between farmers and seedling producers, reducing the role of intermediaries and ultimately lowering production costs. However, the reality is that the adoption of digital technology in the agricultural sector, especially in the purchase of grafted orange seedlings, still faces various challenges, such as a significant digital divide between urban and rural areas (lack of internet access). In addition, many farmers are still technologically illiterate, especially older farmers who are unfamiliar with the use of digital technology, which can hinder the adoption of online purchasing systems.

A thorough understanding of preferences can accelerate the transformation of agricultural input distribution, particularly high-quality seedlings, which are an important foundation for improving productivity and sustainability in the citrus industry. By understanding farmers' preferences and the factors that influence them, relevant parties can develop appropriate policies and programs to improve the citrus seedling supply system, both through digital and conventional systems.

METHODOLOGY

This research was conducted in Tolitoli Regency using a quantitative descriptive method, in which Sugiyono(2016) states that a quantitative approach can be interpreted as a research approach based on the philosophy of positivism. The population in this study consisted of all orange farmers. Since the number of farmers was unknown, the Lameshow formula was used to facilitate the researcher in determining the sample, as follows.

$$N = \frac{Z^2 1-\alpha/2 p(1-p)}{d^2}$$

Explanation:

n: Number of Samples

Z 2 1- α /2: 95% confidence level ($\alpha = 0.05$), resulting in (Z = 1.96)

p: Estimated proportion 50% (0.5)

d: Sampling error of 10% (0.1)

Based on the above formula, the sample size to be taken is

$$n = \frac{1,962 \cdot 0,5 (1-0,5)}{0,1^2}$$
$$n = 96.04 \approx 106$$

The result of the formula is 106. The sample size was rounded up to 106 because if one of the questionnaires contained invalid data, the additional questionnaire could be used, and also to make it easier for researchers to process the data. The research data was sourced from primary data obtained through interviews, questionnaires, and field observations, while secondary data was obtained from previous research, scientific publications, and so on.

The data analysis used in this study is multiple linear regression with the following equation model.

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + e$$

Explanation:

Y = Farmers' preferences for digital and conventional purchasing

a = Constant value

X1 = Price

X2 = Seed quality

X3 = Convenience

X4 = Ease of access

X5 = Trust

e = Error

RESEARCH AND RESULTS

Before performing multiple linear regression testing, it is necessary to conduct classical assumption testing, which aims to obtain the best regression model in terms of estimation accuracy, absence of bias, and consistency. Classical assumption testing consists of normality, multicollinearity testing, and heteroscedasticity testing.

Normality Test

The normality test is part of the classical assumption test that aims to see whether the independent and dependent variables in a regression model have a normal distribution. A regression model is considered good if it has a normal or near-normal data distribution, as shown in the following figure

Table 1. Kolmogorov Smirnov Normality Test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		106
Normal Parameters ^{a,b}	Mean	.000000
	Std. Deviation	1.73663062
Most Extreme Differences	Absolute	.068
	Positive	.068
	Negative	-.066
Kolmogorov-Smirnov Z		.704

Asymp. Sig. (2-tailed)	.704
a. Test distribution is Normal.	
b. Calculated from data.	

Source: SPSS Output, 2025

Based on the results of the Kolmogorov-Smirnov normality test in Table 1, the Asymp Sig value is 0.704, which is greater than alpha 0.05. This means that the data in this study is normally distributed.

Multicollinearity Test

The multicollinearity test aims to test whether there is a high or perfect correlation between variable x and variable y in the regression model. A good regression model should not have any correlation between variables. For more details, see the following table

Table 2. Multicollinearity Test

Model		Collinearity Statistic	
		Tolerance	VIF
1	(Constant)		
	Price	.397	2,517
	Seed Quality	.464	2,154
	Comfort	.247	4,053
	Ease of Access	.353	2,831
	Security	.258	3,869

Source: SPSS Output, 2025

Based on the test results in Table 2, it can be seen that all variables have a VIF value of less than 10 and a tolerance value greater than 0.1, so it can be concluded that this study is free from multicollinearity.

