



Risk Analysis of Cassava Farming in Central Lampung Regency

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Abstract. This research aims to; (1) determine the level of income of cassava farming in Central Lampung Regency, (2) identify sources of farming risk in Central Lampung Regency and (3) determine the level of risk of cassava farming in Central Lampung Regency. Central Lampung Regency was chosen as the research location with the consideration that the district is the center of cassava production in Lampung Province. A total of 60 respondents were taken using a stratified simple random sampling method. Primary data were collected through direct interviews with farmers. Farming risk analysis uses the formula of standard deviation, coefficient of variation, and lower limit. The results showed that cassava farming in Central Lampung Regency was profitable with an R/C value against total costs of 1.99. Production risk in cassava farming as much as 58.06% is due to low / decreased production yields. Price risk in cassava farming is 37.50% due to limited capital and high production costs. The income risk in cassava farming is 87.50% due to fluctuating prices. Cassava farming in Central Lampung Regency has a coefficient of variation < 0.5 and a lower limit value > 0 indicating that cassava farming in Central Lampung Regency has a low level of risk. This conclusion indicates that Central Lampung cassava farming activities should be developed.

Keywords: Cassava, Farming Risk, Production Risk, Price Risk, Income Risk.

1 Introduction

Cassava is a very common food crop found in Indonesia. Cassava is widely utilized mainly in the raw materials of the food industry such as tapioca flour and other food products. Cassava is also used as raw material for animal feed, paper, textiles, bioethanol, pharmaceuticals, chemicals, biotechnology and the beauty industry. In addition to meeting the needs of the domestic industry, cassava is also a potential export commodity. BPS [1] has noted that cassava is the food crop commodity with the highest export value in Indonesia surpassing the export value of corn, sweet potato, peanut, and rice commodities with the export value of cassava in 2021 reaching US\$42.52 million. The potential of cassava as a raw material for various industries and export commodities makes this commodity play a strategic role in the global economy. The need for cassava

will increase along with the development of various cassava-based industries and increasing export demand. Currently, Indonesia is the country with the 6th largest cassava production in the world after Nigeria, Congo, Thailand, Ghana, and Brazil. The latest data from FAO (2023) [2] shows that Indonesia's cassava production reached 17,749,000 tons and contributed 6% of world cassava production in 2021. One of the cassava production centers in Indonesia is Lampung Province. Lampung Province is the first production center in Indonesia with the contribution of cassava production reaching 40% of the production of all provinces in Indonesia in 2022 [3]. Currently, cassava has become one of the leading commodities in Lampung Province because of its good contribution to regional economic activities. Data on production, productivity, planting area, and harvested area of cassava in Lampung Province can be seen in Table 1.

Table 1. Data on production, harvested area, and productivity of cassava in Lampung Province 2018-2022 [4].

Year	Production (Ton)	Harvested area (ha)	Productivity (ton/ha)
2018	5,016,790.00	211,753.00	23.69
2019	5,438,850.00	200,025.00	27.19
2020	5,820,831.00	230,451.00	25.26
2021	5,643,185.00	222,746.00	25.33
2022	5,941,823.00	208,192.00	28.54

In the last 5 years, production, harvested area, and productivity of cassava in Lampung Province have fluctuated. Interestingly, Lampung has been able to increase the production and productivity of cassava in the last 2 years when there was a decrease in harvested area. This is a good achievement because it can support the availability of cassava commodities for domestic and foreign demand. Therefore, Lampung Province is one of the cassava development areas in Indonesia. There are three largest cassava production centers in Lampung Province, namely Central Lampung, North Lampung, and East Lampung. In total, the cassava production of the three Regencys reached 68% of the total cassava production in Lampung Province. Central Lampung Regency is the district that has the largest contribution among other districts and cities in Lampung Province, which is 36% [5].

