



## Dynamics of Price Growth of Curly Red Chili and Red Chili In Kolaka District

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### ARTICLE INFO

ISSN: 2548-2211  
Vol. 3, No. 2, December 2020  
URL: <https://www.usnsj.com/index.php/AJ/article/view/1367>

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### Abstract

This study aims to: 1) Identify the price data pattern of Curly Red Chili and red chilies in Kolaka Regency; 2) Obtain the best time series forecasting method for forecasting the price of Curly Red Chili and ordinary red chilies in Kolaka Regency; 3) Get a forecast for the price of Curly Red Chili and regular red chilies for the coming year. This type of research is descriptive quantitative, the source of the data in this study is secondary data obtained from the office of industry and trade, Kolaka district. The data analysis method used is the time series forecasting method. The results showed that: 1) The results of the identification of data patterns on the plot of price data for Curly Red Chili and common red chilies in Kolaka Regency in 2015-2019 obtained a seasonal pattern. 2) The results of the application of the time series forecasting method for the price of curly red chilies, obtained the best time series forecasting method, namely the box-jenkins method of the SARIMA (1,0,0) (2,0,0) 12 model with the smallest MSE value, namely MSE = 41,534 590 While for the price of ordinary red chilies, the best time series forecasting method is the box-jenkins method of the SARIMA (1,0,0) (1,0,0) 12 model with the smallest MSE value, namely MSE = 44,764,512. 3) The results of forecasting the price of Curly Red Chili using the box-jenkins method SARIMA (1,0,0) (2,0,0) 12 with the help of the MINITAB 19 program is the highest price of IDR 47,355.4 / Kg which occurred in August 2020 and the lowest price is IDR 23,169 / Kg which occurred in January 2020, while the average price of Curly Red Chili in 2020 is IDR 32,487.3 / Kg. While the results of forecasting the price of ordinary red chilies using the box-jenkins method with the SARIMA (1,0,0) (1,0,0) 12 model with the help of the MINITAB 19 program is the highest price of Rp. 32,967.8 / Kg which occurred in August. 2020 and the lowest price is IDR 16,756.4 / Kg which occurred in December 2020, while the average price of ordinary red chili in 2020 is IDR 23,346.27 / Kg.

**Keywords:** time series forecasting, price of red chilies, curly red chili, red chilies, box- jenkins ARIMA-SARIMA

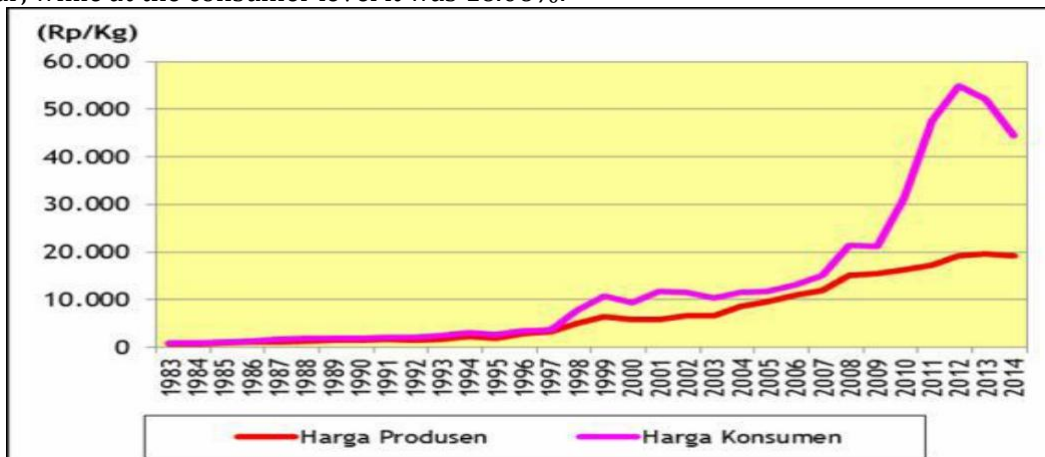


## A. Background

Agriculture is a sector that plays an important role in human life. Activities in agriculture determine the availability of food sources for living things. Most Indonesian people depend on agriculture as a source of livelihood to earn income and meet their daily needs. Agricultural development is also very necessary to make society towards better agriculture. So that agricultural activities are not only carried out to meet family needs.

