

Planting Time, Market Prices, And Economic Performance Of Curly Red Chili Farming: Evidence From Pidie Regency, Indonesia

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Abstract

Planting time may influence the economic performance of chili farming because it affects both production conditions and the period when harvested products enter the market. This study examined differences in productivity, selling price, and estimated economic margin across planting periods and explored farmers' considerations when determining planting time. A retrospective survey was conducted in July 2026 involving 72 curly red chili farmers in Pidie, Sakti, and Tangse subdistricts, Pidie Regency, Indonesia. Data were analyzed using descriptive statistics, the Kruskal–Wallis test, Mann–Whitney U post-hoc comparisons, Spearman correlation, and multivariate regression. The results showed that April–June had the highest productivity at 29.27 tons/ha but the lowest selling price at IDR 17,000/kg. In contrast, July–September had lower productivity at 19.58 tons/ha but generated the highest estimated economic margin at IDR 797.00 million/ha. Productivity was negatively correlated with selling price ($\rho = -0.652$), while selling price was positively correlated with economic margin ($\rho = 0.607$). After planting period and location were taken into account, productivity remained positively associated with economic margin. Only 34.7% of farmers considered selling prices before planting, although 94.4% reported having experienced an unfavorable planting time because of the selling price received and 93.1% were interested in

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planting-time information. These findings indicate that planting-time decisions should consider both production potential and expected market conditions at harvest.

Keywords: curly red chili, planting time, productivity, selling price, economic margin.

INTRODUCTION

Chili is an important horticultural commodity in Indonesia, both for household consumption and as a source of income for smallholder farmers. National chili production remains substantial, although production is affected by climatic conditions, pest and disease attacks, water availability, and farming practices (BPS-Statistics Indonesia, 2025; Directorate General of Horticulture, 2025). These production risks are accompanied by considerable market uncertainty, particularly fluctuations in selling prices. Previous studies have shown that chili prices are sensitive to changes in production, supply, consumption, climatic conditions, and market dynamics (Lestari et al., 2022; Muflikh et al., 2021, 2024; Rahmawati & Fariyanti, 2018; Sumaryanto et al., 2024). As a result, good production performance does not always guarantee favorable economic outcomes for farmers.

Productivity remains an important determinant of farm performance, and several studies have examined the role of production inputs, technology, season, and technical efficiency in chili farming. Differences in production season have been associated with differences in productivity, production costs, revenues, and farm income, while improvements in production technology can increase productivity and production efficiency (Amrin et al., 2024; Nuha et al., 2023; Nurmalita et al., 2025; Rahayu & Simanullang, 2023; Tinaprilla et al., 2024). However, the economic value of higher productivity also depends on the selling price received by farmers. Studies on chili farming have shown that higher selling prices can lead to better farm returns even when differences in productivity are relatively small (Yanuar et al., 2022). Therefore, production and market conditions need to be considered together when assessing the economic performance of chili farming.

Planting time is relevant because it affects both crop production conditions and the period when harvested products enter the market. Farmers who plant at different times may face different selling prices when their crops are harvested. This is particularly important for chili because the product is relatively perishable and its price can change considerably within a short period. Previous studies have emphasized the importance of

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market information and planting coordination in helping farmers respond to price fluctuations (Sumaryanto et al., 2024). The potential use of future economic information in planting decisions has also been demonstrated through planting-date recommendation approaches based on predicted economic value (Nhita et al., 2018). However, farmers may still determine planting time based on experience, seasonal conditions, land availability, water, or capital rather than expected market conditions.

Most empirical studies on chili farming in Indonesia have examined production, technical efficiency, farm income, price volatility, or marketing separately. Studies conducted in Aceh and areas close to the present research have also largely focused on production factors, farmer characteristics, and farm income (BPS-Statistics of Pidie Regency, 2024; Laili et al., 2024). Limited attention has been given to how different planting periods are associated simultaneously with productivity, selling prices, and farmers' economic outcomes. This distinction is important because a planting period that produces high yields may not necessarily coincide with favorable market prices. Understanding this relationship can provide a stronger empirical basis for developing planting-time information that considers both production and market conditions.

Therefore, this study examines curly red chili farming in Pidie Regency by comparing productivity, selling prices, and estimated economic margins across four planting periods: January–March, April–June, July–September, and October–December. It also analyzes the relationships among productivity, selling price, and economic margin and examines farmers' considerations when determining planting time. The study is expected to provide empirical evidence on the relationship between planting time and the economic performance of curly red chili farming and to provide an initial basis for developing planting-time information that integrates production potential with expected market conditions.

