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Analysis of Economic Efficiency of the Use of Production Factors in Soybean Farming (*Glycine max (*L.*)* Merrill) in Dam Village, Kedawung District Sragen Regency

Agung Prasetyo[1*], Dewi Rahmawati Intan Permatasari [1], Ermareta Hanasya Rachman[1]

1 Universitas Tunas Pembangunan Surakarta, Surakarta
Corresponding Email: agungpras17@gmai.com

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Abstract

This study aims to determine the cost, revenue, and income of soybean farming and analyze the influence and efficiency of the use of production factors on soybean production in Dam Village, Kedawung District, Sragen Regency. The research method used is descriptive analytics with survey techniques. The research sample amounted to 30 farmers who were selected using the simple random sampling method. Production analysis uses the Cobb-Douglas production function. The results of the study showed that the cost of soybean farming was IDR 8,210,872.27/Ha/MT, revenue was IDR 10,026,073.81/Ha/MT, and income was IDR 1,815,210.54/Ha/MT. Simultaneously, the factors of production of land area, labor, seeds, NPK Phonska fertilizer, Gandasil B fertilizer, and Dursban insecticide have a significant effect on soybean production. Partially, the area of land and seeds has a real effect, while other factors have no real effect. The use of production factors in soybean farming has not reached optimal economic efficiency.

Keywords: *soybean farming, production factors, Cobb-Douglas production function, economic efficiency, farmer income.*

Introduction

Indonesia is an agrarian country where most of the population works in the agricultural sector. One of the food crop commodities that has an important role besides rice and corn is soybeans (*Glycine max* (L.) Merrill). Soybeans are a source of vegetable protein that is widely consumed by Indonesians in various processed forms such as tofu, tempeh, soy sauce, and soy milk. The high protein content makes soybeans one of the important food ingredients in meeting the nutritional needs of the community.

The demand for soybeans in Indonesia continues to increase in line with population growth, increasing public awareness of the importance of nutrition, and the development of the food and animal feed industry. However, the domestic soybean production capacity is still not able to meet national needs, so some needs are still met through imports. Dependence on soybean imports can have various impacts such as increasing the country's foreign exchange expenditure and reduced employment opportunities in the agricultural sector.

The low domestic soybean production is influenced by various factors, including limited land, low productivity, and the management of production factors that are not optimal. In farming activities, the use of production factors such as land, labor, seeds, fertilizers, and pesticides greatly determines the level of production produced. Therefore, the management and combination of the use of the right production factors is necessary so that farming activities can run efficiently and provide optimal income for farmers.

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Sragen Regency is one of the soybean-producing areas in Central Java Province, including Kedawung District which has the potential for the development of this commodity. One of the villages with a fairly good level of soybean productivity is Dam Village. However, in practice, farmers still face various obstacles in the allocation of production factors so that the production produced is not optimal.

Based on these conditions, a study is needed on the use of production factors in soybean farming. This study aims to analyze the cost, revenue, and income of soybean farming and determine the influence and level of efficiency of the use of production factors on soybean production in Dam Village, Kedawung District, Sragen Regency.

Method

This study uses a **descriptive analytical** method with survey techniques. This method is used to describe the conditions of soybean farming and analyze the relationship between the use of production factors and the production results obtained by farmers. The data obtained were compiled, explained, and analyzed to provide an overview of the conditions of soybean farming in the research site. The research sample consisted of **30 soybean farmers** who were selected using **the simple random sampling** method, so that each farmer had the same opportunity to be selected as respondents. The respondents selected were farmers who cultivated soybean crops on rice fields in the research area.

The types of data used in this study include **primary data and secondary data**. Primary data was obtained through direct interviews with respondents using questionnaires that had been prepared, including data on the use of production factors, production costs, production yields, and farm revenues. Secondary data was obtained from related agencies such as **the Sragen Regency Agriculture Office, the Central Statistics Agency (BPS), and the Kedawung District office**, which are related to agricultural conditions and soybean production in the research area.

Data analysis was carried out with several approaches. Farming income analysis is used to calculate costs, income, and income of farmers with the formula:

$$PdU = PyY - BU$$

where PdU is farming income, Py is the price of soybeans per kilogram, Y is the amount of soybean production, and BU is the total cost of farming.

To analyze the influence of production factors on soybean production, the **Cobb-Douglas production function** is used which is stated as:

$$Y = aX_1b^1\ X_2b^2\ X_3b^3\ X_4b^4\ X_5b^5\ X_6b^6$$

which is then transformed into a linear logarithmic form:

$$\log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6$$

where Y is soybean production, X_1 is land area, X_2 labor, X_3 seeds, X_4 NPK Phonska fertilizer, X_5 Gandasil B fertilizer, and X_6 Dursban insecticide.
Model testing was carried out using a **determination coefficient (Adjusted R^2)** to determine the model's ability to explain production variations, **an F test** to determine the influence of production factors simultaneously, and **a t test** to determine the influence of

each production factor partially on soybean production. In addition, an economic efficiency analysis was carried out by comparing the value of marginal products (NPM) with the price of the factor of production (Px). The use of production factors is said to be efficient if the NPM/Px value = 1.