There are several agricultural sub-sectors in Indonesia, namely food crops, plantations, forestry, horticulture, fisheries and livestock. One of the agricultural subsectors that plays an important role in everyday life is horticultural crops. One of the horticultural plant commodities that the people of Indonesia always need is red chili. The spicy taste in red chilies is the reason why red chili is one of the most indispensable spices in the household. Apart from being used for household purposes, chili can also be used for industrial purposes, including the cooking spices industry, the food industry and the medicine or herbal medicine industry (Rukmana, 1994).

In order for the need for red chilies to be fully met, the use of various red chilies must be followed by an increase in production and price stabilization. In the last few years, the chili pepper commodity has often been monitored by the government because the price of this horticultural commodity has often fluctuated. Based on data from the Central Bureau of Statistics (in the 2016 Chili Outlook), the development of red chili prices at the producer and consumer levels in Indonesia during 1983–2014 shows an increasing trend (Figure 1.1). In that period, the price of red chili at the producer level experienced an average growth of 12.80% per year, while at the consumer level it was 16.06%.

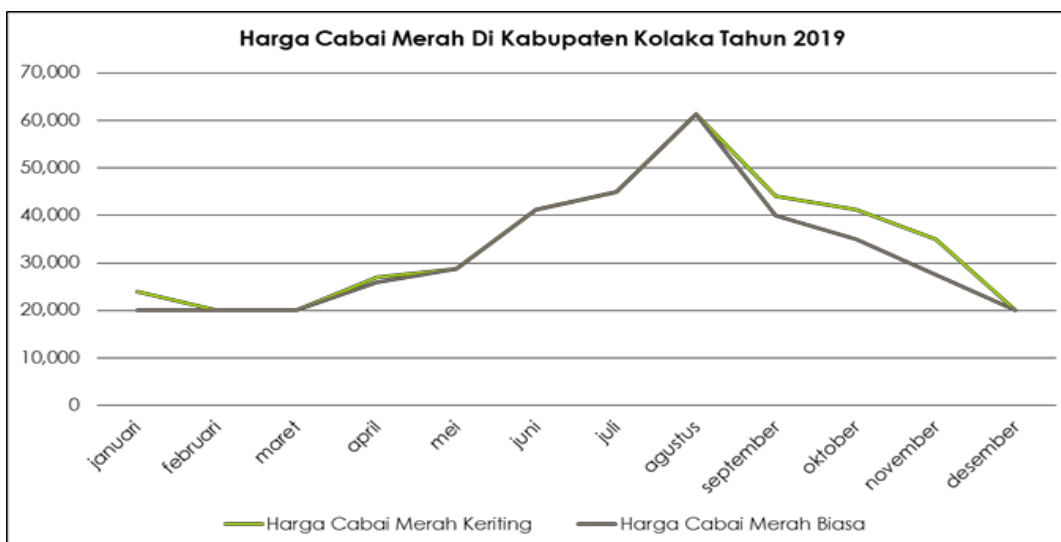


Source: Chili Outlook 2016

Figure 1.1. Indonesian Producer and Consumer Prices, 1983–2014.

In the last 5 years (2010–2014), the price of red chili at the producer level as well as at the consumer level has increased quite sharply. In 2010 the producer price of red chili was IDR 16,343 per kg and in 2014 it was IDR 19,237 per kg, while the price of red chili in 2010 at the consumer level was IDR 31,260 per kg, while in 2014 it was IDR 44,519 per kg.

The largest margin occurred in 2012 amounting to Rp. 35,712.11 / kg, where the price of red chili at the producer level is Rp. 19,206.89 / kg, while at the consumer level it reached Rp. 54,919.00 / kg. According to the Ministry of Agriculture 2015 (in Outlook for Chili 2016), this increase in chili prices was caused by reduced supply, while demand was constant and continuous every day, even increasing in certain seasons. Chili price fluctuations occur due to seasonal chili production, rain factors, production costs and the length of distribution channels (Farid and Subekti, 2012). Meanwhile, the disparity in the price of chili between regions occurs because the center of chili production is concentrated in Java and the quality of road infrastructure is inadequate (Irawan, 2007). Kolaka Regency is one of the regions that produces red chilies. The price of red chili in Kolaka Regency in the last one year is still experiencing uncertain changes every month.