The availability of cassava as an agro-industrial raw material and export commodity is very important to note. Any disruption in the availability of production and fluctuations in the selling price of cassava will result in disruption in the fulfillment of consumer needs and the welfare of cassava producers. This increase in production can be maintained with one of the efforts to reduce the level of risk in cassava farming. These disturbances are part of the risk of farming. The level of risk can be controlled by identifying and managing sources of risk. Therefore, the risks faced by farmers are mainly related to the management capacity of farmers [6]. This capacity can help farmers in making farming decisions. These decisions are often related to the amount of inputs to

be used, to prevent risks that may arise during the farming process. Farmers' decisions will also affect decision-making for the next farm. Farming risks that are often faced by farmers are production risk and price risk. Production risk can be caused by extreme climatic conditions (dry season or flooding) that cause crop failure. In addition, the decline in production can be influenced by many factors, one of which is the result of commodity switching. This commodity switching can be caused by fluctuating cassava prices. In addition, cassava productivity is relatively low because the cultivation techniques applied by farmers are still simple. Farmers, in general, have not used fertilizers and control plant pests and diseases intensively and at the right dose, and they use varieties with low production potential and are sensitive to major pests and diseases [7]. Low productivity and prices of cassava will have an impact on farmers' income. The price risk of both output and input prices is influenced by the market structure and the level of production produced, if production is abundant then the selling price of output will fall, and if the planting season arrives the price of production facilities increases.

Based on the high level of cassava production, Central Lampung is very prospective to be able to meet the needs of cassava commodities. Therefore, to meet the demand for cassava, it is considered necessary to know the level of risk of cassava farming in Central Lampung. This study aims to; (1) determine the level of income of cassava farming in Central Lampung Regency, (2) identify sources of farming risk in Central Lampung Regency and (3) determine the level of risk of cassava farming in Central Lampung Regency.

2 Research Methods

This research was conducted in the Central Lampung Regency. The research location was determined purposively with the consideration that Central Lampung is the largest cassava-producing district in Lampung Province. The research was conducted in April-September 2020. This study used a survey method in the location of cassava production centers in Lampung Province. The sample size was 60 cassava farmers, was taken by stratified simple random sampling. Data were analyzed qualitatively and quantitatively.

Income analysis was used to determine the profitability of cassava farming. Return Cost (R/C) ratio analysis is the ratio between revenue and cost with the formula:

$$R/C = \frac{Y \cdot P_y}{\sum_{i=1}^n X_i \cdot P_{xi}} \quad (1)$$

Description :

Y = Production (kg)

P_y = Production price (Rp)

X_i = production factors (i=1,2,3,...n)

P_{xi} = Production factors price i (Rp/unit)

Decision-making criteria:

- If $R/C < 1$, then the farm is making a loss.
- If $R/C > 1$, then the farm is profitable.
- If $R/C = 1$, then the farm is at the break-even point.

Risk analysis uses the Standard Deviation (V), Coefficient of Variation (CV), and Lower Limit (L) formulas. The analytical tools used in this study are in line with the research [7] and [8]. To determine the standard deviation, the following formula is used [9]:

The formula of varians:

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} \tag{2}$$

Coefficient of variation formula:

$$KV = \frac{s}{E} \times 100\% \tag{3}$$

The magnitude of the coefficient of variation indicates the relative risk of farming. A small coefficient of variation indicates low variability in the average value of these characteristics. This illustrates the risk that farmers will face to obtain the average production or price is small. Conversely, a large coefficient of variation indicates high variability in the average value of these characteristics. This illustrates the risk that the farmer will face to obtain the average production or price is large.

Lower limit formula:

$$L = E - (2s) \tag{4}$$

Description:

- s = varian sample
- KV = coefficient of variation
- L = lower limit
- xi = i-th x value
- E = mean
- n = sample size

Decision-making criteria:

- If the KV value is < 0.5 and $L > 0$ then the cassava farm has a low risk.
- If the KV value is > 0.5 and $L < 0$ then the farm has a high risk

3 Results and Discussion

3.1 Characteristics of Respondents

The age of the respondent is one of the factors that affect work activity and productivity. Based on the research that has been done, the results obtained the average age of respondent farmers in the study area amounted to 49.08 years, with a range of ages 22 to 78 years. The level of education of respondent farmers varies, namely not graduating from elementary school, elementary school, junior high school, high school / vocational school, and bachelor's degree. The majority of cassava farmers only have an elementary school education. Some cassava farmers have side jobs as cattle, chicken, goat farmers, construction workers, drivers, trading, and sugarcane farming. Farmer households that have a diversity of businesses will usually have a higher income than farmers who only rely on income from cassava farming. The average cultivated area of cassava farmers is 1.5 ha with the status of self-owned land.