RESULT AND DISCUSSION

Location of the Research Area

Sragen Regency is one of the districts in Central Java Province which is geographically located at 110°45'–111°10' East Longitude and 7°15'–7°30' South Latitude. This regency is located in the easternmost part of Central Java Province and is directly adjacent to Ngawi Regency, East Java Province. The area of Sragen Regency reaches 941.55 km² which is divided into 20 sub-districts and 208 villages/sub-districts.

One of the sub-districts in Sragen Regency is Kedawung District with an area of about 49.78 km². This sub-district is located about 8.5 km south of the capital of Sragen Regency and is about 39.5 km from Surakarta City. Administratively, the boundaries of Kedawung District are Karangmalang District to the north, Sambirejo District to the east, Karanganyar Regency to the south, and Masaran District to the west.

Dam Village is one of the villages in Kedawung District with an area of about 665.33 hectares. The village is about 0.5 km from the district capital and about 7 km from the district capital. Geographically, Dam Village is bordered by Puro Village to the north, Sambirejo Village to the east, Kedawung Village to the south, and Wonokerso Village to the west. The Dam Village area is divided into four hamlets, namely Dam Hamlet, Bali Hamlet, Druju Hamlet, and Bonggo Hamlet.

Regional Topography

Sragen Regency has an average height of about 109 meters above sea level with a standard deviation of about 50 meters. The topographical conditions of the region are quite diverse, providing great potential for the development of various types of agricultural commodities. In the northern part of the Bengawan Solo River there is a limestone hilly area that stretches from east to west, while in the other part it is dominated by a fairly large lowland.

The types of soil found in Sragen Regency are quite diverse, including grumosol, alluvial soil, regosol, latosol, and mediterranean soils. The diversity of soil types causes differences in land use, such as for rice fields, moors, state forests, community forests, and residential areas. The relatively fertile soil conditions make this area quite potential for the development of the agricultural sector.

The Sragen Regency area is also traversed by the Bengawan Solo River which divides the area into two parts, namely the northern region and the southern region. The northern region of Bengawan Solo includes the districts of Kalijambe, Plupuh, Tanon, Miri, Gemolong, Sumberlawang, Sukodono, Gesi, Mondokan, Tangen, and Jenar where most of the land is in the form of rainfed land and moorland. Meanwhile, the southern area of Bengawan Solo includes Masaran, Gondang, parts of Sambungmacan, Ngrampal, Karangmalang, Kedawung, Sragen, and Sidoharjo areas where most of the land receives irrigation from the Bengawan Solo project and irrigation from Mount Lawu so that it has great potential for the development of food crops.

Kedawung District itself is located at an altitude of about 116 meters above sea level with topographic conditions that are mostly in the form of sloping plains and a small part in the form of hills. The relatively flat conditions of this area are very supportive of agricultural activities, including soybean farming which requires land with a low slope so that land cultivation and plant maintenance can be carried out more optimally.

Climate Conditions

Sragen Regency has a tropical climate with relatively moderate air temperatures. Based on weather observation station data, the average number of rainy days in 2012 reached around 173 days with an average rainfall of 3,287.83 mm per year. The highest rainfall occurs in January, while the lowest rainfall occurs in August.

In Kedawung District, rainfall in 2012 was recorded at around 4,243 mm per year with the number of rainy days of about 105 days. This condition shows that the region has sufficient water availability to support agricultural activities, especially in the rainy season.

The air temperature in Sragen Regency ranges from 24°C to 29°C. Areas that are close to Mount Lawu tend to have lower temperatures than areas in the northern part of Bengawan Solo. In addition, the air humidity level ranges from 75% to 92%. Such climatic conditions strongly support the growth of soybean plants which generally require a tropical climate with sufficient water availability, especially in the early stages of growth.

With relatively stable climatic conditions and sufficient water availability in the rainy season, farmers in the study area generally plant soybeans at the beginning of the rainy season so that the plant's water needs can be met optimally. This is also related to the irrigation system, which partly still relies on rainwater.

Conclusion

Based on the results of research on soybean farming in Dam Village, Kedawung District, Sragen Regency, it can be concluded that soybean farming still provides benefits for farmers. The average production cost incurred in one planting season is IDR 8,210,872.27/Ha, with a revenue of IDR 10,026,073.81/Ha so that an income of IDR 1,815,210.54/Ha is obtained. This shows that soybean farming is still feasible even though the level of profit obtained by farmers is relatively not too large. The results of the analysis of production factors show that simultaneously the use of production factors which include land area, labor, seeds, NPK Phonska fertilizer, Gandasil B fertilizer, and Dursban insecticide have a very real effect on soybean production. However, only partially the land area and seed factors have a real effect on soybean production, while labor, NPK Phonska fertilizer, Gandasil B fertilizer, and Dursban insecticide have no real effect on increasing production. In addition, the results of the efficiency analysis show that the use of production factors in soybean farming in the study area has not reached the optimal level of economic efficiency. This condition shows that there is still an opportunity to improve the efficiency of the use of production inputs so that soybean production and farmers' income can be increased in the next planting season.

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