Volume. 2 No 1 April (2025)

e-ISSN: 3062-7737
p-ISSN: 3063-2137

Semeton Mathematics Journal

Homepage jurnal: http://eigen.unram.ac.id/semeton

Trends Analysis Between The Relationship Rice Harvest and Rice Productivity in Nusa Tenggara Province

Yulinda Raudatul Hamdiah[1], Nuzla Af'idatur Robbaniyyah[1*]

1. Department of Mathematics, University of Mataram Mataram, Indonesia.

ABSTRACT

This study aims to analyze the monthly trends in rice productivity and harvested area in West Nusa Tenggara (NTB) Province in 2023 and identify the relationship between these two variables. The data used in this research were obtained through a rice crop cutting survey based on the Area Sample Frame (KSA) method conducted by the Central Statistics Agency. Productivity was calculated based on the amount of yield produced per unit area of land each month. The results showed that rice productivity in NTB Province fluctuated, with the highest productivity recorded in January at 56.54 quintals per hectare (ku/ha) and the lowest in June at 48.40 ku/ha. Similarly, the harvested area varied, with the largest area recorded in March at 73,766 hectares and the smallest in December at 5,382 hectares. The analysis of the relationship between harvested area and rice productivity revealed an inverse pattern, where an increase in harvested area was not always accompanied by an increase in productivity. Therefore, rice productivity and harvested area are more influenced by external factors and do not directly affect each other.

Keywords: Harvested area, rice productivity, crop cutting survey, monthly trends.

Received: 17-12-2024;
Accepted: 24-04-2025;

doi: https://doi.org/10.29303/semeton.v2i1.257

1. Introduction

The Central Bureau of Statistics is a non-ministerial government agency that reports directly to the President. BPS plays an important role in providing accurate and valid statistical data for both the government and the public. At the national level, the central BPS holds the highest authority, while at the regional level, provincial and district/city BPS offices support data collection and analysis in their respective areas.

One of the surveys conducted by BPS is the rice crop-cutting survey based on the Area Sampling Frame (ASF) method. This survey aims to collect data on crop productivity by directly measuring the production yield from randomly determined crop-cutting plots during the harvest season [1]. The survey is conducted every subround (quarterly) and focuses on rice and secondary crops. The crop-cutting plots used have a size of 2.5 × 2.5 m^2 or 6.25 m^2, and in one hectare, approximately 1,600 plots can be randomly selected. Field officers then weigh the harvest yield in the form of Fresh Harvested Dry Grain (GKP), which is converted into Milled Dry Grain (GKG) [2]. The crop-cutting survey enables BPS to estimate production yield per unit area, which is essential for national food security planning. The data collected serves as a basis for formulating policies related to the agricultural and food sectors and contributes to enhancing food security [3].

The Area Sampling Frame (ASF) survey is an area-based survey conducted through direct observation of sample segments, aimed at estimating the area by extrapolating from the sample to the population within a relatively short period (rapid estimate). In Indonesia, the ASF method

* Corresponding author
e-mail: nuzla@unram.ac.id

was developed by BPPT in 1998 for estimating current production and the potential for the next three months, utilizing spatial statistics. The technology used in this survey includes Android smartphones with the ASF application, which allows officers to capture photos and determine the growth stages of rice. The observation point coordinates are locked, requiring officers to visit the location to take the photos. The ASF survey is conducted during the last seven days of each observation month [1]

Rice, scientifically known as *Oryza sativa*, is a staple crop in the form of tufted grass originating from two continents, namely tropical and subtropical Asia and West Africa. This ancient agricultural plant has now spread across the globe and grows in nearly every part of the world (Shabrina et al., 2020). Rice is a vital cultivated crop, serving as the primary carbohydrate source for the majority of the world's population, following cereals such as maize and wheat. Indonesia, as a country where the majority of the population depends on rice, considers rice a critical commodity with strategic value in its economy. Rice is consistently positioned as a key commodity in the formulation and implementation of Indonesia's economic policies (Darmawan, 2019). Rice plants typically require 3–4 months to grow, starting from seedling to harvest [4].

