

The Influence of Climate Change on Paddy Production in West Sumatra

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Abstract

Paddy is a food crop commodity that produces rice which is the food most consumed by the population in Indonesia. Paddy is produced in almost all regions in Indonesia, one of which is West Sumatra. West Sumatra is one of the largest paddy-producing regions in Indonesia, however, in recent years, paddy production in West Sumatra has experienced a significant decline. This research aims to determine the climate factors that influence paddy production in West Sumatra. The type of data used in this research is secondary data including data on paddy production, rainfall, number of rainy days, temperature, humidity, wind speed, and air pressure in West Sumatra Province in 2013 - 2023. The data analysis used in this research is simple linear regression analysis. The research results show that rainfall, number of rainy days, and temperature have a significant effect on paddy production in West Sumatra, while humidity, wind speed, and air pressure do not have a significant effect on paddy production in West Sumatra.

Keywords: Climate Change, Paddy Production, Rainfall, Temperature, Regression Analysis, West Sumatra, Agricultural Productivity

1. Introduction

Food is the most important human need. To create quality human resources, food needs for each individual need to be met (Ariyanti et al., 2024), therefore the country needs to ensure sufficient food to meet the food needs of its population. In Indonesia, the development of consumption patterns for staple food sources of carbohydrates is still dominated by the grain group, especially paddy (Center for Agricultural Data and Information Systems, 2024). Rice is a paddy-producing food crop commodity that is most widely consumed by the Indonesian population. The need for rice derived from paddy is increasing along with the increase in population. To meet these needs, efforts are needed to increase paddy production in various regions in Indonesia.

West Sumatra is one of the provinces in Indonesia which is one of the largest paddy producing areas in Indonesia. The problem currently being faced is the decline in paddy production in West Sumatra in recent years. Paddy production in West Sumatra in 2013 - 2023 can be seen in table 1.



Table 1. Paddy Production in West Sumatra Province

Year	Production (tons)
2013	2,457,384.00
2014	2,519,020.00
2015	2,550,609.00
2016	2,503,452.00
2017	2,824,509.00
2018	1,483,076.48
2019	1,482,996.01
2020	1,387,269.29
2021	1,317,209.38
2022	1,373,532.19
2023	1,482,468.79

Source: West Sumatra Central Statistics Agency, data processed (2024)

The data in Table 1 shows that paddy production in West Sumatra for the 2013 - 2023 period experienced a significant decline. West Sumatra paddy production in 2023 will be 1,482,468.79 tons, a decrease of around 39% compared to 2019 which had production of 2,457,384.00 tons. The decline in paddy production that occurred in West Sumatra could potentially hamper efforts to meet food needs in the form of paddy, thereby threatening food sovereignty.

The decline in paddy production in West Sumatra can be caused by various factors, one of which is climate. The current climate change has had an impact on decreasing food production, especially in developing countries, including Indonesia (Asnawi, 2015). Rusmayadi et al. (2024) stated that climate change has a significant impact on food crop productivity through increasing temperatures, changes in rainfall patterns, and extreme weather which results in decreased production. Sari et al. (2021) stated that climate change is affecting paddy productivity in Aceh Besar Regency. Auliya et al. (2024) in their research results also reported that climate change has an influence on paddy productivity in East Java. Several studies report that climate change has affected paddy productivity and production in several regions. This research aims to find out how climate change affects paddy production in West Sumatra.

2. Methods

This research was carried out in West Sumatra Province from November 2024 to January 2025. This location was chosen with the consideration that West Sumatra Province has experienced a significant decline in paddy production in recent years. This research uses secondary data obtained from articles, journals, books, and data from the Central Statistics Agency of West Sumatra Province. The data used in this research are data on paddy production, rainfall, number of raindrops, temperature, humidity, wind speed and air pressure in West Sumatra Province in 2013 - 2023. The selection of the data time range in this research is adjusted to the availability and completeness of the data. The data analysis used in this research is linear regression analysis carried out using Microsoft Excel software.

Regression analysis in this research is used to identify the relationship and influence of independent variables on the dependent variable. In this research, the independent variable used is climate change which consists of rainfall, number of rainy days, temperature, humidity, wind speed and air pressure. The dependent variable used in this research is paddy production in West Sumatra. This research uses a significance level of 5% where an independent variable is said to have an effect on the dependent variable if it has a significance value below 0.05. The type of regression analysis used in this research is simple linear regression with the following mathematical formula (Wulandari & Rumini, 2023):

$$Y = a + b.X$$

3. Results and Discussion

3.1. The Influence of Climate Change on Paddy Production in West Sumatra

During the period 2013 – 2023 in West Sumatra there have been climate changes including rainfall, number of rainy days, temperature, humidity, air pressure and wind speed. The results of a simple linear regression analysis carried out between various indicators of climate change on paddy production show that climate change has an influence on paddy production in West Sumatra. The results of simple linear regression analysis of the influence of climate change on West Sumatra paddy production can be seen in Table 2.

