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Risk Study of Cayenne Pepper and Tomato Farming in Suralaga District, East Lombok

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Abstract
West Nusa Tenggara Province is one of the central areas for developing horticultural commodities, including cayenne pepper and tomato plants. High production not balanced by market demand can cause cayenne peppers and tomatoes to be sold at lower prices. The purpose of this study was to analyze the level of risk of production, price, and income of cayenne pepper and tomato farming in Suralaga District, East Lombok Regency. This study was conducted in Suralaga District, East Lombok Regency in Kerongkong Village and Suralaga Village. Respondents in this study were cayenne pepper and tomato farmers in the Suralaga District totaling 60 respondents. Risk measurement uses the method of variance, standard deviation, and coefficient of variation. The results of the study showed. The level of risk of cayenne pepper farming is greater or riskier than tomato farming, both in terms of production risk, price risk, and income risk. In cayenne pepper farming, the production risk is KV = 0.16 / Ha is greater than the risk of tomato production of KV = 0.11 / Ha. The risk of cayenne pepper price, which is KV=0.04, is greater than the risk of tomato price, which is KV=0.01. The risk of cayenne pepper farming income, which is KV=0.18/Ha, is greater than the risk of income in tomato farming, which is KV=0.11/Ha. 1. It is expected that cayenne pepper farmers will optimize the use of inputs, especially fertilizers so that the production produced is high with good quality. Meanwhile, tomato farmers are expected to think about off-farm, namely processing agro-industry, to be able to get higher added value.

Keywords: *Risk Study; Cayenne pepper; Tomato; coefficient variance*

1. Introduction

West Nusa Tenggara Province is one of the central areas for the development of horticultural commodities, including cayenne pepper and tomato plants. The production of cayenne pepper and tomatoes in West Nusa Tenggara is spread across various districts/cities in West Nusa Tenggara. The total production of cayenne pepper in West Nusa Tenggara in 2021 reached 626,911 kw with a cultivated land area of 8,065 Ha. The center of cayenne pepper production in West Nusa Tenggara is in East Lombok with a production volume of 493,984 kw with a land area of 6,513 ha or 78.99 percent of the total production in West Nusa Tenggara. Meanwhile, the total tomato production in West Nusa Tenggara in 2021 reached 285,114 kw, with a land area of 1,409 ha. The tomato production center in West Nusa Tenggara is also in East Lombok Regency with a production of 209,814 kw with a land area of 1,116 ha or 73.58 percent of the total production of West Nusa Tenggara [1].

According to data from the East Lombok Regency BPS, the area of cayenne pepper plants in Suralaga District in 2021 was 2,489 ha with a production of 54,210 kw, while the area of tomato plants was 253 ha with a total production of 13,314 kw. Meanwhile, the lowest land area for cayenne pepper plants is in Jerowaru District with a land area of 3 ha with a production of 210 kw. The lowest land area for tomato plants is in Sakra District with a land area of 2 ha with a production of 90 kW [2].

In agricultural activities, farmers are very vulnerable to risks in carrying out their farming activities. Risk is an uncertain condition faced by a person or company that can have a detrimental

impact [3]. The risk in agricultural activities is greater than the risk in non-agricultural activities because agriculture is greatly influenced by natural and non-natural factors.

Based on the results of a field survey, the risk in cayenne pepper and tomato farming is caused by natural factors such as changes in climate and weather conditions, the presence of pests and diseases, and natural disasters such as drought and floods. While non-natural factors can arise from marketing activities for production results. Cayenne pepper and tomato farmers in Suralaga District often plant simultaneously, so that when the harvest season arrives, the stock of cayenne pepper and tomatoes is abundant in the market which often causes the selling price to decrease. This is because high production is carried out simultaneously and is not balanced by the value of market demand, causing cayenne pepper and tomatoes to be sold at lower prices. This will have an impact on the income received by farmers. Based on the background that has been described, the researcher is interested in conducting research on risk assessment in cayenne pepper and tomato farming in Suralaga District, East Lombok.

2. Materials and Methods

This research was conducted in Suralaga District, East Lombok Regency. Suralaga District consists of 15 villages, namely Anjani Village, Tebaban, Kerongkong, Suralaga, Bagik Payung, South Bagik Payung, East Bagik Payung, Gerung Permai, Dasan Borok, Tumbuh Mulia, Gapuk, Bintang Rinjani, Paok Lombok, Dames Damai, and Waringin. Then 2 villages were determined as research locations, namely Kerongkong Village and Suralaga Village. The determination of the research location used the purposive sampling method with the consideration that in Kerongkong Village and Suralaga Village, farmers cultivate cayenne peppers and tomatoes throughout the year.