Rice productivity is a key indicator that reflects production efficiency in rice farming. Rice productivity is calculated based on the total rice yield in the form of Dry Milled Grain (DMG) per unit area of land, expressed in quintals per hectare (qu/ha) [5]. Productivity is a key factor in determining the success of the agricultural sector in a region. Improving rice productivity is crucial to ensuring food security in Indonesia, as rice is a staple food for the majority of the population. Factors that influence rice productivity include seed quality, fertilizer use, water availability, and the cultivation techniques applied by farmers.

Harvested area refers to the area of rice plants that are collected after they have reached maturity, and is measured in hectares (ha) [6]. The harvested area reflects the land that has produced agricultural commodities ready for harvest. The larger the area planted, the greater the harvested area obtained. However, the harvested area does not always correspond directly to the planted area, and crop failure may occasionally occur [7]. The harvested area for rice consists of both irrigated rice fields and dry rice fields. The harvested area serves as a measure to assess the level of rice production, as it directl y influences rice production. Changes in the harvested area, whether an increase or decrease, will affect rice availability. Thus, the harvested area is the total area of all types of land used to produce agricultural products that can be harvested within a specific period [8].

Furthermore, productivity and harvested area data are also essential in assessing rice availability in a region. For instance, based on BPS data from 2023, rice production in West Nusa Tenggara Province reached approximately 15.385.369,2 quintals of Milled Dry Grain (GKG). Meanwhile, with a population of 5.560.287 people and an average rice consumption per capita of around 96 kg per year, the estimated annual rice demand is about 5.337.810 quintals, which equals 8.606.140 quintalss of GKG after conversion. These figures indicate that, quantitatively, rice availability in NTB is sufficient to meet the consumption needs of the population.

However, this achievement highly depends on the monthly conditions of rice productivity and harvested area. Therefore, it is important to analyze how the monthly trends of productivity and harvested area evolve throughout the year. Are there seasonal patterns or significant fluctuations? Is the relationship between productivity and harvested area positively correlated, or do they diverge over time?

The purpose of this study is to analyze the monthly trends in rice productivity in West Nusa Tenggara Province in 2023, as well as the monthly trends in harvested rice area in the province. This study also aims to identify the relationship between the trends in harvested rice area and rice productivity in West Nusa Tenggara Province Province throughout 2023. By understanding these trends, it is hoped that deeper insights can be gained regarding the dynamics of the rice farming sector in West Nusa Tenggara Province, which can later contribute to decision-making related to agricultural policies and food security in the region.

2. Methods

This study uses secondary data obtained from the Central Statistics Agency of West Nusa Tenggara Province (NTB Province). The data used includes information on rice productivity and harvested rice area West Nusa Tenggara Province Province for the year 2023. Data collection was conducted by accessing publications and reports available on the official Central Statistics Agency West Nusa Tenggara Province website. After the data was gathered, it was processed using Microsoft Excel to calculate rice productivity, and the results will be presented in the form of graphs or images. Data analysis is performed using descriptive analysis methods. Quantitative descriptive analysis is used to numerically describe rice productivity and harvested rice area in West Nusa Tenggara Province for 2023, while qualitative descriptive analysis is used to explain patterns related to the relationship between harvested area and rice productivity in the region.

3. Results and Discussion

The data used in this analysis was obtained through the ASF-based rice plot survey, which includes rice production and harvested area in West Nusa Tenggara Province for the year 2023, as presented in Table 1 below. Table 1 shows rice production in tons and the harvested area in hectares for each month.

