

## THE EFFECT OF HARVESTED AREA AND PRODUCTIVITY ON CORN PRODUCTION IN INDONESIA IN 2023

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1

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### Abstract

Corn is a strategic commodity that can be used as a substitute for rice, therefore, corn production requires serious attention in efforts to support national food security. Harvested area and productivity are two key factors influencing corn production levels. Therefore, accurate analysis is needed to determine the extent to which these two factors impact corn production in an effort to strengthen food security. This study aims to analyze the influence of harvested area and productivity on corn production in various provinces in Indonesia in 2023. The method used is panel regression analysis, which allows testing the influence of independent variables (harvested area and productivity) on the dependent variable (corn production) by considering both time and regional dimensions. The results show that harvested area and productivity have a significant effect on corn production at the provincial level. Provinces with high harvested area and productivity tend to have greater corn production. However, there is variation between provinces due to differences in climate conditions and other factors. These findings have important implications for the planning and development of the corn agricultural sector, where targeted increases in harvested area and productivity can support increased national corn production. However, such improvement strategies need to be tailored to the characteristics of each region.

**Keywords:** Corn Production, Food Security, Harvested Area, Panel Regression, Productivity

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## INTRODUCTION

Indonesia is a developing country where the majority of its population relies on the agricultural sector for its livelihood, making agriculture one of the main pillars of the national economy (BPS, 2023; FAO, 2022). The agricultural sector plays a crucial role in the economic development process in developing countries due to its contribution to national income, employment, and food security (Todaro & Smith, 2015). Among various agricultural commodities, corn is a leading crop due to its strategic role in supporting food security and agro-based industries. Corn not only serves as a staple food in several regions of Indonesia but is also used as animal feed and industrial raw materials such as corn oil and cornstarch (Siregar & Anindita, 2018; Adebayo & Onu, 2022; Nuraini et al., 2020). This multipurpose role gives corn high economic value and makes it one of the priority commodities in national agricultural development.

Corn production in Indonesia is influenced by various factors, particularly harvested area, land productivity, and the use of production inputs such as fertilizers and superior seeds (Rarun et al., 2023; Setyowati et al., 2023). Several studies have shown that increasing land area and input efficiency significantly impact production increases, even at the local or village level. Furthermore, data-driven predictive methods such as exponential smoothing are beginning to be used to estimate future corn production trends as a basis for food security planning (Tedi, 2023). Food security is determined not only by availability but also by the resilience of agrifood systems to various shocks, including climate and economic crises (FAO, 2021). Other studies also emphasize the importance of considering variations in agroecological characteristics, climate, and local production capacity in designing production increase policies (Huynh & Yabe, 2021; Suryana & Saptana, 2015).

However, challenges such as limited farmer access to technology, limited capital support, and low literacy regarding efficient cultivation practices remain significant obstacles (Saputra & Rachman, 2022; Indaka, 2023; Dossou-Yovo et al., 2022). Furthermore, inputs such as fertilizer and appropriate cultivation techniques play a crucial role in harvest success, given that corn is highly susceptible to damage from pests, diseases, and environmental conditions during pollination (Wangi & Adriansyah, 2023). Post-harvest issues and distribution infrastructure also impact production stability in various regions (Nainggolan et al., 2023; Nuryanti & Swastika, 2018). In the agribusiness context, increasing productivity through input efficiency and technology can boost farmer incomes and overall agricultural sector growth (Soekartawi, 2016).

Several studies have concluded that growing corn can be a profitable source of income for farmers, provided it is supported by appropriate production schemes and access to adequate land (Sakinah et al., 2023). Research by Dossou-Yovo et al. (2022) also emphasizes that successful corn cultivation is closely correlated with the implementation of good agronomic practices, including the use of superior seeds, balanced fertilization, and effective pest and disease control. Furthermore, a study by Saputra and Rachman (2022) shows that the availability of production inputs such as subsidized fertilizer and agricultural machinery directly contributes to increased productivity and income for corn farmers. Institutional support, such as agricultural extension services and market access, also enhances the potential profits from corn cultivation (Nainggolan et al., 2023; Nuryanti & Swastika, 2018). Thus, corn serves not only as a food commodity but also as an instrument for economic empowerment of farmers in various regions, particularly in areas with limited access to other primary food commodities (Smutka et al., 2022; Xu et al., 2020; Huynh & Yabe, 2021). Therefore, a thorough understanding of the extent to which harvested area and productivity influence corn production is crucial for designing sustainable, data-driven production improvement strategies. This research is expected to contribute to agricultural

policymaking, particularly in optimizing national corn production through an approach based on land potential and productivity efficiency.