Respondents in this study were cayenne pepper and tomato farmers in Suralaga District, East Lombok Regency. The determination of the number of respondents was carried out using Quota Sampling, namely 60 respondents with details of 30 cayenne pepper farmers in Kerongkong Village and 30 tomato farmers in Suralaga Village. The determination of each sample of 30 was carried out by the opinion of Sugiyono [4], who stated that if the sample is divided into categories, then the number of samples for each category is at least 30 to produce more accurate statistical calculations. Then the respondents in each village were carried out by accidental sampling or taking respondents by chance, namely the sampling was sufficient by taking anyone who happened to be met by the researcher in the field according to the needs of the study.

Variance

The risk distribution using a quantitative approach can be calculated by using the expected return value as an indicator of the probability of investment and the size of the variance. Variance can be calculated using the formula [5]:

$$Va^2 = \frac{\sum_{i=1}^{n}(xi-\bar{x})^2}{n-1}$$

Description:
Va^2 = variance
xi = Production, price, and income
$\bar{x}$ = Average production, price, and income
n = Number of samples

The variance value shows that the greater the variance value, the greater the deviation value, so the greater the risk faced by farmers in chili and tomato farming activities.

Standard deviation

Standard deviation has the same meaning as variance, namely to measure the level of deviation from the farming business being run. Standard deviation is calculated using the formula [5]:

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$Va = \sqrt{Va^2}$

Description:
Va = Standard deviation
Va^2 = variance

The smaller the standard deviation value, the lower the risk faced by farmers in running chili and tomato farming activities. The higher the value of the variance and standard deviation, the higher the level of risk.

Coefficient Variance

The coefficient of variation is used to measure the level of risk in the farming business being run. Coefficient variance is calculated using the formula [5]:

$KV = \frac{Va}{\bar{x}}$

Description:
KV = Coefficient of Variation
Va = Standard Deviation
$\bar{x}$ = average yield of production, price, and income

If the KV value <0.50, then the analyzed farm has a small risk or Risk Taker and vice versa if the KV value > 0.50 then the analyzed farm has a large risk or risk averse, and if the KV value = 0.50 then the analyzed farm has a moderate risk or risk neutral. The coefficient of variation value shows that the smaller the coefficient of variation value, the smaller the risk faced in carrying out farming activities, and the greater the coefficient of variation value, the greater the risk that must be borne by farmers.

Analysis of Farm Business Income Risk Sources

To find out the source of income risk of cayenne pepper and tomato farming in Suralaga District, East Lombok Regency, an analysis was conducted using descriptive analysis. Descriptive analysis was conducted using observation and interview methods by providing several questions related to the causes of obstacles in farming that cause income risks in farming [4]. Thus, it can be the right alternative handling to minimize the income risk faced by Cayenne pepper and tomato farmers in Suralaga District, East Lombok Regency.

3. Results and Discussion

Production Risk Analysis

Production risk is a risk that arises due to the uncertainty of the amount of harvest obtained from farming that has a detrimental impact. Production risk is the deviation of the production volume obtained compared to the expected production volume. Meanwhile, what is meant by the level of risk is the opportunity for risk to occur in cayenne pepper and tomato farming. Based on the results of interviews with respondents in the research area, cayenne pepper, and tomato plants have production risks caused by climate and weather conditions. Natural factors are one of the causes of production risks that are difficult to avoid because they are unpredictable and difficult to control [6]. The level of production risk of cayenne pepper and tomato farming in Suralaga District, East Lombok Regency can be seen in Table 1.

Table 1. Risks of Cayenne Pepper and Tomato Farming Production in Suralaga District

Description	Kg/LLG	Kg/Ha
Cayenne Pepper variance (Va^2)	1,799,105	2,791,209

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Standard deviation (Va)	1,341.31	1,670.69
Coefficient Variance (KV)	0.41	0.16
Tomato		
variance (Va^2)	6,057,018	1,333,972
Standard deviation (Va)	2,461.10	1,154.98
Coefficient Variance (KV)	0.47	0.11