Table 1. Rice Production and Harvested Area in NTB Province in 2023

Month	Production (quintal GKG)	Harvested Area (hektare)
January	364.383,2	6.444,98
February	1.501.836,7	27.338,61
March	4.103.405,7	73.766,28
April	2.794.015,5	51.297,00
May	1.835.243,7	33.725,71
June	1.215.701,7	25.119,14
July	1.080.273,1	22.142,38
August	735.391,8	14.247,15
September	490.645,4	9.250,64
October	565.215,9	10.643,13
November	411.636,4	8.154,63
December	287.620,1	5.382,49
Total	**15.385.369,2**	**287.512,14**

(Source: Central Statistics Agency West Nusa Tenggara Province [9])

Based on the data obtained through the ASF-based rice sampling survey. The Formula to find out the rice productivity is

$$\text{Productivity (qu/ha)} = \frac{\text{Total Production (qu)}}{\text{Harvested Area (ha)}}.$$

Then, the calculation results for productivity and the analysis of rice productivity in West Nusa Tenggara Province in 2023 are presented in Table 2.

Table 2. Rice Productivity in West Nusa Tenggara Province in 2023

Month	Production (quintal)	Harvest Area (hektare)	Productivity (qu/ha)

January	364.383,2	6.444,98	56,53752223
February	1.501.836,7	27.338,61	54,93464006
March	4.103.405,7	73.766,28	55,62711987
April	2.794.015,5	51.297,00	54,467425
May	1.835.243,7	33.725,71	54,41675505
June	1.215.701,7	25.119,14	48,39742523
July	1.080.273,1	22.142,38	48,78757839
August	735.391,8	14.247,15	51,61676546
September	490.645,4	9.250,64	53,03907622
October	565.215,9	10.643,13	53,10617271
November	411.636,4	8.154,63	50,4788568
December	287.620,1	5.382,49	53,43625348
Total	**15.385.369,2**	**287.512,14**	**53,51206805**

Based on the data in Table 2, rice productivity in West Nusa Tenggara Province in 2023 shows significant fluctuations from month to month. peak production: The highest production occurred in March at 4.103.405,7 quintals GKG, with a harvested area of 73,766.28 hectares. The lowest production: The lowest production was recorded in December, with 287.620,1 quintals GKG and a harvested area of 5,382.49 hectares.To further illustrate the monthly trend of rice productivity throughout 2023, it can be seen in Figure 1 on the following below.

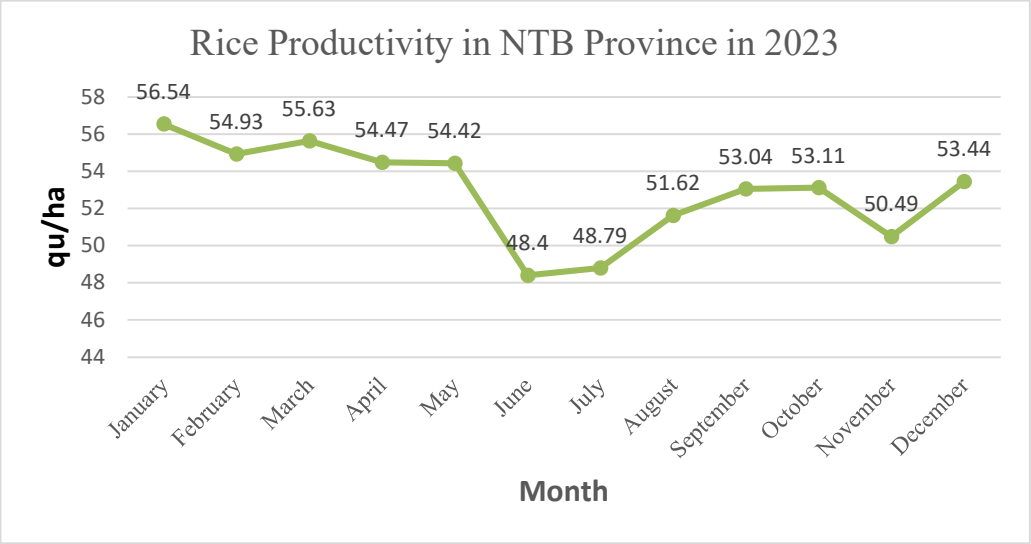

Figure 1. Rice Productivity Chart in West Nusa Tenggara Province in 2023

Rice productivity in West Nusa Tenggara Province in 2023 experienced fluctuations. In January, rice productivity reached 56.53 qu/ha, but in February it decreased to 54.93 qu/ha. Although rice productivity slightly increased again to 55.63 qu/ha in March, it declined consecutively in April and May to 54.47 qu/ha and 54.42 qu/ha, respectively. The lowest rice productivity occurred in June, at only 48.40 qu/ha, followed by a slight increase in July to 48.79