Heteroscedasticity Test

A heteroscedasticity test is conducted to examine whether the regression model has unequal variance from one observation residual to another. Heteroscedasticity arises due to variance in the regression model variables that are not equal. The expected regression model is one in which the residuals from one observation to another are constant, or

homoscedasticity, or the absence of heteroscedasticity. The test results can be seen in the following table.

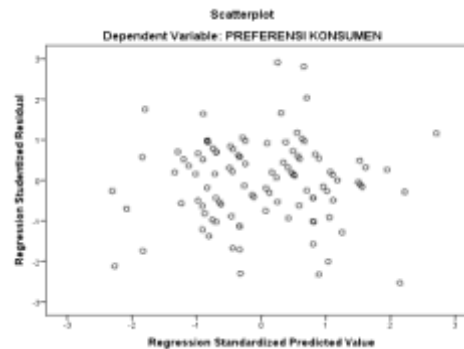


Figure 1 above shows that the points on the horizontal and vertical lines are evenly distributed and do not form a pattern, so it can be said that the regression model in this study is free from heteroscedasticity.

Multiple Regression Analysis

Multiple linear regression is a statistical method used to see if independent variables have an effect on a dependent variable. This analysis includes three tests: the R squared test, which shows how well the model fits the data; the partial test, also known as the T test, which checks the significance of each variable; and the simultaneous test, or F test, which looks at the overall significance of the model. The regression results are shown in the table below.

Table 3. Multiple Linear Regression Model.

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.661	1.784		2,052	.043
	Price	.240	.050	.355	4,817	.000
	Seed Quality	-.066	.046	-.097	-1.430	.156
	Comfort	.156	.067	.219	2,345	.021
	Ease of Access	.119	.048	.193	2,472	.015
	Security	.214	.062	.314	3,442	.001

a. Dependent Variable: Consumer Preferences

Source: SPSS Output, 2025

The regression model equation can be written as follows.

$$Y = a + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + e$$

$$Y = 3.661 + 0.240x_1 - 0.66x_2 + 0.156x_3 + 0.119x_4 + 0.214x_5 + e$$

Based on the results of the multiple regression analysis test on the above model, the interpretation is as follows:

1. The constant coefficient is 3.661. This means that if the consumer preference in Toli-toli Regency stays the same, then farmers' tendency to buy grafted orange seedlings will go up by 3.661, as long as all other factors remain unchanged.
2. The coefficient for the price variable is 0.240. If the price goes up by 1%, the consumer preference for buying grafted orange seedlings will increase by 0.240, assuming everything else stays the same.
3. The coefficient for the seedling quality variable is -0.066. If seedling quality improves by 1%, the consumer preference for buying grafted orange seedlings will drop by 0.066, as long as other factors remain unchanged.
4. The coefficient for the comfort variable is 0.156. If comfort increases by 1%, consumer preference for buying grafted orange seedlings will rise by 0.156, provided all other factors stay the same.
5. The coefficient for the ease of access variable is 0.119. If it's easier to get to the seedlings by 1%, consumer preference for buying them will go up by 0.119, as long as other factors remain the same.
6. The coefficient for the access convenience variable is 0.214. If convenience improves by 1%, the consumer preference for buying grafted orange seedlings will increase by 0.214, assuming everything else remains unchanged.

Determination Coefficient Test (R^2)

The coefficient of determination (R^2) is a series of multiple linear regression test procedures that essentially measure the extent to which the model can explain the variation of the dependent variable. The coefficient of determination value ranges from zero to one. The results of the coefficient of determination test can be seen in the following table.

Table 4. Results of the Coefficient of Determination Test (R^2)

Model Summary ^b				
Model	R	R Square	Adjusted R-Square	Standard Error of the Estimate
1	.886 ^a	.785	.774	1.77952

a. Predictors: (Constant), Safety, Seed Quality, Price, Ease of Access, Convenience

b. Dependent Variable: Consumer Preference

Source: SPSS Output, 2025

The coefficient of determination value is seen in the adjusted R square table, where the test results in Table 4 show an adjusted R square value of 0.774. This value means that 77.4% of the variables of price, seed quality, convenience, ease of access, and security influence consumer preferences in purchasing grafted orange seeds in Tolitoli Regency digitally and conventionally. Meanwhile, the remaining 22.6% is explained by factors not examined in this study.

