FARMERS' INCOME OF CASSAVA AND MAIZE INTERCROPPING SYSTEM IN DRY LAND AGRICULTURE

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ABSTRACT
Dry land agriculture, a less fertile land, only a few commodities tha planted such as cassava, maize, sweet potatoes and any kind of nuts Cassava and maize are secondary crops that usually cultivate in dr land. Cassava and maize are strategic food commodities after rice This study aimed to analyze farmers' income of cassava and maiz intercropping system on dry land agriculture in Karanganyar Regency Central Java, Indonesia. 60 farmers were taken as researc respondents consist of 30 farmers who planted Jalak Towo cassav variety intercropping with maize and 30 farmers who planted othe cassava varieties intercropping with maize. The data were analyze with the concept of farmers' income by subtracting revenues an explicit costs. The results showed that the intercropping of Jalak Tow cassava variety and maizeE yielded better farmers' income.

KEYWORDS Cassava, dry land, farmers' income, maize

INTRODUCTION

Dryland agriculture is the cultivation of agricultural crops with less water and less soil fertility. This dry land occurs as a result of very low rainfall leading to water shortages, high air temperature and low humidity. The extreme conditions that occur in dry land cause several obstacles for agriculture crops cultivation, because water as a boundary factor in producing agricultural crops leading to only few plants that cultivated (Wijayanti, 2021).

Agricultural development is directed to increasing incomes in order to improve farmers' living standards, expanding employment and business opportunities, as well as expanding domestic and foreign markets through advanced, efficient and resilient agricultural systems so as to increase production and productivity of agricultural products. The government carries out four main programs to achieve the direction of agricultural development, namely intensification, extensification, diversification and rehabilitation. If efforts to expand land are no longer possible because of the limited productive agricultural land, then the efforts that can be made by farmers to increase income are by intensifying the land they own.

The existence of dry land agriculture in Indonesia covers an area of 14.38 million hectares, larger than rice fields (7.4 million hectares) (Ministry of Agrarian and Spatial Planning, 2019). This reality showed that the potential for dry land agriculture is strategic to be developed compared to rice fields. Commodities that can be cultivated on dry land

other than upland rice, other food of secondary crops such as maize, cassava, soybeans, nuts, annual food and non-food crops (Matheus et al., 2022).

Land is the main factor in agricultural production. The land managing ability is able to provide different levels of production. Dryland agriculture requires serious attention to supply national food demand, as well as to increase the income of dryland farmers (Dyah, 2017).

Karanganyar is one of the regencies in Central Java Province, Indonesia which has dry land that cover 74% of its total area (BPS, 2022). The potential of Karanganyar Regency dry land will produce various kinds of food commodities other than rice if it developed properly. One of the commodities commonly grown by dry land farmers in Karanganyar Regency is cassava. Cassava is the main food commodity after rice and maize, and as the second source of carbohydrate after rice, so that cassava can be used as an alternative food ingredient other than rice (Herlina and Nuraeni, 2014). Cassava also can be processed into flour and various processed food products (Irianto et al., 2022).

Beside that, Karanganyar Regency also has local superior cassava variety that has a very delicious taste, soft and glutinous texture, namely Jalak Towo variety. This Jalak Towo cassava variety can be found in Jatiyoso District. Jalak Towo cassava variety can be processed into various processed foods such as a traditional food such as gethuk, brownies and another various processed food. Irianto et al. (2022) stated that converting cassava into various processed foods can increase the economic value of cassava. The selling price of Jalak Towo cassava variety can reach 3-4 times than other varieties.

Farmers in Jatiyoso District usually plant cassava intercropping with maize. Intercropping is a form of agricultural intensification program which is an alternative to obtain optimal production results. The advantage of the intercropping pattern, besides can be harvested more than once a year, it also served to maintain soil fertility. The intercropping pattern implementation should choose suitable plants so that it can be utilized space and time efficiently and reduce the effect of competition between plants (Lanamana & Supardi, 2021).

Agricultural intensification is an effort to optimize existing agricultural land. In practice, intensification can be realized in the form of an intercropping system. Intercropping is a type of cropping system in which two or more types of plants are planted simultaneously in the same or different relative times with intermittent planting and regular spacing on the same plot of land. The intercropping system is more profitable than the monoculture system because land productivity is high, the types of commodities produced are diverse, efficient in the use of production facilities and the risk of failure is small. Intercropping can minimize soil erosion and maintain soil fertility.

Manihuruk et al., (2018) found that intercropping cassava were more efficient than planted in monoculture system (as one commodity). Sebayang & Simamora (2018) stated that maize has a good commodity value and can be cultivated efficiently in intercropping system. Furthermore, Prasetyo & Fauziyah (2020) stated that hybrid maize varieties provide better farmers' income than local maize varieties. As described by Firdaus & Fauziyah (2020) hybrid maize local varieties favorably cultivated in dry land.