qu/ha. Then, in August, rice productivity rose again to 51.62 qu/ha, and in September and October it reached 53.04 qu/ha and 53.11 qu/ha, respectively. However, in November, productivity dropped again to 50.48 qu/ha before rising in December to reach 53.44 qu/ha. Therefore, West Nusa Tenggara Province experienced substantial rice production in 2023, with March contributing the largest share. Productivity was stable overall, averaging around 53.51 qu/ha, although mid-year declines suggest possible seasonal or environmental challenges affecting yields.

Based on the data in Table 1, the harvested area of rice in West Nusa Tenggara Province in 2023 shows significant fluctuations, varying from month to month. The data indicates that the highest harvested area of rice, reaching 73,766.28 ha, occurred in March, while the lowest harvested area of 5,382.49 ha occurred in December. Based on this data, the graph of the harvested area of rice in West Nusa Tenggara Province in 2023 is presented in Figure 2.

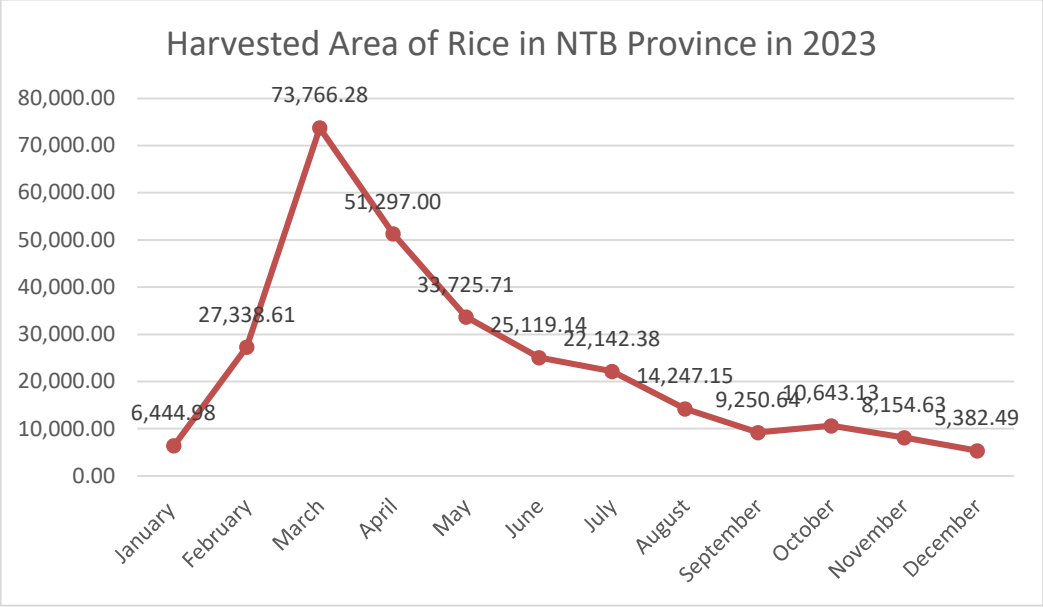

Figure 2. Graph of the Harvested Area of Rice in NTB Province in 2023

Figure 2 shows the monthly trend of the harvested rice area in West Nusa Tenggara Province in 2023. The data reveals significant fluctuations throughout the year. In January, the harvested area was recorded at 6,444 ha. Then, in February, there was an increase in the harvested area to 27,338 ha. The peak of the harvested area occurred in March, with a total of 73,766 ha. From April to September, there was a continuous decrease in the harvested area, recorded at 51,297 ha, 33,725 ha, 25,119 ha, 22,142 ha, 14,297 ha, and 9,250 ha, respectively. However, in October, the harvested area increased slightly to 10,643 ha. Subsequently, there was another decrease in November and December, w ith the harvested area recorded at 8,154 ha and 5,382 ha, respectively.