Simultaneous Test (F)

Simultaneous tests are used to test regression coefficients together to test the model of variables that influence the relationship between independent and dependent variables. The F test between independent variables in this case is price (X1), seed quality (X2), comfort (X3), ease of access (X4), and safety (X5) and consumer preferences (Y). The results of the simultaneous test analysis can be seen in the following table.

Table 5. Simultaneous Test Results

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1154.389	5	230,878	72,908	.000 ^b
	Residual	316,668	100	3,167		
	Total	1,471,057	105			
a. Dependent Variable: Consumer Preferences						
b. Predictors: (Constant), Safety, Seed Quality, Price, Ease of Access, Convenience						

Source: SPSS Output, 2025

A simultaneous test model is considered significant if the significance value is less than alpha 0.05. Based on the test results in Table 5, the significance value in the f test is 0.000, which is less than alpha 0.05. Therefore, it can be concluded that the variables of price, seed quality, convenience, ease of access, and security together influence consumer preferences in purchasing grafted orange seeds in Tolitoli Regency digitally and conventionally.

Partial Test (T)

Based on Table 3, the partial test results are as follows.

Price Variable

The price variable has a positive coefficient value of 0.240 with a significance value of 0.000, which is smaller than alpha 0.01. Therefore, it can be concluded that the price variable has a positive and significant effect on consumer preferences in purchasing grafted orange seedlings in Tolitoli Regency digitally and conventionally with a confidence level of 99%. This means that H0 is accepted and H1 is rejected. A positive coefficient indicates a direct relationship, meaning that if the price increases, consumer preference also increases.

Based on the t-test results in Table 4, it shows that price is one of the variables that influence consumer preferences in purchasing grafted orange seedlings. This is based on the fact that the prices offered by producers, in this case nurseries, are in the low price category, both conventionally and digitally. For conventional seedling sales, producers set prices ranging from IDR 5,000 to IDR 15,000 per seedling, while digital prices start from IDR 15,000 to IDR 150,000 per seedling. The results of this study are in line with the research (Sembiring, 2016) which states that price influences consumer preferences. This is because the prices offered vary and can be adjusted to the consumers' ability to pay. The pricing of orange seedlings by producers is based on the age and type of seedlings.

Price influences farmers' preferences in purchasing conventionally grafted citrus seedlings through direct interaction in traditional markets or local agricultural stores, where farmers can assess prices in real time and negotiate for discounts. In this context, competitive prices are often the main determining factor, as farmers with limited budgets tend to choose seedlings from the nearest sellers offering lower prices, even though quality may vary. If the price of grafted seedlings is too high compared to local alternatives, farmers may be reluctant to buy and switch to regular seedlings, which has an impact on overall demand. Factors such as minimal transportation costs and trust in local sellers further reinforce the influence of price, making farmers more sensitive to seasonal fluctuations that affect their purchasing preferences.

Seed Quality Variable

Based on Table 3, the seed quality variable has a positive-negative coefficient value of -0.066 with a significance value of 0.156, which is greater than all alpha values. Therefore, it can be concluded that the seed quality variable has no effect on consumer preferences in

purchasing grafted orange seeds in Tolitoli Regency, both digitally and conventionally. This means that H0 is rejected and H1 is accepted.

Based on the t-test results in Table 3, it shows that seedling quality is the only variable that does not affect consumer preferences in purchasing grafted orange seedlings. As grafted seedlings are susceptible to changes (Net al., 2019; Waryat et al., 2023; Widyasari & Rinojati, 2014) although the results of the study (Supriyanti et al., 2022) show that seedling quality also influences consumer preferences, it again comes back to the susceptibility factor of grafted seedlings.