METHOD

This study used a quantitative observational approach with a retrospective farm survey conducted in July 2026 in Pidie Regency, Aceh Province, Indonesia. Pidie, Sakti, and Tangse subdistricts were purposively selected because they represent areas with a relatively high concentration of curly red chili farmers and were accessible for field data collection. The unit of analysis was one completed curly red chili production cycle managed by each respondent.

Respondents were selected using non-probability accidental sampling, while field data collection was directed to obtain representation from four planting periods:

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January–March, April–June, July–September, and October–December. Farmers were eligible if they had cultivated curly red chili, completed at least one production cycle within the previous 12 months, and were able to provide information on production, selling price, and production costs. A total of 72 farmers met these criteria. Data were collected through direct interviews using a structured questionnaire administered by trained enumerators. The purpose of the study was explained before each interview, participation was voluntary, and verbal consent was obtained.

The questionnaire collected information on respondent and farm characteristics, planting month, production, selling price, production costs, marketing channel, and farmers' considerations in determining planting time. Farmers reported total production for one completed production cycle to reduce recall difficulties associated with reporting production from individual harvests. The original planting month was retained and subsequently grouped into four planting periods. Farm area was standardized into hectares.

Productivity was calculated as total production divided by farm area. Production sold was obtained by subtracting unsold production from total production. The selling price used in the analysis was the price most frequently received by each farmer during the production cycle. Total production cost was estimated by multiplying the number of plants by the farmer-reported cost per plant, which represented major production expenses from planting to the end of harvest. Estimated revenue was calculated as production sold multiplied by the most frequently received selling price, while estimated economic margin was calculated as estimated revenue minus total production cost and expressed per hectare for comparison across farms. The term *estimated economic margin* was used because revenue was based on the most frequently received selling price rather than a transaction-volume-weighted average price.

Data were analyzed using IBM SPSS Statistics. Descriptive statistics were used to summarize respondent characteristics, farm characteristics, planting-time considerations, and production and economic indicators. Differences in productivity, selling price, production cost, estimated revenue, and estimated economic margin among the four planting periods were tested using the Kruskal–Wallis test. Significant results were followed by pairwise Mann–Whitney U tests with Holm adjustment. Spearman rank correlation was used to examine the relationships between productivity, selling price, and estimated economic margin per hectare.

Two multivariable regression models were estimated as supporting analyses. The first model used the natural logarithm of selling price as the dependent variable and

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included planting period and subdistrict as explanatory variables. The second model used the natural logarithm of estimated economic margin per hectare and additionally included the natural logarithm of productivity. January–March and Pidie Subdistrict were used as reference categories. HC3 robust standard errors were applied. Variety and cost per plant were not entered together with subdistrict because these variables were closely associated with location in the study sample. Statistical significance was evaluated at the 5% level, and the results were interpreted as associations rather than causal effects because of the observational design and non-probability sampling.

RESULTS AND DISCUSSIONS

Respondent and Farm Characteristics

This study involved 72 curly red chili farmers from Pidie, Sakti, and Tangse subdistricts. Respondents were 38.68 years old on average and had 12.38 years of chili-farming experience. The median farm size was 0.08 ha, indicating that chili farming in the study area was generally conducted on a relatively small scale. Most respondents had completed senior high school, and more than half marketed their products through village collectors.

Table 1. Main characteristics of respondents and farms

Characteristic	Value
Number of respondents	72
Average age (years)	38.68
Average chili-farming experience (years)	12.38
Median farm size (ha)	0.08
Median number of plants	1,820
Senior high school education	79.2%
F1 hybrid seed	61.1%
Marketing through village collectors	58.3%

The relatively long farming experience suggests that most respondents were familiar with repeated production cycles and changes in chili prices. However, planting-time decisions are also influenced by the availability of capital, land, water, seasonal conditions, and market circumstances. This is particularly relevant for chili because the



selling price that ultimately determines farm returns is only known when the harvested product enters the market.

Planting Period, Productivity, Selling Price, and Economic Margin

Differences among planting periods were examined based on productivity, selling price, and economic performance. The comparison was intended to determine whether periods associated with higher production were also associated with more favorable selling prices and economic outcomes. The results are presented in Table 2.

Table 2. Productivity and economic performance by planting period

Indicator	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	p-value
Number of respondents	22	21	21	8	—
Productivity (tons/ha)	21.98	29.27	19.58	13.52	<0.001
Most frequently received selling price (IDR/kg)	19,000	17,000	51,000	51,000	<0.001
Production cost (million IDR/ha)	87.50	84.00	84.00	84.00	0.802
Estimated revenue (million IDR/ha)	427.53	528.75	867.57	689.35	<0.001
Estimated economic margin (million IDR/ha)	337.88	430.40	797.00	601.35	<0.001



Note: Production and economic indicators are presented as group medians. Estimated revenue and economic margin were calculated using the selling price most frequently received during one production cycle.