Source: Industry and Trade Office of Kolaka Regency 2019

The price changes that occurred in the commodity of red chili in Kolaka district were quite large, so the price of red chili had no price certainty. The lowest selling price of Curly Red Chili in Kolaka Regency is around IDR 20,000.00 / Kg, while the highest price can reach IDR 61,250.00 / Kg. and for regular red chilies, the lowest price is the same as Curly Red Chili, which is IDR 20,000.00 / Kg and the highest selling price is IDR 61,250.00 / Kg. According to the Department of Industry and Trade of Kolaka Regency, the decline in the price of red chili was caused by the increase in local farmers' production so that the stock of goods increased while consumer demand decreased or stabilized. Meanwhile, the increase in the price of red chili was caused by decreasing production of local farmers so that the stock of goods decreased while consumer demand increased. In addition, the increase in the price of red chilies was also caused by high consumer demand before the holiday, and decreased production of local farmers due to uncertain weather.

The fluctuating price of red chilies is a recurring phenomenon throughout the year. This is an unfavorable situation for both producers and consumers. Sometimes producers benefit greatly, and vice versa. The chili commodity traders will always expect profit. The amount of profit that will be obtained by these traders is relatively fluctuating due to changes in the price of chili. Based on the above background, the author takes the title "The Dynamics of Red Chili Price Growth in Kolaka Regency".

## B. Methodology

### 1. The research object

The research object is the problem under study. According to Sugiyono (2012) the object of research is an attribute of people, objects or activities that have certain variations that are determined by the researcher to be studied and then draw conclusions. The object of this research is the Department of Industry and Trade of Kolaka Regency, where the price data for curly red chilies and red chilies are used as data from the Department of Industry and Trade of Kolaka Regency.

### 2. Data Analysis Techniques

Secondary data that obtained is quantitative data, its processed using Microsoft Excel 2010 and Minitab 19 programs. The selection of the program was based on the reason that the program was widely known and easy to use.

### 3. Technique of Data Collection

The solution to the first problem is by identifying data patterns on the data plot of curly red chili and regular red chilies. The results that will be obtained from the identification of data patterns are the form of data patterns that will be adjusted to the forecasting method that will be carried out. Patterns that can be formed include the following patterns: 1) Stationary Patterns, 2) Seasonal Patterns, 3) Cyclic Patterns, and 4) Trend Patterns. Minitab program 19.

The best forecasting methods result from the processing of the average monthly price of red chili, the most appropriate method is chosen to predict the price of red chili. The criteria for

selecting the most frequently used method or the main criterion is the mean square error (MSE). The method chosen is the method that has the lowest MSE value. In addition, the second criterion is having the simplest form and requiring the least amount of time in the processing (Alex Muharlis, 2007).

The forecasting method that has the smallest MSE value implies that the smaller the MSE value of a forecast, the forecasting results will be closer to the actual value (stronger forecasting power) (AkhmadZacky, 2007). MSE values are formulated :

$$MSE = [ \sum_{t=1}^n e_t^2 ] / n \dots\dots\dots(2.1)$$

The solution to the third problem is forecasting the price of red chili for the next year using the best time series forecasting method that meets the criteria.

**C. Findings and Discussion**

1. Identification of Data Patterns on the Plot of Curly Red Chili Price Data in Kolaka Regency 2015-2019

Kolaka Regency is one of the areas that always experiences fluctuations in the price of red chilies, both Curly Red Chili and regular red chilies. Curly Red Chili is a commodity that is widely marketed in the Kolaka district. The following is a plot of the Curly Red Chili (HCMK) price data in Kolaka Regency obtained with the help of the MINITAB 19 computer program.