The quality of grafted citrus seedlings does not significantly influence farmers' preferences in conventional purchases, as farmers tend to prioritize other factors such as price and local availability rather than thoroughly verifying quality. In traditional markets or agricultural stores, farmers often make purchases based on verbal recommendations from sellers or neighbors, without conducting rigorous checks on aspects such as plant vigor or disease resistance, so that seedling quality variations do not become a major obstacle in purchasing decisions. This is due to limited technical knowledge among smallholder farmers and a focus on short-term cost savings, where seeds that appear visually healthy are considered sufficient, even if their genetic quality may be low. As a result, farmers' preferences remain stable toward inexpensive conventional options, unaffected by quality differences between sellers. Similarly, in digital purchases through e-commerce platforms, seedling quality variables do not influence farmers' preferences because ease of access and price promotions often outweigh concerns about quality that are difficult to verify online. Farmers tend to choose grafted citrus seedlings based on brief descriptions, images, or general reviews without checking quality certifications such as quarantine standards or laboratory tests, especially for those who are less familiar with technology. Factors like digital discounts or fast delivery become top priorities, so even low-quality seedlings aggressively promoted remain in demand, without altering overall preferences. This situation indicates that in the digital age, farmers' preferences are driven more by transaction efficiency than long-term quality assurance.

Comfort Variables

Based on Table 3, the comfort variable has a positive coefficient value of 0.156 with a significance value of 0.021, which is smaller than alpha 0.1. Therefore, it can be concluded that the comfort variable has a positive and significant impact on consumer preferences in purchasing grafted orange seedlings in Tolitoli Regency digitally and conventionally with a confidence level of 90%. This means that H0 is accepted and H1 is

rejected. A positive coefficient indicates a direct relationship, meaning that if comfort increases, consumer preference increases.

Based on the t-test results in Table 3, it shows that convenience is one of the variables that influence consumer preferences in purchasing grafted orange seedlings. Convenience is the sense of security and satisfaction felt by consumers when purchasing grafted orange seedlings, both digitally and conventionally (Hisniati et al., 2023; Insani, 2013). This is because the communication process between consumers and producers in conventional and digital distribution channels is two-way. Producers promote the seedlings they sell using language that is easy to understand and accompanied by attractive visual documentation, which is what makes consumers feel comfortable in their transactions.

Comfort variables influence farmers' preferences in purchasing conventionally grafted citrus seedlings through easy access to local sales locations such as farmers' markets or nearby agricultural stores, which allow for direct interaction and physical verification without complicated processes. Farmers tend to prefer this method if the travel distance is short and the purchasing process is quick, such as on-site price negotiations or direct consultations with sellers, thereby reducing the physical burden and time required for long journeys. This is especially true for older farmers or those in rural areas who are less familiar with technology, where the emotional comfort of trust in local social relationships drives a preference for instantly available grafted seedlings, even when digital options exist. As a result, this level of conventional comfort reinforces farmers' loyalty to traditional channels, increasing the volume of grafted citrus seedling purchases at the community level. Conversely, in digital purchases through e-commerce applications or agricultural websites, the comfort variable influences farmers' preferences by providing the flexibility of shopping from home, instant price comparisons, and direct delivery to the field, which is very attractive to young or busy farmers who avoid the hassle of traveling. Features like real-time order tracking and online customer support add a sense of security and efficiency, making farmers more inclined to choose grafted orange seedlings from digital platforms if the process is simple and fast, especially during the busy planting season. However, for farmers with limited internet access, the lack of convenience can hinder adoption, although overall, digital technology advancements are increasingly shifting preferences toward this method to optimize time and reduce the risk of physical exhaustion.

Accessibility Variable

Based on Table 3, the ease of access variable has a positive coefficient value of 0.119 with a significance value of 0.015, which is smaller than alpha 0.1. Therefore, it can be concluded that the ease of access variable has a positive and significant impact on consumer

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preferences in purchasing grafted orange seedlings in Tolitoli Regency digitally and conventionally with a confidence level of 90%. This means that H_0 is accepted and H_1 is rejected. A positive coefficient indicates a direct relationship, meaning that if access ease increases, consumer preference increases.