The highest productivity was recorded during April–June at 29.27 tons/ha, while the lowest was observed during October–December at 13.52 tons/ha. The Kruskal–Wallis test showed significant differences among planting periods, and the post-hoc analysis confirmed that productivity during April–June was higher than during the other periods. In contrast, farmers planting during April–June most frequently received only IDR 17,000/kg, whereas the selling price during July–September and October–December reached IDR 51,000/kg.

The post-hoc results also showed that selling prices during July–September and October–December were higher than those during January–March and April–June. These results indicate that the period with the highest productivity did not coincide with the period with the highest selling price. The findings therefore suggest that favorable production conditions do not necessarily result in the most favorable market conditions. This pattern should not be interpreted as evidence that higher farm productivity directly causes lower prices because the study did not measure total market supply. Rather, periods of relatively high productivity coincided with lower selling prices in the observed sample. Previous studies have similarly shown that curly red chili prices are affected by harvest seasonality and market-level price formation, while producer prices may experience substantial fluctuations over time (Miftahuljanah et al., 2020; Nurjati, 2021). Evidence from Aceh also indicates that chili prices are influenced by several production and market-related factors rather than production alone (Munandar et al., 2017).

The different combinations of productivity and selling price were also reflected in farmers' economic outcomes. Although April–June produced the highest productivity, its median estimated economic margin was IDR 430.40 million/ha, while the highest margin was recorded during July–September at IDR 797.00 million/ha. Production costs were relatively similar across periods and did not differ significantly, indicating that differences in economic margins were mainly associated with the combination of production and selling price. This interpretation is also consistent with recent evidence that red chili prices at the farmer level can fluctuate substantially and are linked to broader market dynamics (Putri et al., 2025).

Planting-time decisions therefore need to consider both expected production performance and market conditions at harvest. Previous research has suggested that managing cropping patterns can contribute to reducing the effects of price instability,

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while harvest seasonality remains an important factor in chili price fluctuations (Miftahuljanah et al., 2020; Nurjati, 2021). These findings strengthen the argument that planting-time information should consider not only agronomic conditions but also the likely market situation when production reaches the market.

Relationships Among Productivity, Selling Price, and Economic Margin

The relationships among productivity, selling price, and economic margin were further examined using Spearman correlation and multivariate regression. The correlation analysis was used to identify the direction of the relationships among the main economic variables, while the regression analysis examined whether the observed differences remained after planting period and location were taken into account. The results are presented in Table 3.

Table 3. Relationships among productivity, selling price, and economic margin, and multivariate regression results

A. Spearman correlation

Relationship	Correlation coefficient	p-value
Productivity and selling price	-0.652	<0.001
Selling price and margin/ha	0.607	<0.001
Productivity and margin/ha	0.099	0.408

B. Multivariate regression

Variable	Selling price model	p-value	Margin/ha model	p-value
April–June	-0.0794	0.071	0.0029	0.964
July–September	0.7330	<0.001	0.8452	<0.001
October–December	0.9523	<0.001	1.0283	<0.001
Productivity	—	—	0.9356	<0.001
Sakti	-0.0217	0.724	-0.0563	0.415
Tangse	-0.0226	0.772	-0.0700	0.421
Number of observations	72		72	
R ²	0.790		0.696	



Note: January–March and Pidie Subdistrict were used as reference categories. The regression models used logarithmic transformations and HC3 robust standard errors.

Productivity was negatively correlated with selling price ($\rho = -0.652$; $p < 0.001$), while selling price was positively correlated with economic margin ($\rho = 0.607$; $p < 0.001$). In contrast, the simple correlation between productivity and margin was not significant ($\rho = 0.099$; $p = 0.408$). These results indicate that higher productivity tended to occur together with lower selling prices, while higher prices were more clearly associated with higher economic margins.

The regression analysis provides further explanation. After planting period and location were taken into account, productivity was positively associated with economic margin, with a coefficient of 0.936. This indicates that a 1% increase in productivity was associated with an approximately 0.94% increase in economic margin, holding planting period and location constant.

The apparent difference between the correlation and regression results can be explained by the conditions observed across planting periods. April–June had the highest productivity but the lowest selling price, whereas July–September had lower productivity but substantially higher prices. Consequently, when all observations were analyzed together, the economic benefit of higher productivity was partly offset by the lower prices occurring during the same period. The importance of productivity for chili-farming performance is consistent with previous studies emphasizing the role of production efficiency and improved cultivation practices in increasing farm performance (Nurmalita et al., 2025; Rahayu & Simanullang, 2023; Tinaprilla et al., 2024)

The regression results also showed that selling prices and economic margins during July–September and October–December remained higher than those during January–March after relevant variables were taken into account. In contrast, the difference in margin between April–June and January–March was no longer significant after productivity was included in the model, indicating that the relatively higher margin during April–June was mainly associated with its higher productivity. These findings suggest that productivity remains beneficial, but high productivity alone does not automatically generate the highest economic return.