3.2 Cassava Farming Income

The income received by farmers will not be separated from the amount of revenue obtained. The results of the analysis of the income of cassava farming carried out can be a clue as to whether the farming of cassava cultivated by respondent farmers is profitable or not. Production costs incurred by farmers for each growing season consist of cash costs and imputed costs. The need for production facilities, costs, and income of cassava farming in 2020 can be seen in Table 2.

Table 2. Production inputs, costs and income of cassava farming in 2020.

Num	Description	Unit	Per hectare	
			Physical	Value (Rp)
1	Revenue			
	Production	Kg	16,555.32	20,780,866.64
2	Production Cost			
	I. Cash Cost			
	Seeds	Ikat	99.50	772,644.71
	Urea	Kg	180.94	414,531.89
	Phonska/NPK	Kg	101.28	304,940.34
	TSP/SP-36	Kg	57.75	181,181.15
	KCl	Kg	44.84	221,124.49
	Manure	Kg	1,404.64	807,420.33
	Herbicide	Liter	4.08	308,682.35
	Insecticide	Kg	0.15	15,784.17
	Non-Family Labour	HOK	43.80	2,812,387.97
	Tax	Rp		66,621.83
	Transportation Cost	Rp		1,056,503.20
	Total Cash Cost			6,961,822.44

Table 2. Cont.

Num	Description	Unit	Per Hectare Physical	Value (Rp)
	II. Calculated Cost			
	Family Labour	HOK	5.80	372,587.91
	Depreciation	Rp		140,623.54
	Land Rent	Rp		2,942,134.57
	Total Calculated Cost	Rp		3,455,346.01
	III. Total Cost	Rp		10,417,168.46
3	Profit			
	I. Profit on Cash Cost	Rp		13,819,044.20
	II. Profit on Total Cost	Rp		10,363,698.19
4	R/C Ratio			
	I. R/C Ratio on Cash Cost	Rp		2.98
	II. R/C Ratio on Total Cost	Rp		1.99

Based on Table 2, it can be seen that the results of the R/C ratio analysis show that the economics of cassava farming provide benefits to respondents. The difference in the value of the R/C ratio on cash costs is influenced by the amount of cash costs incurred by respondent farmers during farming activities. The greater the revenue, the higher the R/C ratio value, and the smaller the revenue, the lower the R/C ratio.

3.3 Sources of Risk in Cassava Farming in Central Lampung

There are various farming risks that farmers can face, but in this study, the risks analyzed are focused on production, price, and income risks. The first risk is production risk. The production risk faced by farmers is that production yields decrease as a result of the extreme weather experienced [10]. Weather/climate is the external factor that most drives production risk [11]. This is because weather/climate can affect the process of plant growth [12].

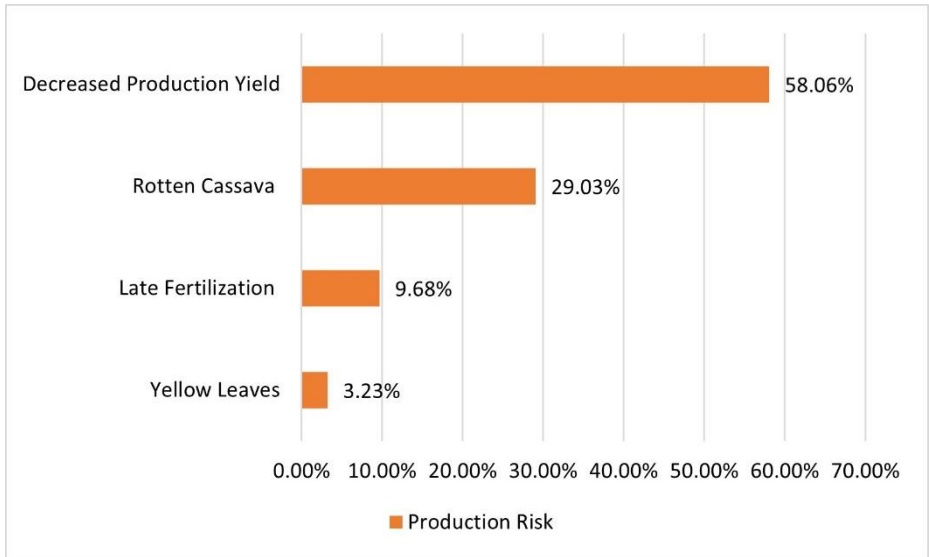


Figure 1. Source of production risk in cassava farming in Central Lampung.