The role of cassava in the national economy declined because it was not considered as a main commodity so it did not receive investment support both in research and development terms, counseling, procurement of facilities and infrastructure, as well as in regulation and services. The harvested area of cassava decreased and cassava productivity did not increase significantly. One of the reasons was the lack of precise technology to increase cassava farmers' income. This was because natural resources and human resources had not been utilized optimally in the management of cassava farming, both on dry land and paddy fields, so the agricultural products productivity is still very diverse. In addition,

it is also caused by the ability of the community which is still diverse in adapting the patterns they already have with the available land resources.

Cassava's planting period is about 9-12 months, which is longer than the planting period of other food crops. Farmers choose to plant maize as an intercrop of cassava plants to receive income while waiting for the cassava harvest. Maize was chosen as a commodity that planted for cassava as an intercrop because it has high economic value and has a relatively short planting season. During one cassava planting season, farmers in Jatiyoso District can plant maize for 2 planting seasons (one maize planting season 3-4 months).

Cassava farming is the main source of income for farmer households, especially for dry land areas. Cassava has a higher adaptation rate to drought, low soil fertility and resistance to pests and diseases (Prasmatiwi et al., 2022). Cassava productivity is closely related to efficiency in the use of production factors. Efficiency is a determining factor in increasing the productivity of food crop commodities in areas with limited resources and low levels of technology adoption. Efficiency can be achieved by minimizing resources to achieve a certain level of production or by using certain factors of production to maximize production output. The ability to allocate resources optimally is called technical efficiency. When technical efficiency has been achieved, farmers can increase their income through increased productivity. There was another problem that experienced by farmers, high prices of pesticides and fertilizers as well as the uncertain price of price maize seeds caused the production costs were very expensive. Furthermore, farming is currently dominated by elder farmers. The younger generation prefers to work in other sectors rather than working on their farm. This caused the expenditure for labor costs are also high. What frequently happened was the farmers' expenditures on input production costs are more expensive than the income that gained. Based on the description of the background, this study aimed to analyze the farmers income of intercropping cassava and maize in Karanganyar Regency dry land, Central Java Province, Indonesia.

RESEARCH METHOD

The research was conducted in Jatiyoso District, Karanganyar Regency, Central Java Province, Indonesia. The location is selected because this area has a large dry land that still possible to developed and many farmers are found planting Jalak Towo cassava variety. The study was conducted in July 2022 by interviewing 60 farmers who were taken randomly, which divided into 30 farmers of intercropping Jalak Towo cassava variety with maize and 30 of intercropping other cassava variety with maize.

The data were analyzed using the concept of farm income, by subtracting the farm revenue with explicit costs. Explicit costs are costs that are actually incurred in real terms such as input production cost (seeds, fertilizers, pesticides and labor costs) and other costs that are actually incurred. Farm revenue and income are formulated as follows:

TR = Py. Y

where:

TR = Total Revenue (Rupiah/year)
Py = Production Price (Rupiah/kg)
Y = Yield/Production (kg)

FI = TR - TCe

where:

FI = Farmers' Income (Rupiah/year)
TR = Total Revenue (Rupiah/year)
TCe = Total Explicit Cost (Rupiah/year)

RESULT AND DISCUSSION

Table 1 showed that the average of respondents' land area of intercropping Jalak Towo cassava variety with maize was wider than the average intercropping of other cassava variety with maize. This showed that farmers in the study area prefer to plant Jalak Towo cassava variety because it has a distinctive and delicious taste, soft and glutinous texture. Table 1 showed that the production of Jalak Towo towo cassava is less than other cassava variety. Likewise, the maize production produced was greater when it was planted in an intercropping with Jalak Towo cassava variety compared to other cassava varieties.

Table 1. Average land area, production and productivity of cassava and maize intercropping system in dry land agriculture of Karanganyar Regency

Description	Jalak Towo cassava and maize	Other cassava with maize
Land area (ha)	0,33	0,30
Production (kg)		
Cassava	5.911,11	6.055,86
Maize	4.422,02	3.563,89
Productivity (Rupiah/ha)	21.435.576	13.394.167

Source: Primay data analysis (2022)

Farm productivity is the ratio of the total output with inputs that used in production. Output of dry land food crop commodities that grown in intercropping system is a heterogeneous product such as cassava and maize which produced simultaneously on one land in a planting season. Therefore, productivity is measured in production value. The difference value of output per farmer illustrates the difference of output quality of each farmer. For farmers, high food crops productivity is very important, given the limited land area for farming and the importance of farming output to supply their own demands (Suwarto, 2013).