Source: Processed Primary Data, 2024

Based on table 1, shows that the value of the variety or variance is 1,799,105/LLG or 2,791,209/Ha, and the standard deviation value is 1,341.31/LLG or 1,670.69/Ha, resulting in a coefficient of variation (KV) value of 0.41/LLG or 0.16/Ha. This shows that the risk level of cayenne pepper farming production is classified as low risk or risk taker indicated by the KV value <0.50. In tomato farming, the value of the variety or variance is 6,057,018/LLG or 1,333,927/Ha and the standard deviation value is 2,461.10/LLG or 1,154.98/Ha, resulting in a coefficient of variation (KV) value of 0.47/LLG or 0.11/Ha. This shows that the risk level of tomato farming production is also classified as low risk or risk taker indicated by the KV value <0.50. At this stage, farmers dare to take risks by continuing to plant cayenne pepper and tomatoes even though it will affect production results. Production results are greatly influenced by environmental factors such as climate, weather, and temperature, as well as pest and disease disturbances [7]. So, farmers must schedule their commodity planting time well to reduce the risk of production. From Table 1, it can be concluded that the risk level of cayenne pepper farming production per hectare is greater than the risk level of tomato farming production per hectare. In cayenne pepper farming, the risk level of production per hectare is 0.16 while the risk level of tomato production per hectare is 0.11. This means that the smaller the KV value obtained, the lower the level of production risk in the farming business, and vice versa, the greater the KV value obtained, the greater the level of production risk faced by farmers.

When compared to the research conducted by Rosdianingsih [8], the results of the study showed a variance value of 3,716, a standard deviation of 1,928, and a coefficient of variation value of 0.17. Because the KV value <0.50 means that the risk of farming production is relatively small. It can be concluded that there are similarities in this study, where the Coefficient of Variation value obtained in each study is less than 0.50 or is classified as low risk.

Price Risk Analysis

Price risk is a risk that arises due to price uncertainty in cayenne pepper and tomato farming. The existence of price risk will also affect the amount of income that will be received by cayenne pepper and tomato farmers. The distribution of prices among farmers is felt to have a final impact on the income obtained by farmers. Prices will affect the amount of income received by farmers before finally being reduced by production costs so that income from the farming business is obtained. In farming activities, farmers do not have full control over the pricing of products or inputs used, so they potentially face risks related to price fluctuations [9]. Price risk in cayenne pepper and tomato farming in Suralaga District, East Lombok Regency can be seen in Table 2.

Table 2. Price Risk of Cayenne Pepper and Tomato Farming in Suralaga District

Description	Cayenne Pepper (Rp/Kg)	Tomato (Rp/Kg)
Variance (Va^2)	792,587	8,034
Standard Deviation (Va)	890.27	89.63
Coefficient Variance (KV)	0.04	0.01

Source: Processed Primary Data, 2024

Based on table 2, on the risk level of cayenne pepper farming prices, it shows that the value of the variety or variance is 792,584, and the standard deviation value is 890.27, resulting in a Coefficient of Variation (KV) value of 0.04. This shows that the risk level of cayenne pepper farming prices is classified as low risk or risk taker indicated by the KV value <0.50. In tomato farming, the value of the variety or variance is 8,034 and the standard deviation value is 89.63,

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resulting in a coefficient of variation (KV) value of 0.01. This shows that the risk level of tomato farming prices is also classified as low risk or risk taker indicated by the KV value <0.50. At this stage, farmers dare to take risks by continuing to sell their crops even though the price obtained is below standard. From Table 2, it can be concluded that the risk level of prices in cayenne pepper farming is greater than in tomato farming. In cayenne pepper farming, the KV value is 0.04, while in tomato farming, the KV value is 0.01. This means that the smaller the KV value obtained, the smaller the price risk level faced by farmers. Likewise, the greater the KV value obtained, the greater the price risk level in farming. Price risks often arise due to the high costs that farmers must pay for needs such as purchasing seeds, fertilizers, plant nutrients, and pesticides, as well as quite large labor costs [10].

When compared to the research conducted by Rosdianingsih [8], the results of the study showed a variance value of 11,940, a standard deviation of 3,456, and a coefficient of variation value of 0.13. Because the KV value <0.50 means that the risk of farm prices is relatively small. It can be concluded that there are similarities in this study, where the Coefficient of Variation value obtained in each study is less than 0.50 or is classified as low risk.

Income Risk Analysis

Income risk is the deviation of expected income compared to the income obtained. Meanwhile, what is meant by the level of risk is the opportunity for risk to occur in farming. Income risk comes from production risk and price risk itself. If production decreases, income will also decrease. Likewise, if prices decrease, income will also decrease. Therefore, production risk and price risk greatly affect income risk. Farmers need to know the income risk in determining the decision to carry out a farming business. The variables that have a significant effect on income risk are land area, NPK fertilizer price, and managerial ability [11]. The magnitude of the income risk of cayenne pepper and tomato farming in Suralaga District, East Lombok Regency can be seen in Table 3.

