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ANALYSIS OF PRODUCTION FACTORS IN SOYBEAN FARMING IN DELI SERDANG REGENCY (CASE STUDY OF THE UPSUS PAJALE PROGRAM)

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Abstract

This study aims to analyze the influence of production factors on soybean farming results in Deli Serdang Regency within the framework of the Special Effort Program (Upsus) PAJALE. The production factors analyzed include land area, seeds, fertilizers, labor, and pesticides. The research method used is a quantitative approach with Cobb-Douglas production function analysis using cross-section data of 90 farmer respondents. The results of the study indicate that partially the variables of land area, seeds, and fertilizers have a positive and significant effect on soybean production, while labor and pesticides have a positive but insignificant effect. Simultaneously, all independent variables have a significant effect on soybean production with an F count of 61.150 and a significance level of 0.000. The coefficient of determination (Adjusted R^2) of 0.772 indicates that 77.2% of the variation in soybean production can be explained by production factors in the model, while the rest is influenced by other factors outside the study. The results of the technical efficiency analysis indicate that the use of land area, seeds, and pesticides is still in an inefficient condition (increasing returns to scale), so there is still potential for improvement. Meanwhile, fertilizer and labor use are inefficient (decreasing returns to scale), necessitating adjustments. Therefore, increasing soybean production in Deli Serdang Regency depends not only on additional inputs but also on efficient management of production factors and support from the Upsus PAJALE program.

Keywords: soybeans, production function, efficiency, Upsus PAJALE, Deli Serdang

INTRODUCTION

Soybeans are a strategic food commodity in Indonesia because they serve as an important source of vegetable protein for the population. Various processed soybean products, such as tempeh and tofu, are part of daily consumption, so demand for this commodity tends to be stable and even increases annually. However, domestic production capacity is still unable to optimally meet national demand, resulting in a high dependence on soybean imports (Ministry of Agriculture, 2017). This situation indicates that increasing domestic soybean production is a priority in agricultural sector development. The Indonesian government has launched various programs to increase food production, one of which is the Special Effort Program (Upsus) PAJALE, which covers rice, corn, and soybeans. This program focuses on increasing productivity through optimizing land use, improving access to production facilities, and providing technical assistance to farmers (Suryana, 2016). The program is being implemented in various regions with potential for agricultural commodity development, including Deli Serdang Regency, one of the agricultural regions in North Sumatra Province.

Deli Serdang Regency has significant potential for soybean farming development, supported by favorable agro-climatic conditions and the availability of agricultural labor resources. However, soybean productivity at the farmer level remains variable and suboptimal. This indicates that certain factors influence soybean farming output, particularly related to the use of production inputs and farm management practices. From a production economics perspective, a farm's output is determined by the combined use of various production factors, such as land area, labor, seeds, fertilizers, and pesticides. The relationship between inputs and outputs can be analyzed using a production function approach to determine the efficiency of factor use (Soekartawi, 2003). Production function analysis can also be used to identify the factors that have the most significant influence on increasing production output (Gujarati, 2004).

Inefficient use of production factors can lead to low farm productivity. For example, using inferior seeds or seeds that are not suited to land conditions can inhibit plant growth, while inappropriate fertilizer dosages can reduce yields (Hernanto, 1996). Furthermore, inefficient labor can increase production costs without significantly contributing to increased output (Mubyarto, 1995). Therefore, optimal management of production factors is key to increasing soybean farm productivity. In addition to technical factors, successful production increases are also influenced by government policies and programs. The Upsus PAJALE program is expected to have a positive impact by providing production inputs, increasing farmer capacity, and strengthening agricultural institutions. However, the effectiveness of this program requires further study to determine its contribution to increasing soybean production at the farmer level (Rahim & Hastuti, 2007) Based on the description, this study aims to analyze the production factors that influence soybean farming results in Deli Serdang Regency and examine the role of the PAJALE Upsus Program in increasing soybean farming productivity.

RESEARCH METHODS

The research area was determined using a purposive method where the research location was in Deli Serdang Regency which was carried out from January to March 2025.

The analysis used in this study is multiple linear regression with the least squares method (*OLS: Ordinary Least Square*) with *the Douglas CPBB approach* . To facilitate regression analysis, the production function can be transformed into a linear function as:

$$\mathbf{In\ y = Ln\ a + b_1 LnX_1 + b_2 LnX_2 + b_3 LnX_3 + b_4 LnX_4 + b_5 LnD + D + Ɛ}$$

Description:
Y = Soybean Production (Kg)
X1 = Land area (m2)
X2 = Seeds (Kg)
X3 = NPK Fertilizer (Kg)
X4 = Labor (OH)
D = Pesticide (bottle) (Dummy **)**
a = intercept
bi = elasticity
ln = natural logarithm e (2.1782…)
Ɛ = residual (error)

RESULTS AND DISCUSSION

The Influence of Production Factors on Soybean Farming Results in Deli Serdang Regency

The production function analysis in this study uses the Cobb-Douglas approach to determine the influence of production factors on soybean farming yields. The variables analyzed include land area, seeds, fertilizer, labor, and pesticides.