Planting-time decisions therefore need to consider both expected production performance and market conditions at harvest. This is consistent with previous studies emphasizing the importance of price information in chili-farming decisions and the potential use of predicted economic value in determining planting dates (Nhita et al.,

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2018; Sumaryanto et al., 2024). However, the present results should not be interpreted as identifying July–September as a universally optimal planting period because market conditions may change between years and price dynamics can respond to changes in production and supply (Muflikh et al., 2021).

Farmers' Considerations in Determining Planting Time

Farmers' considerations in determining planting time provide additional context for the production and economic patterns described above. The analysis examined whether farmers explicitly considered selling prices before planting, the main factors influencing their planting decisions, and their experiences after harvest. The results are presented in Table 4.

Table 4. Farmers' considerations and perceptions regarding planting-time decisions

Indicator	N	Percentage
Considered selling price before planting		
Yes	25	34.7%
No	47	65.3%
Had experienced an unfavorable planting time because of selling price		
Yes	68	94.4%
Interest in planting-time information		
Very interested	44	61.1%
Interested	23	31.9%
Other responses	5	6.9%
Main reason for determining planting time		
Followed usual practice	18	25.0%
Expected favorable prices at harvest	13	18.1%
Followed other farmers	12	16.7%
Availability of capital	11	15.3%
Availability of land	10	13.9%
Season/rainfall conditions	6	8.3%
Availability of water	2	2.8%



Only 34.7% of farmers reported considering selling prices before planting, while 65.3% did not explicitly include price in their planting-time decisions. The most frequently reported reason for determining planting time was following usual practice, reported by 25.0% of respondents, whereas only 18.1% of farmers selected planting time primarily because they expected favorable prices at harvest. These decisions are understandable because farmers do not always have complete flexibility in determining when planting can begin. Some farmers must wait until capital becomes available, others must adjust to land availability, while others are constrained by water availability and seasonal conditions. Planting time is therefore influenced by several considerations simultaneously.

However, a considerable difference was found between farmers' considerations before planting and their experiences after harvest. A total of 94.4% of respondents reported having experienced a situation in which they felt that their planting time had been unfavorable because of the selling price received. At the same time, 93.1% of respondents reported being interested or very interested in information that could assist them in determining planting time. These results suggest that price-related problems are already directly experienced by farmers, but information that can be used before planting remains limited.

The price prevailing when farmers begin planting may provide little indication of the price they will receive when the crop begins to produce. Current price information alone may therefore be insufficient to support planting-time decisions. Farmers require information that can provide some indication of likely market conditions at the time of harvest. Previous studies have similarly emphasized the importance of price information and coordination of planting schedules in supporting chili farmers' production planning (Sumaryanto et al., 2024). In the context of Pidie Regency, this need is evident from the high proportion of farmers who reported having experienced an unfavorable planting time because of selling prices and the high level of interest in information that could support their planting decisions.

Information intended to support planting-time decisions should therefore not be limited to a crop calendar. It should combine information on conditions that support good production with an assessment of likely market conditions when the crop is harvested. Overall, this study shows that planting periods are associated with differences in productivity, selling prices, and the estimated economic margins of curly red chili farmers. April–June produced the highest productivity, but farmers planting during this period received the lowest selling prices. In contrast, July–September produced lower

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productivity but generated the highest estimated economic margin within the study sample. The findings indicate that improving productivity remains important, but higher productivity alone does not guarantee better economic outcomes. The selling price received when the product enters the market must also be considered when developing information to support planting-time decisions.

CONCLUSION

This study shows that planting period is associated with differences in productivity, selling price, and the estimated economic margin of curly red chili farming in Pidie Regency. April–June produced the highest productivity but the lowest selling price, while July–September generated lower productivity but the highest estimated economic margin. Productivity remained positively associated with economic margin after planting period and location were taken into account, indicating that productivity is still important, but its economic benefit depends on the selling price received at harvest. The findings also show that market considerations have not been widely incorporated into farmers' planting-time decisions. Only 34.7% of respondents considered selling prices before planting, although 94.4% had experienced an unfavorable planting time because of the price received, and 93.1% were interested in information that could support planting-time decisions. Therefore, information for determining planting time should not rely only on production or crop calendars, but should also consider expected market conditions at harvest. Future research should develop and validate a planting-time recommendation system that integrates production potential, expected selling prices, and market conditions across a wider area and a longer observation period.

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