Table 2. Results of Simple Linear Regression Analysis of the Effect of Climate Change on Paddy Production in West Sumatra

Climate Elements	Significance Value	Information
Rainfall	0,019	Influential
Number of Rainy Days	0,03	Influential
Temperature	0,023	Influential
Humidity	0,8	Not Influential
Air Pressure	0,64	Not Influential
Wind Velocity	0,85	Not Influential

Source: primary data processed (2024)

The results of simple linear regression analysis in table 2 show that there are several indicators of climate change that influence West Sumatra paddy production. In this research, influential climate change indicators are shown with significance values below 0.05. Of the six climate change indicators used as independent variables, there are three climate change indicators that have a significant effect, namely changes in rainfall, number of rainy days, and temperature. These three variables are said to have a significant effect because they have a significance value of less than 0.05, while other climate change indicators such as humidity, air pressure and wind speed have a significance value of greater than 0.05 so they do not have a significant effect on paddy production in West Sumatra.

3.2. The Influence of Changes in Rainfall on Paddy Production in West Sumatra

The results of simple linear regression analysis show that changes in rainfall have a significance value of 0.019, where this value is smaller than 0.05, so there is an influence of changes in rainfall on paddy production in West Sumatra. The regression coefficient from the analysis results has a negative value so that the effect of changes in rainfall on paddy production in West Sumatra is negative, meaning that increasing rainfall can cause a decrease in paddy production in West Sumatra.

The results of the analysis which show that there is a significant influence of changes in rainfall on paddy production in West Sumatra are in line with the research results of Khodijah (2015) which reported that the dominant climate factor influencing lowland paddy production in South Sumatra is rainfall which indicates that water availability will greatly influence paddy production. Auliya et al. (2024) stated that rainfall is the climate component that is most easily changed and has a major impact on the production of food crops, including paddy.

3.3. The Influence of Changes in the Number of Rainy Days on Paddy Production in West Sumatra

The results of simple linear regression analysis show that changes in the number of rainy days have a significance value of 0.03, where this value is smaller than 0.05, so there is an influence of changes in the number of rainy days on paddy production in West Sumatra. The regression coefficient from the analysis results has a negative value so that the effect of changes in the amount of rain on paddy

production in West Sumatra is negative, which means that an increase in the number of rainy days can reduce paddy production in West Sumatra.

3.4. The Influence of Temperature Changes on Paddy Production in West Sumatra

The results of simple linear regression analysis show that temperature changes have a significance value of 0.023, where this value is smaller than 0.05, so there is an influence of temperature changes on paddy production in West Sumatra. The regression coefficient from the analysis results has a negative value so that the effect of temperature changes on paddy production in West Sumatra is negative, which means that an increase in temperature can reduce paddy production in West Sumatra. This finding is in line with the research results of Gunawan et al. (2024) who reported that there is a significant influence between rainfall and air temperature on paddy productivity and production.

3.5. The Influence of Humidity Changes on Paddy Production in West Sumatra

The results of simple linear regression analysis show that changes in humidity have a significance value of 0.80, where this value is greater than 0.05, so there is no effect of changes in humidity on paddy production in West Sumatra. The regression coefficient from the analysis results has a positive value so that the effect of changes in humidity on paddy production in West Sumatra is positive, meaning that increasing humidity can increase paddy production in West Sumatra. This finding is in line with the research results of Khodijah (2015) which reported that there was a negative relationship between humidity and paddy production. Novelia et al. (2024) in their research results also reported that there was a negative correlation between humidity and paddy plant productivity.

3.6. The Influence of Changes in Air Pressure on Paddy Production in West Sumatra

The results of simple linear regression analysis show that changes in air pressure have a significance value of 0.64, where this value is greater than 0.05, so there is no effect of changes in air pressure on paddy production in West Sumatra. The regression coefficient from the analysis results has a negative value so that the effect of changes in air pressure on paddy production in West Sumatra is negative, meaning that an increase in air pressure can reduce paddy production in West Sumatra.

3.7. The Effect of Changes in Wind Speed on Paddy Production in West Sumatra

The results of simple linear regression analysis show that changes in wind speed have a significance value of 0.85, where this value is greater than 0.05, so there is no effect of changes in wind speed on paddy production in West Sumatra. The regression coefficient from the analysis results has a negative value so that the effect of changes in wind speed on paddy production in West Sumatra is negative, meaning that an increase in wind speed can reduce paddy production in West Sumatra.

4. Conclusion

From the research results, it can be concluded that climate change consisting of changes in rainfall, number of rainy days and air temperature has a significant influence on paddy production in West Sumatra, while changes in humidity, wind speed and air pressure do not have a significant influence on paddy production in West Sumatra. The factors changing rainfall, number of rainy days, and air temperature have negative regression coefficient values so that they have a negative relationship, which means that increasing rainfall, increasing the number of rainy days, and increasing temperature can reduce paddy production in West Sumatra.

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