Based on the t-test results in Table 36, it shows that ease of access is one of the variables that influence consumer preferences in purchasing grafted orange seedlings. For conventional distribution, farmers can easily reach nurseries in Tolitoli Regency, although it takes 5-6 hours to travel to producers in Parigi Moutong District. The same is true for digital distribution. Seed sellers are available, and the ease of using the marketplace and chat features facilitates communication between producers and potential consumers. The results of this study are in line with the findings from (Sari et al., 2025), which states that ease of access significantly influences consumer preferences. (Rohmawati & Disastra, 2024) also adds that this ease is not separate from the ease of contacting producers, accessing product information, and using *marketplaces*.

The variable of ease of access influences farmers' preferences in purchasing conventionally grafted citrus seedlings through the availability of easily accessible local sellers, without the need for sophisticated technological infrastructure. Farmers tend to prefer this method because the process is simple, using four-wheeled vehicles, thereby reducing logistical barriers and allowing for spontaneous purchases when needed, especially during the planting season. This is particularly beneficial for farmers in remote areas with limited internet access, where this convenience builds trust and loyalty to grafted seedlings from the nearest source, even though the quality or price may not be optimal. As a result, preference for conventional channels remains high, as direct access supports farmers' daily efficiency and reduces the risk of supply delays.

Security Variables

Based on Table 3, the safety variable has a positive coefficient value of 0.214 with a significance value of 0.000, which is smaller than alpha 0.01. Therefore, it can be concluded that the safety variable has a positive and significant impact on consumer preferences in purchasing grafted orange seedlings in Tolitoli Regency digitally and conventionally with a confidence level of 99%. This means that H_0 is accepted and H_1 is rejected. A positive coefficient indicates a direct relationship, meaning that if security increases, consumer preference increases.

Based on the t test result in table 3, it shows that ease of access is one of the variables that influence consumer preferences in purchasing grafted orange seedlings. The conventional seedling distribution process, which requires consumers to come directly to

the producer's location, can increase a sense of security because by coming directly to see and communicate with the producer, consumers can find out the condition of the seedlings. To enhance security in every transaction, producers provide a guarantee that if the purchased seedlings do not bear fruit, they can be replaced with shipping costs borne by the producer. For digital distribution, security is created because producers include contact details, ensure the confidentiality of consumer personal data, and provide a tracking feature on the marketplace. The findings of this study align with those of (Kumbara et al., 2023; Rohmawati & Disastra, 2024; Sari et al., 2025) who state that security influences consumer preference. Product security and consumer data privacy are strictly maintained by producers.

Security variables influence farmers' preferences in purchasing conventionally grafted citrus seedlings through a high level of trust in local sellers at farmers' markets or cooperatives, where face-to-face interactions allow for direct verification of seedling quality and avoid the risk of fraud. Farmers tend to prefer this method because they feel physically and emotionally secure, such as being able to inspect the seedlings directly to ensure they are free from pests or diseases, as well as the possibility of transparent negotiations without worrying about losing money. This is especially relevant for experienced farmers who rely on long-term social relationships, so this security reinforces their preference for conventional channels, reduces concerns about potential losses, and encourages repeat purchases of grafted seeds from trusted sources in the community. Conversely, in digital purchases through e-commerce platforms, security variables influence farmers' preferences by raising major concerns about online transactions, such as the risk of payment data theft or damaged seed delivery due to poor handling, which can reduce farmers' interest in this option. Although features such as data encryption and return guarantees can increase security and encourage preference among tech-savvy farmers, many farmers in rural areas remain hesitant due to their lack of experience with cybersecurity, causing them to avoid purchasing grafted citrus seedlings digitally. As a result, improvements in digital security standards, such as platform certification and shipping insurance, have the potential to shift farmers' preferences toward this method, facilitating safer and more efficient access in the agricultural supply chain.

CONCLUSION AND RECOMMENDATIONS

Based on the results of multiple linear regression tests, it was found that the variables of price, comfort, ease of access, and security influence consumer preferences in purchasing grafted orange seedlings in Tolitoli Regency, while the variable of seedling quality has no influence.

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