During the dry season, the cassava fruit is smaller than during the rainy season it is caused by the water content needed by the plant is not optimal and there is no special handling from farmers to overcome this problem. However, if the availability of water is too much, the cassava will be affected by fungal upas disease causing the cassava to rot, to overcome this problem farmers uproot the cassava affected by the fungus so that it does not spread to other plants. This also shows that damage caused by pests and diseases is also one of the reasons for the decline in production. This statement is by Ghozali's research [12] and corroborated by Ndem's research [5] which states that the main sources of risk in cassava production are pest attacks and weather conditions.

The internal factors that can encourage production risks to occur include improper fertilization activities. Cassava production is not optimal due to late fertilization, which will have an impact on farmers' income [13]. To overcome this problem, farmers cannot do much, because the availability of fertilizers is limited and farmers can only wait for fertilizers to be available at agricultural stores.

The results showed that the causes of production risks of cassava farming that occurred were due to yellowing leaves (3.23%), late fertilization (9.68%), rotten cassava (29.03%), and decreased production (58.06%) due to extreme weather. This can lead to a decrease in cassava productivity. Production risks faced by farmers will certainly be an obstacle for farmers in cassava farming. This production risk will have an impact on the production costs used and the income to be received by farmers. The greater the risk faced by farmers, the greater the opportunity for farmers to experience failure in cassava farming.



Figure 2. Source of price risk in cassava farming in Central Lampung.

The second risk is price risk. This risk can be caused by high wage prices (6.25%), limited capital (37.50%), high production input prices (18.75%) and high production costs (37.50%). One of the inputs of production facilities needed in cassava farming activities is fertilizer. The condition that occurs is that when cassava farmers in Central Lampung fertilize, subsidized fertilizers are not available when needed, so farmers look for alternative non-subsidized fertilizers at high prices. This causes the cost of production facilities to increase. Many farmers have to limit the use of fertilizers to continue cultivating cassava. As a result, cassava productivity is low. Fluctuating input prices cause uncertainty for farmers in farming. This is in line with Syamsiyah's research [14], the risks faced by farmers are fluctuating output prices, high input prices, and pest attacks. High input prices are due to the absence of institutions that regulate farm input prices [5].

The limited capital owned by farmers will have an impact on the use of inputs in cassava farming. Hanafie [15] states that capital is an absolute requirement for the continuation of a farm. Farm capital is classified as a form of wealth, either in the form of money or goods used to produce something directly or indirectly in a production process. Capital formation aims to increase production and farm income and support further capital formation. The more limited the farmer's capital will cause the use of fertilizers and medicines to be less and lower productivity. Research by [16] shows that farmers face farm capital constraints in cultivating cassava so the intensification carried out by farmers in cassava farming is still low, as a result, production per hectare is also low. Mamondol and Sopani [17] states the same thing that one of the causes of low farm productivity is to lack of capital so that farmers cannot carry out farming activities optimally.

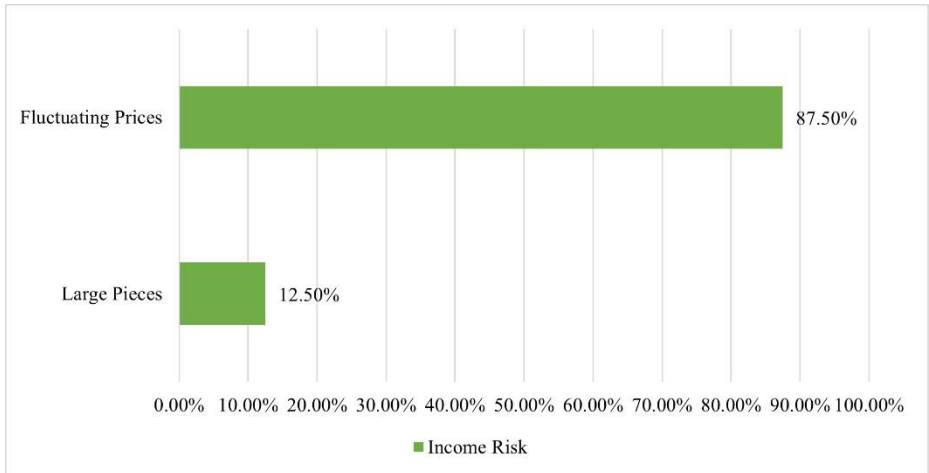


Figure 3. Source of income risk in cassava farming in Central Lampung.