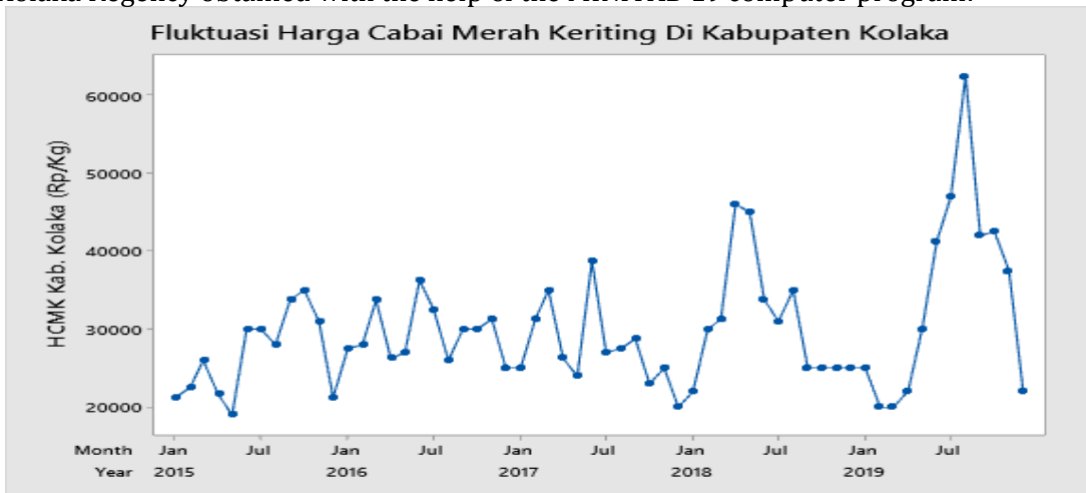


Figure 4.1. Plot of Curly Red Chili Price Data in Kolaka Regency

During 2015-2019, the price of Curly Red Chili fluctuated with the difference between the highest price and the lowest price of IDR 43,500.00. The highest price was reached at the price level of Rp.62,500 / Kg which occurred in August 2019, the high price was due to the decreasing production of local farmers so that the stock of goods decreased while consumer demand increased. Meanwhile, the lowest price was IDR 19,000 / Kg which occurred in May 2015. The low price was caused by the increase in local farmers' production yields so that the stock of goods increased while consumer demand decreased or stabilized. The average price was reached at the price level of Rp. 29,837.5 / Kg. Based on the data plot in Figure 4.1, the seasonal pattern of Curly Red Chili prices in Kolaka district is obtained. The pattern that occurs is low prices in four consecutive months, namely in November-February, while for the other eight months the prices tend to be higher which are repeated in the following year.

2. Identification of Data Patterns on the Plot of Common Red Chili Prices in Kolaka Regency 2015- 2019

The price of regular red chili always fluctuates. Ordinary red chili is also a commodity that is widely marketed in Kolaka district. Based on the results of the data plots obtained with the help of the Minitab 19 computer program, they are as follows.