## RESEARCH METHODS

Corn production is directly influenced by two main factors: harvested area and productivity. The larger the planted area and the higher the productivity per hectare, the greater the potential total production (BPS, 2023). This aligns with the findings of Wahyuni et al. (2022), which show that fluctuations in corn production in Indonesia are largely determined by changes in harvested area, not solely by increases in productivity.

Corn productivity itself is influenced by many technical and managerial factors, such as the selection of superior varieties, the application of agricultural technology, appropriate planting patterns, and pest and disease management. Studies by Orawu et al. (2022) in Uganda and Ariani et al. (2020) in Indonesia show that increasing corn productivity is highly dependent on access to quality seeds, balanced fertilizer use, and water and microclimate management on farmland. Several previous studies also confirm that corn can be a significant source of income for farmers, especially when supported by efficient production schemes and guaranteed access to land and inputs (Sakinah et al., 2023; Kafle et al., 2021). Kafle et al. (2021) add that institutional support, such as extension services and access to agricultural credit, are important factors in driving higher corn productivity and production scale.

Furthermore, mechanization technology and precision farming practices have been shown to contribute to time and cost efficiencies and increased yields (Huang et al., 2020; Setiawan & Widodo, 2022). Furthermore, research by Zurohman et al. (2021) indicates that the main obstacles for farmers in increasing production are limited access to subsidized fertilizer and delayed planting due to climate uncertainty. Considering the results of previous research, it is crucial for government policy to not only encourage the expansion of harvested land but also increase productivity through technological interventions, farmer training, and targeted production input support. The combination of land expansion and technical efficiency is believed to increase the competitiveness of national corn commodities and strengthen domestic food security (FAO, 2022; Rahman et al., 2021). Harvested Area, Productivity, and Corn Production in Indonesia in 2023 are presented in Table 1.

**Table 1. Harvested Area, Productivity, and Corn Production in Indonesia in 2023**

Province	Harvested Area (ha)	Productivity (kg/ha)	Production (tons)
Aceh	11951.91	57.10	68247.73
North Sumatra	208488.53	63.05	1314467.47
West Sumatra	78815.58	61.29	483055.73
Riau	351.45	30.46	1070.62
Jambi	1206.07	61.53	7420.62
South Sumatra	49715.37	64.33	319803.02
Bengkulu	8224.19	64.70	53208.64
Lampung	167856.96	65.73	1103357.14
Heavy Javanese	80001.52	74.75	597987.46
Central Java	384545.62	58.76	2259593.87
East Java	755071.41	58.66	4429459.28
Banten	1760.92	70.51	12415.66
Bali	9410.75	44.35	41738.08
North Sulawesi	26006.08	34.02	88471

South Sulawesi	177861.46	56.46	1004374.67
West Sulawesi	5301.65	52.14	27644.98
Maluku	2344.5	30.51	7153.27
Papua	2956.92	46.6	13778.62
West Papua	1048.65	44.08	4622.86
North Maluku	1533.24	47.14	7226.97
Gorontalo	113572.62	46.82	531780.13
East Nusa Tenggara	99065.5	25.83	255903.73
West Kalimantan	15624.22	43.54	68028.76
North Kalimantan	211.58	48.45	1025.1
DI Yogyakarta	43015.18	50.17	215817.44
West Nusa Tenggara	177649.54	70.32	1249261.84
Riau Islands	2.64	48.17	12.71
South Kalimantan	19624.07	61.78	119009.38
Central Kalimantan	6028.2	37.65	22696.29
Southeast Sulawesi	18422.44	35.56	65519.3

Source: Central Statistics Agency, 2023

In the T test there are two bases for decision making, namely by:

- If the sig value  $< 0.05$ , or t count  $>$  table, then there is an influence of variable X on Y.
- If the sig value  $> 0.05$ , or t count  $<$  table, then there is no influence of variable X on variable Y.