The third risk is income risk. This risk is closely related to the output and production prices received by farmers. The results showed that income risk was caused by fluctuating selling prices (87.50%) and large deductions (12.50%). The risk of cassava prices faced by farmers in cassava farming is certainly unavoidable. Fluctuating cassava prices will have an impact on changes in income in each cassava growing season. Price risk is even the biggest obstacle that farmers have to face in cassava farming [10]. Fluctuating cassava prices and high discounts will greatly affect the income of farmers in Central Lampung. The price of cassava in Lampung is not the only signal of profit for farmers, but also reactions. When the price is high but the raffaction set by the factory is high, the farmers will lose, even more so when the price is low [18]. The cut received by farmers is 18 to 20 percent. The deductions received by farmers in factories and stalls are different. The cut at the cassava stalls will be higher than the cut at the factory. In the case that occurred at the research location, most farmers prefer to sell to factories rather than to stalls because although the price at the stalls is high, the cut is also high (20%) compared to the low-price factory but the largest cut is only 8%, so that if calculated, the profit obtained by cassava selling farmers will be greater if sold directly to the factory. In line with Kusmaria's research [18] selling cassava to factories is more profitable than being sold because factories provide more certainty in terms of determining selling prices and small raffactions.

3.4 Risk Analysis of Cassava Farming

The calculation of the risk of cassava farming uses the coefficient of variation. A larger coefficient of variation reflect more risk faced by farmers. Table 3 shows the value of the coefficient of variation that describes the level of risk of cassava farming in Central Lampung Regency.

Table 3. Risk analysis of production, price, and income of cassava farming in Central Lampung Regency in 2020.

Description	Production risk	Price risk	Income risk
Mean (E)	25,930.05	974.7	25,395,996.7
Standard deviation (V)	2,492.56	93.15	3,750,709.06
Coefisien Variasi (CV)	0.11	0.09	0.15
Lower Limit (L)	20,944.93	784.44	17,627,934.54

Source: Primary data

Table 3 shows that the CV value for production risk is less than 0.5, meaning that the risk of farmers experiencing losses due to decreased production is low. The production lower bound value of 20,944.93 means that the lowest amount of cassava production that may occur is 20,944.93 kg per farm or 18,768 kg per ha. A CV value smaller than 0.5 indicates the risk faced by farmers is low. In line with Othi's research [19], a CV value of less than 0.5 means that the risk of farmers experiencing losses due to decreased production is low.

Price risk shows a CV value below 0.50, meaning that the risk of farmers experiencing losses due to price changes is low. The lower limit value of the price of Rp784.44/kg means that the lowest price of cassava that farmers may receive is Rp784.44/kg. The coefficient of variation $CV < 0.5$ indicates that the risk faced by farmers is low.

Income risk shows the average income received by cassava farmers in 2020 is Rp. 25,395,996.70. The standard deviation value (V) is 3,750,709.06, with a coefficient of variation of 0.15 and a lower limit (L) of Rp. 17,627,934.54. The coefficient of variation indicates that the income risk for cassava farming in Central Lampung is low and the lower limit indicates that the lowest income of cassava farming that can be tolerated with the various constraints that exist is Rp. 17,627,934.54.

Research [20] shows the high risk of farm income, due to the high intensity of pest attacks and plant diseases that cause high variations in production so that variations in income are also high. If production is high, but prices are low, the income that farmers will receive will also be low, and vice versa. If it is related to this research, it can be concluded that cassava farming activities in Central Lampung Regency have a low intensity of pest and disease attacks, relatively uniform production, and less volatile prices. These factors cause the risk of cassava farming in Central Lampung to be low.

4 Conclusion

Cassava farming in Central Lampung Regency is profitable with an R/C value against total costs of 1.99. Production risk in cassava farming is 58.06% due to low/declining production yields. Price risk in cassava farming is 37.50% due to limited capital and high production costs. The income risk in cassava farming is 87.50% due to fluctuating prices. Cassava farming in Central Lampung Regency has a coefficient of variation < 0.5 and a lower limit value > 0 indicating that cassava farming in Central Lampung

Regency has a low level of risk. This conclusion indicates that Central Lampung cassava farming activities should be developed.

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