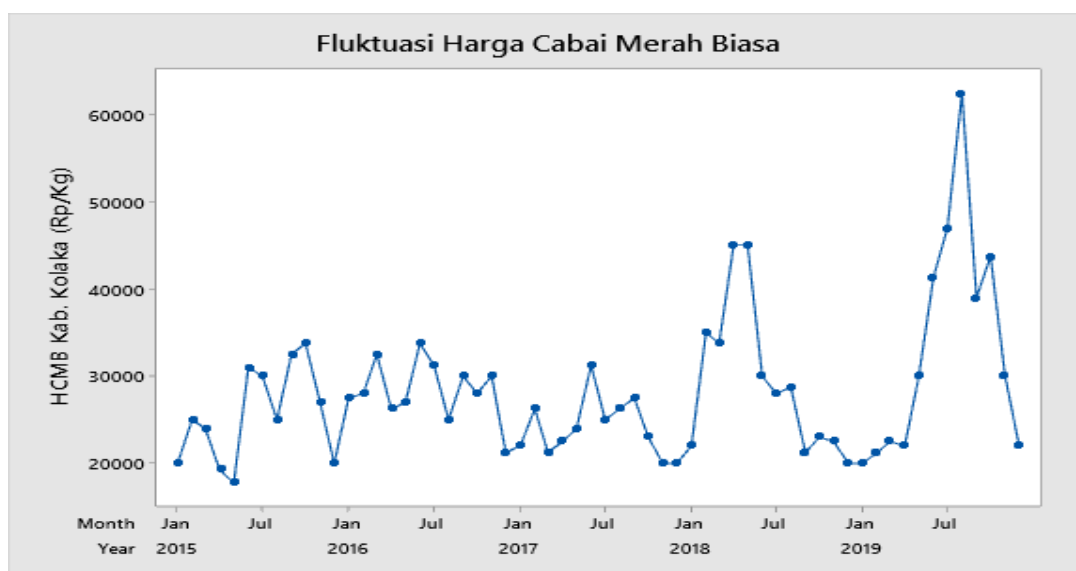


Figure 4.2. Plot of Common Red Chili Prices in Kolaka Regency

In 2015-2019, the price of regular red chilies fluctuated with the difference between the highest price and the lowest price of IDR 44,000.00. The highest price was reached at the price level of Rp.62,500 / Kg which occurred in August 2019, the same as curly red chilies, the high price was also caused by decreased local farmers' production so that the stock of goods decreased while consumer demand increased. Meanwhile, the lowest price was IDR 17,750 / Kg which occurred in May 2015. The low price was caused by the increase in local farmers' production yields so that the stock of goods increased while consumer demand decreased or stabilized. The average price was reached at the price level of IDR 28,220.83 / Kg. Based on the data plot in Figure 4.2, the seasonal pattern of red chili prices is obtained in Kolaka district. The pattern that occurs is low prices in four consecutive months, namely in November-February, while the other eight months the price tends to be higher repeatedly in the following year.

The fall in the price of red chili in Kolaka Regency, both the price of curly red chili and the price of regular red chili, is influenced by, among others, the increase in the production of local farmers so that the stock of goods increases, and the production of farmers' production increases while consumer demand decreases or is stable. Meanwhile, the increase in the price of red chili in Kolaka Regency is influenced by the decreasing production of local farmers so that the stock of goods decreases while consumer demand increases, high consumer demand ahead of holidays and decreasing production of local farmers due to unpredictable weather.

### 3. Selection of the Best Time Series Forecasting Method

The criteria for selecting the most frequently used method or the main criterion is the mean square error (MSE). The method chosen is the method that has the lowest MSE value. The MSE value of each time series forecasting method can be seen in table 4.13.

Tabel 4.13 MSE Value Application of Time Series Forecasting Method

Methods	MSE		Least MSE	
	HCMK	HCMB	HCMK	HCMB
Trend linear	57.456.446	61.208.227	7	7
Trend kuadrat	56.877.051	59.562.399	6	6
Trend pertumbuhan eksponensial	58.439.170	62.332.877	8	8
Pemulusan eksponensial tunggal	47.472.433	45.459.353	4	2
Pemulusan eksponensial ganda	50.483.357	50.707.183	5	5
Winters multiplikatif	66.859.964	73.318.738	10	10
Winters aditif	65.363.379	70.074.761	9	9
Dekomposisi multiplikatif	46.397.609	49.875.904	2	3
Dekomposisi aditif	46.830.210	50.326.663	3	4
ARIMA-SARIMA terbaik	41.534.590	44.764.512	1	1

Based on the results of the application of the time series forecasting method with the help of the MINITAB 19 program in table 4.13, the smallest MSE value for Curly Red Chili and regular red chilies is found in the best ARIMA-SARIMA box-jenkins method which has met the criteria. For the price of curly red chilies, the ARIMA-SARIMA model that has met the criteria is the

SARIMA model (1,0,0) (2,0,0) 12 with an MSE value of 41,534,590. The application of the box-jenkins method with the SARIMA (1,0,0) (2,0,0) 12 model for the Curly Red Chili price will produce a more accurate forecast value when compared to other methods.

Meanwhile, for the price of ordinary red chilies, the ARIMA-SARIMA model that has met the criteria is the SARIMA model (1,0,0) (1,0,0) 12 with an MSE value of 44,764,512. The application of the box-jenkins method with the SARIMA (1,0,0) (1,0,0) 12 model for the price of ordinary red chilies will produce a more accurate forecast value when compared to other methods.

The advantage of the box-Jenkins ARIMA-SARIMA method is that it is good for short-term forecasting and does not require a certain data pattern so that the model can work properly. While the advantages of the ARIMA-SARIMA box-jenkins method are that the model building takes longer than other methods and there is no way to update the model if there is additional data.

#### 4. Forecasting of price of curly red chili (HCMK) and prices of red chili (HCMB) in Kolaka Regency

Based on the best chosen time series forecast method, the price forecast for curly red chili and red chili peppers can be seen in table 4.14.

Table 4.14 Forecast price of curly red chili (HCMK) and prices of red chili (HCMB) in Kolaka Regency in 2020.