Table 1 showed that the productivity of Jalak Towo cassava intercropping with maize is higher than the intercropping of other cassava varieties with maize. Other varieties of cassava produced higher yields than Jalak Towo cassava variety. On average, an ordinary cassava yields 5 kg of tubers per tree. According to Ijoyah et al., (2012), competition in obtaining nutrients for growth can interfere the vegetative growth of plants, thereby reducing production yields. This is what causes maize production when intercropping with other cassava yields lower production than when planted with Jalak Towo cassava. Although the production of Jalak Towo cassava is lower, the selling price of Jalak Towo cassava can 2-3 times than ordinary cassava.

Table 2. Average farmers' income of cassava and maize intercropping system in dry land agriculture of Karanganyar Regency

Description	Jalak Towo cassava and maize value (Rupiah/year)	Other cassava with maize value (Rupiah/year)
Revenue (A)	21.435.576	13.394.167
Cassava	9.099.960	3.556.111
Maize	12.335.616	9.838.956
Explicit costs (B)	11.282.537	9.078.733
Input production cost	4.708.266	3.759.228
Labor cost	6.293.060	5.104.222

Other cost	230.492	161.506
Farmers' income (A-B)	10.153.039	4.315.433

Source: Primay data analysis (2022)

Table 2 showed that the most expensive costs of the two farms are labor costs. The most expensive expenditure on labor costs is land preparation activities. Most of the research area is dry land that relies only on irrigation from rainfall so that it requires a lot of labor such as hoeing. Many farmers of research respondents were old and rarely assisted by family members. The younger generation prefers to work in other sectors rather than working their fields. According to Susilowati (2016) there are various factors causing the decline in interest of young workers in the agricultural sector, including the image of the agricultural sector that is less prestigious, high risk, does not provide guarantees for stability, and income continuity, narrow average land tenure, diversification of non-agricultural and industrial agriculture in undeveloped villages, low succession of farming management, there is no special incentive policy for young/beginner farmers and the changing perspective of youth in the postmodern era like now. This is what causes the expenditure for labor costs is high.

Production cost of intercropping Jalak Towo cassava with maize is higher than intercropping other cassava varieties with maize. In the same land area and the same number of cassava plants, the need for maize seeds is higher in intercropping Jalak Towo cassava with maize farm. The characteristics of the Jalak Towo cassava trees are smaller, narrower leaf area and less tuber production so that more maize can be planted.

Purchasing manure cost of two farms is relatively small because farmers use manure which processed by themselves from livestock manure. The production cost of inorganic fertilizers were urea, SP-36 and phonska. Phonska fertilizer, although it is a compound fertilizer that contains complete nutrients, is actually the least used by farmers. Farmers think that simply adding urea and SP-36 fertilizers is sufficient for plant nutrient needs. Farmers tend to use sober fertilizers that they already had, because of the high price of inorganic fertilizers.

Other costs incurred by farmers of both farms are land taxes and transportation costs. Land taxes are issued once a year. Transportation costs for transporting harvest crops from the field to the farmer house. The maize harvest is always brought home, so farmers always incur transportation costs when the maize maize harvest season is coming. Farmers who have narrow land usually use by motorbike to transport their crops, while farmers who have large land use pickup truck to transport large crops. Cassava yields are usually sold at middlemen so that farmers do not incur transportation costs.

Farmers' income of intercropping Jalak Towo cassava variety with maize was higher than intercropping other cassava varieties with maize. Farmers revenue comes from higher maize production and higher selling price of Jalak Towo cassava than other varieties. Although the selling price of Jalak Towo cassava is more expensive and provides better income than other cassava varieties, many farmers still grow ordinary cassava variety because is easier to care for and has a shorter planting season than Jalak Towo cassava variety.

CONCLUSION

Intercropping Jalak Towo cassava variety with maize produces better income. Maize production is higher and the selling price of Jalak Towo cassava variety is more expensive than other cassava varieties. However, there are still many farmers who plant other/ordinary cassava varieties because they think it is easier to care for and has a shorter planting season so they can harvest early. The most expensive production costs are labor costs. The most

expensive expenditure on labor costs is land preparation activities. Most of the research area is dry land with relies only on irrigation from rainfall so that it requires a lot of labor such as hoeing. In addition, many farmers of research respondents were old and rarely assisted by family members. The younger generation prefers to work in other sectors rather than working on their farms. This caused the expenditure for labor costs are high. In order to ensure the continuity of farming in the future, a strategy is needed to attract young people to work in agriculture, including changing the perception of the younger generation that the agricultural sector is an attractive and promising sector if managed diligently and seriously, agroindustry development, technological innovation, providing special incentives to young farmers, the development of modern agriculture, training and empowerment of young farmers, and introducing agriculture to the younger generation from an early age.

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