

Dear Sir/Madam

Could you help me to act as a proofreader for our manuscript entitled "The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island"

Hopefully, we can get an answer in the not-too-distant future."

For your cooperation, thank you

Best regards,

Muhamad Siddik

## **The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island**

Muhamad Siddik; Dwi Praptomo Sudjatmiko, Bambang Dipokusumo, and  
Anwar Anwar; Tajidan Tajidan

Correspondence e-mail: [siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)

**Abstract:** The aim of this research is to find a comparison of production risk and price risk between types of chillies which has never been done before; and analyze the relationship between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The study used an explanatory method in three subdistricts/villages that cultivated the three types of chili in a balanced way, each representing the highlands, middle land, and lowlands. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way. Data collection uses structured interviews, in-depth interviews, field observations, virtual surveys, desk study, and documentation. Risk measurement uses variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of chili cultivation were statistically tested with the LSD (*Least Significantly Different*) test. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. The production risk of cayenne pepper was found to be the lowest and significantly different from the production risk of the curly chili crop and the big-red chili crop which have high risk. In contrast to price risk, the cayenne pepper crop falls into the high-risk category and is significantly different from the price risk of big-red chili peppers and curly chili peppers. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

**Keywords:** correlation, price, production, type of chili,

### **INTRODUCTION**

Chili is one of the most important agricultural and food staples in Indonesia (Mariyono, and [Sumarno](#), 2015), because in addition to being widely cultivated and a source of income for many residents, it is also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity (Frankel, 2011), because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months the price is very low and in other months the price increases sharply ([Zaini, et al](#), 2014)

The fluctuating price of chili is due to the erratic production and supply of chili ([Susanawati, et al](#), 2021), while the demand is relatively constant. At certain times, production and supply are very low, causing chilli prices to rise sharply. Meanwhile, at other times the production and supply of chili peppers is abundant, so the price of chili peppers drops drastically ([Siddik, et](#)

al, 2018). This condition causes the commodity crop of chili to face production risks and price risks that are quite high (Siddik, *et al*, 2019).

Theoretically, the courage of farmers to face agricultural risks determines productivity and income from agriculture (Mariyono, 2017). If farmers behave with fear of risk (risk *aversion*), then the utilization of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and farm income lower can be produced. But if farmers are risk *takers*, then resource utilization will be optimal for maximum productivity and income, but with the possibility of increased risk of loss (Ellis, 1988). Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of this crop.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili (Nugroho, 2016). In the Lombok Island, the most cultivated type of chili is cayenne pepper (BPS, 2020). However, among the cayenne pepper plants, many farmers were also found to grow big-red chilis or curly chilis in the same stretch and season. Farmers' choice in determining the type of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study aims to: (1) analyze the differences in risk and income from the cultivation of cayenne pepper, chile big-red, and chili curly; and (2) to analyze the relationship between production risk and price risk with income from the cultivation of cayenne pepper, big-red pepper, and curly pepper in the Lombok Island.

## **RESEARCH METHODS**

### ***Research subjects.***

This research was carried out in Lombok Island, West Nusa Tenggara Province, Indonesia. The research topics were the cultivation of cayenne pepper, chile big-red, and chili curly, which were grown during the 2021/2022 rainy and dry seasons. In the Lombok Island, the rainy season usually occurs from November to April; and the dry season from May to October (NTB BPS in Figures, 2019-2021).

### ***Research Design.***

The research was designed using an explanatory method, that is, research that aims to explain and relate one variable to another that is different but interrelated and produces a causal relationship (Rodder & Lotters, 2010). The research location was determined in stages (multi-stage *purposive sampling*) starting from the district/city, sub-district level to the village level

(Nazir, 2010). The selection of districts/cities was based on the centers of production of the three types of chili; therefore, East Lombok Regency was chosen. In addition, tree districts/villages that cultivated the three types of chili in a more balanced way were selected; and each is expected to represent lowland areas (<200 mpl), mid-plains (200-500 mpl), and upland areas (>500 mpl). Jerowaru District/Jerowaru Village was then selected to represent the lowland areas; then Aikmel district/Kalijaga village, representing the mid-plains area; and Pringgasela District/Pringgasela Village representing the highlands.

**Research respondents.**

Research respondents are farmers who grow cayenne pepper, chile big-red, or chili curly during the rainy season and/or dry season in 2021/2022. In each sub-district/village, 10 farmers were selected by random sampling, each growing cayenne pepper, chili pepper or chili curly, so that the total number of respondents was 90 people.