The fluctuations in rice productivity and harvested area are influenced by various interconnected factors. Weather changes, such as unpredictable rainfall or prolonged drought, affect water availability, which in turn impacts plant growth and farmers' decisions regarding planting area. Soil quality is also a key determinant, where fertile soil supports high productivity, while degraded soil can lower yields and reduce the planting area. Furthermore, the availability of resources, such as irrigation water and labor, significantly affects planting decisions, particularly during the dry season when water stress can hinder productivity and shrink the harvested area. Pest and disease infestations further exacerbate the situation by reducing yields per hectare and narrowing the planting area due to significant crop damage. However, the implementation of appropriate farming techniques, such as crop rotation, proper fertilization,

and integrated pest management, can help improve productivity while maintaining harvested areas despite these challenges.

To understand the relationship between the trends in harvested area and rice productivity, a graph showing harvested area against rice productivity was created (Figure 3).

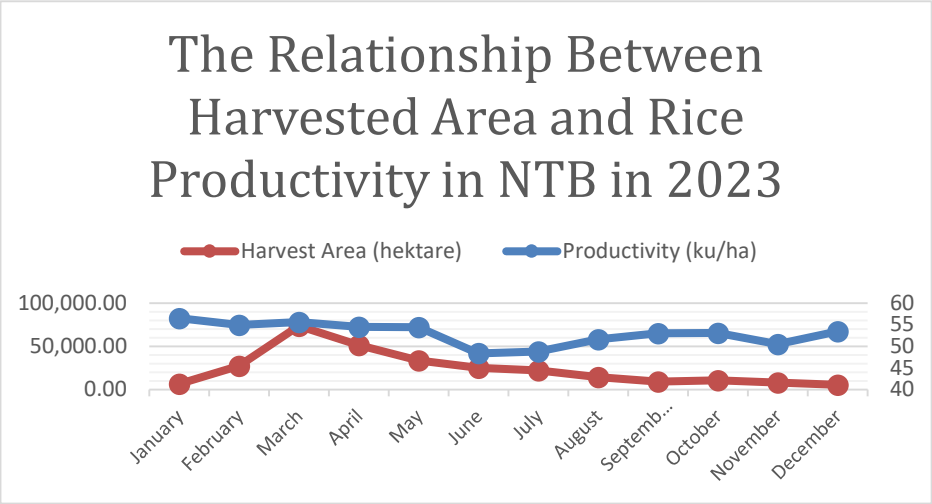

Figure 3. Graph of the Relationship Between Rice Harvest Area and Rice Productivity

Based on Figure 3, it can be seen that the rice harvest area and rice productivity in NTB Province in 2023 have an inverse relationship. This is evidenced by the fact that an increase in the rice harvest area in West Nusa Tenggara Province was not followed by an increase in rice productivity. In March, for instance, the rice harvest area was high, but rice productivity actually decreased. On the other hand, in January, the rice harvest area decreased, but rice productivity increased. Therefore, although there is a relationship between the rice harvest area and rice productivity, the harvest area does not always affect rice productivity. According to previous research by Azizah et al. (2021), rice productivity is influenced by other factors, such as the condition of the irrigation channels and the fertility of the soil. The Figure 3 also indicates a visible inverse relationship between harvested area and productivity. Generally, as the harvested area increases, productivity shows a slight decline, and vice versa.

The relationship between harvested area and rice productivity in West Nusa Tenggara suggests that larger harvested areas may face challenges such as resource constraints or labor limitations, leading to slight decreases in productivity. Smaller harvested areas, typically in off-peak months, achieve better productivity, possibly due to more focused resource allocation and favorable conditions.