Periode	HCMK (Rp/Kg)	HCMB (Rp/Kg)
January	23.169	21.377,7
February	25.319,7	21.230,8
March	26.033,2	21.108,9
April	35.002	20.382,1
May	38.088,8	22.732,8
June	37.051,6	26.273,4
July	38.158,5	27.858,7
August	47.355,4	32.967,8
September	32.630,1	24.081,6
October	32.857,7	25.365,6
November	30.596,6	20.019,4
December	23.585	16.756,4
<b>Min</b>	<b>23.169</b>	<b>16.756,4</b>
<b>Max</b>	<b>47.355,4</b>	<b>32.967,8</b>
<b>Rata-rata</b>	<b>32.487,3</b>	<b>23.346,27</b>

Based on the results of forecasting Curly Red Chili prices and regular red chili prices using the best time series forecasting method, i.e. for Curly Red Chili price forecasting using the box-jenkins method with the SARIMA model (1,0,0) (2,0,0) 12 with the assistance of the MINITAB program 19, it can be explained that for the price of curly red chili peppers, the highest price is 47,355.4 IDR / Kg that It is produced in August 2020 and the lowest price is 23,169 IDR / Kg which is produced in January 2020, while the average price is for Rizado Red Chili in 2020 is IDR 32,487.3 / Kg. The price that will go on the market will not It will be exactly the same as this forecast, but the price will not be far from the forecast using the best time series forecasting method.

Meanwhile, the price of regular red chili peppers uses the box-jenkins method with the SARIMA model (1,0,0) (1,0,0) 12 with application of the MINITAB 19 program, the highest price is IDR 32,967.8 / Kg that occurs in August. 2020 and the lowest price is IDR 16,756.4 / Kg which occurred in December 2020, while the average price of ordinary red chili in 2020 is IDR 23,346.27 / Kg. The price that will come out in the market will not be exactly the same same as this forecast, but the price will not be far from the forecast using the best time series forecasting method.

#### D. Conclusion

1. The results of identifying data patterns in the Curly Red Chili price data plot at Kolaka Regency in 2015-2019 obtained a seasonal pattern. The pattern that occurs is the low prices in four consecutive months, that is, in November-February, while the other eight months the

- price tends to rise repeatedly in the following year. Meanwhile, the results of the identification of data patterns in the data plot of the price of ordinary red chili peppers in Kolaka district in 2015-2019 also showed a seasonal pattern. The pattern that occurs is the low prices in four consecutive months, that is in November-February, while the other eight months the price tends to be repeatedly higher in the following year.
2. The results of the application of the time series prediction method for the price of curly red chili peppers, obtained the best time series prediction method, namely, the box-jenkins method of the SARIMA model (1,0, 0) (2,0,0) 12 with the smallest MSE value, that is, MSE = 41,534,590. Applying the box-jenkins method with the SARIMA (1,0,0) (2,0,0) 12 model for the price of Curly Red Chili will produce a more accurate forecast value compared to other methods. Meanwhile, for the price of ordinary red chili peppers, the best time series forecasting method is the box-jenkins method of the SARIMA (1,0,0) (1,0,0) 12 model with the value of MSE smaller, that is, MSE = 44,764,512. Applying the box-jenkins method with the SARIMA (1,0,0) (1,0,0) 12 model for the price of ordinary red chili peppers will produce a more accurate forecast value compared to other methods.
  3. The results of forecasting the price of Curly Red Chili using the box-jenkins method, the SARIMA (1,0,0) (2,0,0) 12 model with the help of the MINITAB 19 program is the highest price of IDR 47,355.4 / Kg that occurred in August 2020 and The lowest price is IDR 23,169 / Kg that occurred in January 2020, while the average price of Curly Red Chili in 2020 is IDR 32,487.3 / Kg. The price that will go on the market It will not be exactly the same as this forecast, but the price will not be far from the forecast using the best time series forecasting method. Meanwhile, the results of forecasting the red chili prices usually use the box-jenkins method with the SARIMA model (1,0,0) (1,0,0) 12 with the help of the MINITAB program 19, the highest price was Rp. 32,967.8 / Kg that occurred in August 2020 and the lowest price was Rp. 16,756.4 / Kg that occurred in December 2020, while the The price of regular red chili peppers in 2020 is 23,346.27 IDR / Kg. The price that will hit the market will not be exactly the same as this forecast, but the Price will not be far from the forecast using the best time series forecasting method.

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