**Data collection.**

Data collection was carried out by combining several methods simultaneously, namely the method of structured interviews using a list of questions (Newcomer, et al, 2015), in-depth interviews; field observations, virtual surveys, literature studies and documentation (Adams, et al. 2008). The structured interview is aimed at the surveyed farmers who grow cayenne pepper, chile big-red or chili curly. The in-depth interviews were aimed at community leaders who know about chile cultivation and the problems it faces, as well as government policies related to agricultural development.

**Data analysis.** The farm risk studied is the production risk and the price risk. The measurement of both risks uses the variance, the standard deviation and the coefficient of variation (Anderson et al., 1977). Production variation and price variation as a measure of production risk and price risk are based on the experience of farmers carrying out chili cultivation activities before (Farianti, 2008; Siddik, 2015).

$$I_{-} = q_{ih} Q_{ih} + q_{go} Q_{go} + q_{in} Q_{in}, \dots\dots\dots [3.1]$$

$$\int_{1}^{2} = q_{ih} [Q_{ih} - \mu_i]^2 + q_{ir} [Q_{ir} - \mu_i]^2 + q_{in} [Q_{in} - \mu_i]^2 \dots\dots\dots [3.2]$$

$$I_{-} = q_{ih} P_{ih} + q_{ir} P_{ir} + q_{in} P_{in}, \dots\dots\dots [3.3]$$

$$\int_{1}^{2} = q_{ih} [P_{ih} - \theta_i]^2 + q_{ir} [P_{ir} - \theta_i]^2 + q_{in} [P_{in} - \theta_i]^2 \dots\dots\dots [3.4]$$

**Information:**

- what = Production of each type of chili (kg/Ha)
- $I_{-}$  = Expected production of each type of chili (kg)
- $\int_{1}^{2}$  = Variance or risk of production of each type of chili
- P = Price of each type of chili (IDR/kg)

- $I_j$  = Expected price of each type of chili (IDR/kg)
- $\sigma_{i_j}^2$  = Price variation or risk for each type of chili
- $Y_{oi}$  = sample or respondent i
- $wha_t$  = Production opportunity or price opportunity for each type of chili (%)
- $hrn$  = Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

In addition, to analyze the level of production risk and price risk for each type of chili, the coefficient of variation is used, with the formula:

$$CV_{qj} = \frac{j}{Q_j} \dots \dots \dots [3.5]$$

$$CV_{pj} = \frac{j}{P_j} \dots \dots \dots [3.6]$$

Where:

- $CV_{qj}$  = Production variation coefficient for each type of chili
- $\sigma_{i_j}$  = Standard deviation of production for each type of chili
- $CV_{pj}$  = Price variation coefficient for each type of chili
- $\sigma_{j}$  = Standard deviation of the price of each type of chili
- $j$  = Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

If the coefficient of variation of  $CV_{qj}$  or  $CV_{pj}$  is greater than 0.5, the production or price risk is in the high category; but if it is less than or equal to 0.5 it is included in the low risk category.

Furthermore, farm income is measured by reducing the value of production with all production costs. The value of production is the product multiplied by the price of production.

$$q_j = \sum_{k=1}^m Q_k \dots \dots \dots [3.9]$$

$$tc = CV + HR \dots \dots \dots [3.10]$$

$$\Pi_j = \sum_{k=1}^m P_k \times Q_k - CT \dots \dots \dots [3.11]$$

Where:

- What = Production of each type of chili (kg/Ha)
- $\Pi$  = Agricultural income for each type of chili (IDR000)
- P = Price of each type of chili (IDR/kg)
- Tc = Total cost or total cost of each type of chili (IDR)
- CV = Variable cost or variable costs (IDR)
- CF = Fixed cost or fixed costs (IDR)
- J = Type of chili (cayenne pepper, big-red chili, curly chili)
- Met er = The number of times harvested for each type of chili.

Wh<sub>k</sub> = The k-th harvest (k=1,2,3, .....m) of each type of chili at

To compare the risks and returns of growing cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical test (*analysis of variance*) or the F test; then proceed with the LSD (*Least Significantly Different*) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Table 1).

Table 1. Differences of ANOVA and F-test in risk and income of cayenne pepper, chile big-red and chile curly crops.

Origin of variance	H.H	DF	Millisecond	F account
Between Groups (b)	SS <sub>b</sub>	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	SS <sub>w</sub> =SS <sub>T</sub> -SS <sub>b</sub>	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	SS <sub>T</sub>	nk-1		

Information:

- Df = Degrees of freedom
- SS= Sum of Squares
- MS = Sum of mean squares
- SS<sub>T</sub> = Square Sum Total (*Square Sum Total*)
- SS<sub>b</sub> = Sum of squares between groups (*Sum of Square Between*)
- SS<sub>w</sub> = Sum of squares in the group (*Sum of squares within*)
- n = Number of data or samples
- k = number of groups or types of chiles

The decision criterion, if F count > F table at an error rate (α) of 10%, then there is a difference in the risk or income of cayenne pepper, big-red chili and curly chili farming. Conversely, if F count ≤ F table, then there is no difference in risk or income for the three types of chili.