Based on the data obtained, the t-test confirms the following:

$$T \text{ table} = t (a/2 ; nk-1) = T (0.025 ; 27) = 2.052$$

In the F test there are also two bases for decision making, namely by means of

- If the sig value  $< 0.05$ , or F count  $>$  F table, then there is a simultaneous influence of variable X on variable Y.
- If the sig value  $> 0.05$ , or F count  $<$  F table, then there is no simultaneous influence of variable X on variable Y.

Based on the data obtained, the f test confirms the following:

$$F \text{ table} = F (k ; nk) = F (2 ; 28) = 3.34$$

The following are the test results for two variables, namely land area and productivity are presented in Table 2.

Table 2. Variable Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-	51096.174		-4,594	.000
1. Harvested Area (X1)	234715.395		.978	69,885	.000
2. Productivity (X2)	5,820	.083	.064	4,606	.000

Dependent Variable: Production (Y)

Source: Processed data, 2024

Based on Table 2, it is known that the Sig. value for the effect of X1 on Y is  $0.000 < 0.05$  and the calculated t value is  $69.885 > t \text{ table } 2.052$ , so it can be concluded that H1

can be accepted, which means there is an effect of land area on corn production. The positive regression coefficient indicates that increasing harvested area will increase corn production, in accordance with production theory. From the significance value, it can be seen that  $0.00 < 0.05$ , which means that the land area variable has a significant effect on corn production.

It is known that the Sig. value for the effect of X2 on Y is  $0.000 < 0.05$  and the calculated t value is  $4.606 > t$  table 2.052, so it can be concluded that H2 can be accepted, which means there is an effect of productivity on corn production. The coefficient value is positive indicating that the harvested area affects corn production in line with the theory. The significant value shows  $0.00 < 0.05$ , which means that the productivity variable significantly affects corn production. Anova results are presented in Table 3.

**Table 3. ANOVA Results**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	24363410621781.030	2	1218170531 0890.516	2743.001	.000b
Residual	119907357611.889	27	4441013244. 885		
Total	24483317979392.920	29			

Note:

a. Dependent Variable: Production (Y)

b. Predictor: Constant: Productivity (X2), Harvested Area (X1)

Source: Processed data, 2024

Based on the output above, it is known that the significant value for the influence of X1 and X2 simultaneously on Y is  $0.000 < 0.05$  and the calculated F value is  $2743.001 > F$  table 3.34, so it can be concluded that H3 is accepted, which means that there is a simultaneous influence of X1 and X2 on Y. Model summary are presented in Table 4.

**Table 4. Model Summary**

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.998a	.995	.995	66640.92770

a. Predictors: (constant), Productivity (X2), Harvested Area (X1)

Source: Processed data, 2024

Based on the output in Table 4, the R Square value is known to be 0.995, this means that the influence of variables X1 and X2 simultaneously on variable Y is 99.5%. Meanwhile, 0.05% is influenced by other factors.

## CONCLUSION

Based on statistical analysis of corn production data, harvested area, and corn productivity in Indonesia in 2023, it was concluded that harvested area and productivity significantly influence corn production. The analysis shows that both harvested area and productivity significantly influence corn production, with the largest contribution coming from harvested area.

Correlation and linear regression tests found a significant positive relationship between harvested area and corn production, as well as corn productivity and production. This indicates that the larger the harvested area and the higher the productivity, the higher the overall corn production.

This conclusion indicates that greater focus is needed on managing harvested area and increasing productivity to boost corn production at the provincial level. This can form the basis for agricultural policies and farmer development strategies to increase corn production in the province. Further evaluation is recommended to understand the factors influencing the amount of land planted with corn and why corn production will not be significantly affected.

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