4. Conclusion

Based on the analysis of the monthly trends in rice productivity and rice harvest area in West Nusa Tenggara Province in 2023, significant fluctuations were found in both variables. The highest rice productivity was recorded in January at 56.54 qu/ha, while the lowest was in June at 48.40 qu/ha, influenced by factors such as weather changes, irrigation availability, soil conditions, pest and disease attacks, as well as the quality and cultivation techniques. The highest rice harvest area occurred in March at 73,766.28 ha, while the lowest was in December at 5,382.49 ha, with fluctuations influenced by weather, soil quality, resource availability, and pest or disease attacks. The analysis of the relationship between harvest area and productivity shows an inverse pattern, where significant changes in the harvest area are not always followed by similar patterns in productivity. Thus, although they are related, the two variables do not directly influence each other.

Acknowledgments

Thank you to Department of Mathematics, Faculty of Mathematics, University of Mataram of the opportunity to finish the research. Also, thenk you to Central Statistics Agency West Nusa Tenggara Province as a chance to collaboration of the research.

References

[1] C. B. o. S. o. Indonesia, "Efforts to improve rice data using the Area Sampling Frame (ASF) method 2018," Central Bureau of Statistics of Indonesia, (Kota tempat BPS pusat, biasanya Jakarta), 2018.

[2] C. B. o. S. o. Indonesia, "Analysis of rice productivity in Indonesia 2023 (results of the Crop Cutting Survey)," Central Bureau of Statistics of Indonesia, Jakarta, 2024.

[3] C. B. o. S. o. B. Province, "Rice and secondary crop production in Banten Province 2018," Central Bureau of Statistics of Banten Province, Serang, 2018.

[4] C. B. o. S. o. W. N. T. Province, "Harvested area and rice production in West Nusa Tenggara Province 2023 (final figures)," Central Bureau of Statistics of West Nusa Tenggara Province, Mataram , 2024.

[5] N. Shabrina, A. Sukmono and S. Subiyanto, "Analysis of planting area and harvested area in the plantation commodity sector in West Sumatra Province using profile analysis," *Jurnal Geodesi Undip,* vol. 9, no. 3, pp. 59-70, 2020. doi: https://doi.org/10.14710/jgundip.2020.28989

[6] W. Saputri and N. Amalita, "Analysis of planting area and harvested area in the plantation commodity sector in West Sumatra Province using profile analysis," *Journal Of Mathematics UNP,* vol. 3, no. 1, pp. 85-89, 2020.

[7] Nursyamsi, "Analysis of the welfare of rice paddy farmers in Pattallassang District, Gowa Regency," Universitas Islam Negeri Alauddin, Makassar, 2020.

[8] A. Darmawan, "Analysis of rice production estimation based on growth phases and autoregressive integrated moving average (ARIMA) estimation models using Landsat 8 imagery in Sukoharjo Regency with web-GIS visualization," Universitas Muhammadiyah Surakarta, Surakarta, 2019.

[9] F. Azizah, S. Suwarsito and E. Sarjanti, "The effect of rainfall patterns on rice productivity in Bukateja District, Purbalingga Regency," *SAINTEKS,* vol. 18, no. 1, pp. 1-7, 2021. doi: https://doi.org/10.30595/sainteks.v18i1.10567

[10] Salfiana, Surianti, A. Khalik, F. Anas, A. N. Inayah, A. Nurwidah and F. Hasanuddin, "Comparison of rice yield survey results based on regional division in Panca Rijang District, Sidenreng Rappang Regency, 2023," *Jurnal Ilmu Pertanian,* vol. 7, no. 1, pp. 58-63, 2024. doi: https://doi.org/10.35334/jpen.v7il.5159.

[11] C. B. o. S. o. O. K. U. Regency, "Crop Cutting Survey for food crops," Central Bureau of Statistics of Ogan Komering Ulu Regency, Ogan Komering Ulu, 2018.