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD (*Least Significantly Different*) test, to individually test the difference in risk or farm income for each type of pepper. To calculate the LSD value, some data is needed from the ANOVA calculations, namely MS<sub>E</sub> (*mean square error*) data, df (degrees of freedom), r (number of samples for each group or type of chili) and Student's t tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df} \cdot \sqrt{\frac{2(MSE)}{r}}) \dots \dots \dots [3.12]$$

The decision criterion, if the difference between two variables is greater than LSD<sub>α</sub>, then the two variables (agricultural risk or income) show a significant difference. But if the difference

between two variables is less than or equal to  $LSD_{\alpha}$ , then the two variables are not significantly different.

In addition, to analyze the relationship between production risk and price risk with agricultural income for each type of chili, the Pearson correlation coefficient ( $r$ ) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad [3.16]$$

Where:

X = Production risk or price risk for each type of chili

Y = Agricultural income for each type of chili

## RESULTS AND DISCUSSION

### Differences in Risks of Cultivation of Cayenne Pepper, Chili Big-red and Chili Curly

#### *Production Risk.*

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal and low production) based on experience in carrying out activities. chili cultivation. In addition, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big-red chili and curly chili can be seen in Table 2.

Table 2. Production risks of growing cayenne pepper, big-red chili peppers and curly chili peppers in the Lombok Island, 2022.

No	Description	Little Chili	Big-Red Chili	Curly Chili
1	Production Variations	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Source: Primary Data Analysis (2022)

Table 2 shows the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili is quite high, but the highest is the big-red chili (0.51), then the curly

chili (0.49) and the most-low is cayenne pepper (0.45). This means that the production risk of the chilli crop on the island of Lombok is quite risky, but the big-red chilli crop is included in the high-risk category ( $CVq > 0.50$ ), while the curly chillies, especially the allspice cayenne, are still included in the low production risk category.

The results of the LSD test on the differences in risk of cayenne pepper, big-red chili, and curly chili also show that the risk of cayenne pepper production is lower and significantly different from the risk of big-red chili production., including curly pepper, with a confidence level of more than 95 percent ( $\alpha = 5\%$ ); Meanwhile, there is no convincing difference between the production risks of big-red and curly peppers at this level of confidence (Table 3).

Table 3. Yield risk results of the comparative test (LSD) of the cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big-red Chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684
	Big-red Chili	-.01633	.01060	.127	-.0374	.0047

\*. The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The lower value of the coefficient of variation of cayenne pepper production indicates that cayenne pepper growers are better able to control the risk (variation) of production, compared to curly pepper growers, more than chilli growers. big-red.

The results of this study are different from the results of Mala *et al. Alabama*. (2021) in the Sumberrejo district shows that there is no significant difference between the production risk and the income risk of the cultivation of chili big-red and cayenne pepper, but the price risk of chili big-red is higher compared to the cayenne pepper price risk. This condition shows that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of Amin and Prihantini (2021) and Alfianor, et al., (2018) who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper is considered. be a profitable and viable agricultural business (Puspitasari, 2020; Light and Wake, 2020).



**Price risk.** Price risk is also analyzed in the same way as production risk, but the results of the analysis are contradictory. Table 4 shows that the coefficient of variation of prices (CVp) for the cayenne pepper crop is the highest (0.57) compared to the big-red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

Table 4. Price risk for cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022.

No	Description	Little Chili	Big-red Chili	Curly Chili
1	Price Variations Price Standard	182,631,715	64,434,463	68,134,808
2	Deviation Price Variation	13,514	8027	8,254
3	Coefficient	0.57	0.49	0.46

Source: Primary Data Analysis (2022).

The results of this analysis indicate that the cayenne pepper crop in the Lombok Island is in the high price risk category ( $CVp > 0.5$ ), while big-red chili peppers and curly chili peppers are not included in the price risk category. high price, although the coefficient of variation is quite big-red, but still below 0.50. The results of this study are consistent with the results of previous studies (Siddik *et al.*, 2021), that the price risk of cayenne pepper in the cayenne pepper production centers in the Lombok Island, both in the highlands, mid-plains, and lowlands, is listed in the high-risk category.

If the difference in price risk of bird's eye peppers, big-red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, then all three types of peppers have a significantly different price risk, both between cayenne pepper and chile big-reds and chili curly peppers, or between chili peppers big-red and chili curly peppers (Table 5).