Table 3. Risk of Income of Cayenne Pepper and Tomato Farming Business in Suralaga District

Description	Rp/LLG	Rp/Ha
Cayenne Pepper		
variance (Va^2)	555.598.595.018.747	1,206,640,486,318,610
Standard deviation (Va)	23,571,139.03	34,736,731.08
Coefficient Variance (KV)	0.40	0.18
Tomato		
variance (Va^2)	111.786.645.666.162	59,606,364,441,972
Standard deviation (Va)	10,572,920.39	7,720,515.81
Coefficient Variance (KV)	0.47	0.11

Source: Processed Primary Data, 2024

Based on Table 3, shows that the value of the variety or variance is 555,598,018,747/LLG or 1,206,640,486,318,610/Ha, and the standard deviation value is 23,571,139.03/LLG or 34,736,731.03/Ha, resulting in a coefficient of variation (KV) value of 0.40/LLG or 0.18/Ha. This shows that the level of risk of cayenne pepper farming income is classified as low risk or risk taker indicated by the KV value <0.50. Meanwhile, in tomato farming, the variance value was obtained as 111,786,645,666,162/LLG or 59,606,364,441,972/Ha and the standard deviation value was 10,572,920.39/LLG or 7,720,515.81/Ha, resulting in a coefficient of variation (KV) value of 0.47/LLG or 0.11/Ha. This shows that the risk level of tomato farming income is also classified as low risk or risk taker indicated by the KV value <0.50. At this stage, farmers dare to take risks by continuing to cultivate cayenne pepper and tomatoes as a source of income, because the income obtained is quite high and profitable. Farmers' income is influenced by various factors, including production levels, selling prices, and production costs incurred. In addition, income levels also depend on the use of technology, changes in input prices, farmer habits in managing their farms, and climate conditions [12]. From Table 3, it can be concluded that the risk level of

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cayenne pepper farming income per hectare is greater than the risk level of tomato farming income per hectare. In cayenne pepper farming, the income risk level per hectare is 0.18 while the income risk level of tomatoes per hectare is 0.11. This means that the smaller the KV value obtained, the smaller the income risk level in the farming business, and vice versa, the greater the KV value obtained, the greater the income risk faced by farmers.

When compared to the research conducted by Muzammil [13], the results of the study obtained a variance value of 104,849,904,030183, a standard deviation of 10,239,624, and a coefficient of variation value of 0.28. Because the KV value <0.50 means that the risk of farm income is relatively small. It can be concluded that there are similarities in this study, where the Coefficient of Variation value obtained in each study is less than 0.50 or is classified as low-risk

Analysis of Farm Business Income Risk Sources

Risk will affect the income obtained by farmers. Income risk can come from selling prices, input prices (seeds, fertilizers, and pesticides), and labor costs. Sources of income risk need to be analyzed to find out where the highest risk comes from so that appropriate risk prevention and mitigation steps can be taken so that similar risks do not occur again in the future. Sources of income risk for cayenne pepper and tomato farming businesses in Suralaga District, East Lombok Regency can be seen in Table 4.

Table 4. Source of Income Risk of Cayenne Pepper and Tomato Farming Business in Suralaga District

Risk Source	Cayenne Pepper	Percentage (%)	Tomato	Percentage (%)
1. Selling Price	13	43.33	23	76.67
2. Input Price (seeds, fertilizers, and pesticides)	15	50.00	7	23.33
3. Labor Cost	2		0	0
Total	30	100.00	30	100.00

Source: Processed Primary Data, 2024

Based on Table 4, shows that the source of risk that most affects the risk of cayenne pepper farming income is the price of inputs (seeds, fertilizers, and pesticides). As many as 15 out of 30 respondents (50.00%) chose the price of inputs (seeds, fertilizers, and pesticides) as the source of risk that most affect the risk of income. From the results of interviews with respondents, this is due to the uncertainty of input prices, especially fertilizers which often increase due to the scarcity of fertilizers. If there is any, it is very limited and sold quite expensively. In addition to fertilizer, the price of seeds is also a source of risk faced by farmers. The need for seeds and pesticides which are quite large also affects farmers' income, because the costs incurred are also getting higher. At the age of planting 1 to 2 weeks, cayenne pepper plants are very susceptible to pest and disease attacks including fusarium wilt. Plants affected by fusarium wilt must be eradicated immediately by replacing the plants so that they do not spread to other plants. Cayenne pepper plants are also plants that are easily attacked by pests and diseases so they require pesticides to eradicate them. In line with research by FR & Suparyana [14], it was stated that the most dominant obstacle faced by farmers who carry out chili farming is disease attacks. The price of pesticides is also quite expensive, and farmers need enough pesticides to be able to eradicate pests and diseases. Therefore, farmers choose input prices (seeds, fertilizers, and pesticides) as a source that influences risk because input prices are relatively expensive and rare, so the use of these inputs is less than optimal.