Table 1. Cobb-Douglas Analysis Results

Variables	Coefficient	t count	Significance
Land area	0.236	3,844	0,000
Seed	0.544	8,300	0,000
Fertilizer	0.193	3,144	0.002
Labor	0.007	0.151	0.880
Pesticide	0.051	0.811	0.419

Source: Processed data (2025)

Table 1 shows that land area, seeds, and fertilizer have a positive and significant effect on soybean production, while labor and pesticides have no significant effect. This indicates that increasing soybean production is more influenced by primary input factors than by other supporting factors. Land area has a positive and significant impact on soybean production. The larger the area of land managed by farmers, the higher the potential yield. This aligns with production theory, which states that increasing primary inputs will increase output up to a certain point (Soekartawi, 2003). Seeds were the most dominant production factor in this study. A coefficient of 0.544 indicates that increased seed use significantly increased production. This aligns with Suratiyah's (2015) finding that seed quality and quantity significantly determine crop productivity.

Fertilizer significantly impacts soybean production. However, its use must be in accordance with the recommended dosage to avoid inefficiencies (Nugroho, 2015). Excessive fertilizer use does not always optimally

increase yields. Labor has a positive but insignificant effect on soybean production. This indicates that increasing labor does not directly increase production output unless accompanied by work efficiency (Mubyarto, 1995). Pesticides have a positive but insignificant effect. Pesticide use remains important in pest control, but their use must be done wisely to avoid negative impacts on the environment (Anshori & Prasetiyono, 2016).

Simultaneous Test (F Test)

Table 2. F Test Results

F count	Significance	Information
61,150	0,000	Significant

Source: Processed data (2025)

The calculated F value of 61.150 with a significance level of 0.000 indicates that all independent variables collectively have a significant effect on soybean production. This indicates that the combination of production factors significantly contributes to increasing farm yields.

Coefficient of Determination

Table 3. Coefficient of Determination

Adjusted R^2	Information
0.772	77.2% of production variation is explained by the model

Source: Processed data (2025)

The Adjusted R^2 value of 0.772 indicates that 77.2% of the variation in soybean production can be explained by the variables in the model, while 22.8% is influenced by other factors such as soil conditions, climate, and farmer managerial abilities.

Technical Efficiency Analysis

Table 4. Efficiency of Production Factors

Variables	Elasticity	Information
Land area	16,833	Not yet efficient
Seed	1,487	Not yet efficient
Fertilizer	0.026	Not efficient
Labor	0.241	Not efficient
Pesticide	7,754	Not yet efficient

Source: Processed data (2025)

The analysis shows that land area, seeds, and pesticides are still in an inefficient state (increasing returns to scale), so there is still potential for increased production. Meanwhile, fertilizer and labor are in an inefficient state (decreasing returns to scale), so their use needs to be reduced or adjusted. Overall, the research results show that the main production factors such as land area, seeds, and fertilizer have a significant influence on soybean production in Deli Serdang Regency. However, inefficiencies in the use of production inputs, particularly fertilizer and labor, persist. This indicates that farmers have not fully implemented the principles of efficiency in farming. This finding aligns with production theory, which states that the success of a farming business is largely determined by optimal management of production factors (Soekartawi, 2011). Furthermore, the Upsus PAJALE program plays a crucial role in supporting increased production by providing production facilities and technical assistance to farmers (Suryana, 2016).

CONCLUSION AND SUGGESTIONS

Conclusion

Based on the research results, it can be concluded that soybean production in Deli Serdang Regency is significantly influenced by the combination of production factors used, particularly land area, seeds, and fertilizer, which have been shown to have a significant impact on increasing yields. Meanwhile, labor and pesticides have not had a significant impact, indicating the importance of more efficient and targeted use. Overall, production factors are able to explain most of the variation in production results. In terms of efficiency, there is still room for improvement

in the use of land, seeds, and pesticides, while fertilizer and labor need to be optimized because they have been used beyond the efficient level. Therefore, increasing soybean production is not only determined by additional inputs, but also by efficient and proportional management of each production factor.

Suggestion

Based on the results of the research that has been conducted, several suggestions that can be given are as follows:

1. **For Farmers** : Farmers are expected to optimize the use of production factors, particularly land area and seeds, as these have been proven to significantly impact production increases. Furthermore, fertilizer and labor use must be adjusted to meet needs to avoid wasted production costs.
2. **For the Government** : The government, through the Upsus PAJALE program, is expected to improve technical assistance to farmers, particularly regarding the efficient use of production inputs. Furthermore, monitoring the distribution of production inputs is necessary to ensure they are targeted and meet farmers' needs.
3. **For Agricultural Extension Workers** : Extension workers are expected to be more active in providing education to farmers regarding efficient soybean cultivation techniques, including the use of fertilizers and pesticides according to the recommended doses.
4. **For Further Researchers** : Further research is expected to add other variables such as soil conditions, climate, and socio-economic factors of farmers so that the research results are more comprehensive.

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