If the use of input is not optimal, then the resulting production will also be less good which can affect the income received by farmers. Another source of risk comes from the selling price. As many as 13 respondents (43.33%) chose the selling price because the price of cayenne pepper is quite fluctuating and also cayenne pepper plants are not durable for storage so when the harvest season arrives and the selling price drops, some farmers will still sell the cayenne pepper directly, and some farmers also choose to postpone selling or drying the cayenne pepper to then sell it in a

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dry state at a higher price. In addition, there were 2 respondents (6.67%) who chose labor costs as the source of risk that most affected income. The average labor costs incurred by Cayenne pepper farmers were IDR 4,334,500 LLG or IDR 13,167,437/Ha. Based on the interviews conducted, the problem for farmers was the fairly high labor costs. If the use of labor is quite high, but the production produced is less than optimal because the labor used is not competent, then this will affect the income received by farmers. In line with research conducted by Salim et al [15], stating that if labor costs increase then income will decrease, and if farming skills increase then income will increase. Both factors are factors that can be controlled by farmers so that they can reduce the occurrence of income risk.

Meanwhile, for the source of risk of tomato farming income, 23 respondents (76.67%) chose selling price as the source of risk that has the most influence on farming income. According to the interview results, this is because when the harvest season arrives, the selling price of tomatoes often falls. After all, the stock of tomatoes is abundant in the market. However, tomato farmers will still choose to sell their harvest directly even though the price offered is low, this is because tomato plants are not durable for storage and there are no facilities to store tomato plants so that tomatoes can be sold when the price is high. This will certainly have a significant impact on the income obtained by farmers. This is the reason why respondent farmers chose selling prices as a source of income risk. In addition, there were 7 respondents (23.33%) who chose input prices (seeds, fertilizers, and pesticides). Similar to cayenne pepper farmers, tomato farmers also chose input prices as a source of income risk due to the uncertainty of input prices, especially fertilizers, which often experience price increases due to their scarcity. High fertilizer prices encourage farmers to reduce their dosage, which has the potential to reduce the quality of the harvest [16]. Therefore, farmers need to closely monitor the amount of fertilizer given to curly chili plants so that their use is efficient and not excessive. Likewise with the price of seeds, although not rare, tomato plants aged 1-7 days are very susceptible to pests and diseases and also often die due to technical errors when planting, so plants that are affected by disease must be immediately eradicated by replacing them with new seeds, of course, farmers have to spend more money to buy seeds.

Tomato farming also requires pesticides to eradicate pests and diseases. At the age of 1-7 days, tomato plants are very susceptible to pests and diseases, so spraying with pesticides must be carried out to prevent crop failure due to pest attacks. The more pesticides used, the higher the costs incurred, resulting in a decrease in income received by farmers. Therefore, this is the reason why respondent farmers choose input prices as a source of income risk. Price fluctuations like this can affect the income of farmers from tomato farming because when carrying out production activities, farmers spend quite a lot of money [17].

4. Conclusion

The risk level of cayenne pepper farming is greater or riskier than tomato farming, both in terms of production risk, price risk, and income risk. In cayenne pepper farming, the production risk, namely KV = 0.16 / Ha, is greater than the risk of tomato production of KV = 0.11 / Ha. The price risk of cayenne pepper, namely KV = 0.04, is greater than the risk of tomato price KV = 0.01. The income risk of cayenne pepper farming, namely KV = 0.18 / Ha, is greater than the income risk in tomato farming, namely KV = 0.11 / Ha. The source of risk that most affects the income of cayenne pepper farming is the price of inputs (seeds, fertilizers, and pesticides). Farmers choose input prices as a source that affects risk because input prices are relatively expensive and rare, so the use of these inputs is less than optimal. If the use of inputs is less than optimal, the resulting production will also be less good which can affect the income received by farmers. The source of risk that most affect the risk of tomato farming income is the selling price. This is because when the harvest season arrives, the selling price often falls. After all, the stock of tomatoes is abundant in the market.

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