Table 5. Price Risk from Comparative Test Results (LSD) for Cayenne, Big-red Chili and Curly Chili in the Lombok Island, 2022

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big-red Chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big-red Chili	-.02900	.01583	.070	-.0605	.0025

\*The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The results of the analysis and the statistical tests of production risk and price risk above, although they show that there are differences in the level of risk faced, in general all three are quite high production and price risks, as indicated by the coefficients of variation. relatively big-red. in all three, the coefficient of variation of production and the coefficient of variation of price. However, the big-redst possible loss caused by production risk is faced by the big-red chili crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big-redst possible loss caused by price risk is faced by the cayenne pepper crop, then the big-red and small chili crop by the curly chili crop.

#### **Differences in farm income for cayenne pepper, chile big-red, and chili curly**

This study assumes that when choosing and carrying out chili cultivation activities, farmers are oriented to obtain the maximum income or profit. To achieve this objective is highly dependent on the production produced, the price received and the costs incurred, the difference in income for the three types of chili cultivation also depends on these three factors.

#### ***Production and Prices.***

Production is the total yield of chili as a whole from the first harvest to the last harvest, converted into units of hectares. While the price is the average value of production per kilogram of chili received by farmers from the first harvest to the last harvest. The results show that the production of cayenne pepper, chili big-red and chili curly in 2021/2022 differs quite a bit between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the dry season it is 5.1 tons/ha; chile big-red in the rainy season at 3.3 tons/ha and in the dry season at 4.7 tons/ha; and curly pepper, the production rate in the rainy season is 3.1 ton/ha and in the dry season it is 4.6 ton/ha (Table 6).

Table 6. Average production and price of cayenne pepper, big-red chili and curly chili in the Lombok Island, 2021/2022

No	Season	Cayenne pepper		Big-red Chili		Curly chili	
		Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

Source: Primary Data Processed (2022)

If the seasonal production level is above, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average of 4.3 tonnes/ha, then chile big-red 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three types of chilli is irrelevant for the comparison, but when compared to the production of similar chillies the previous year in East Lombok Regency, it seems that the chilli production in 2021/2022 has decreased considerably. East Lombok Regency BPS data in figures (2022) shows that the productivity of cayenne pepper in East Lombok Regency in 2021 is 7.8 tonnes/ha and big-red chilli (including curly chilli) is 10, 8 tons/ha. Relatively the same results were also found in the research by Siddik, *et al.* (2021) that the productivity of cayenne pepper in the areas of the chilli production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicates that chilli productivity on Lombok Island is big-redly determined by location, weather conditions, and other external factors.

Although the production of chili in 2021/2022 has decreased drastically, the sale price has increased considerably, especially during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR 20 thousand/kg and IDR 16 thousand/kg (Siddik *et al.*, 2021), while in 2021/2022 the average price received by farmers during the rainy season is IDR . 41 thousand/kg and in the dry season an average of IDR 15 thousand/ha. Therefore, although during the rainy season the level of production of farmers falls drastically, farmers do not feel a loss, because it is covered by a sharp increase in sales prices. In contrast to the dry season, production did not increase much, but prices fell sharply to around IDR 15 thousand/kg less than in 2021, which fell to IDR 16 thousand/kg. Differences or fluctuations in chili prices during the rainy season and the dry season occur for all types of chili, but the most marked difference is cayenne pepper that reaches around IDR 26 thousand/kg, and around IDR 17 thousand/kg. While for big-red chillies, the price difference is relatively small, around IDR 7,000/kg. This difference indicates that the annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili and the lowest is big-red chili.

#### ***Commercial costs.***

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis show that the cost of growing cayenne pepper is higher than the cost of growing big-red chili peppers and

curly chili peppers, especially during the rainy season. In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of chili big-red is IDR 44 million/ha and curly pepper IDR 43 million/ha. During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, chili big-red IDR 42 million/ha and curly pepper IDR 37 million/ha (Table 7).

Table 7. Average cost of cayenne pepper, big chili and curly chili (IDR000/ha) in Lombok Island, 2022

No	Description	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
<b>A. Variable Costs</b>		<b>42,074</b>	<b>30,689</b>	<b>33,159</b>	<b>30,991</b>	<b>31,907</b>	<b>26,508</b>
1	Saprodi	16,396	13,006	13,267	13,471	11,885	11,188
2	Labor	13,212	10,555	9,117	8,298	8,397	7,047
Cost of Other Input							
3	Production	12,466	7,127	10,775	9,223	11,625	8,273
<b>B. Fixed Costs</b>		<b>14,240</b>	<b>12,257</b>	<b>11,329</b>	<b>11,427</b>	<b>11,173</b>	<b>11,390</b>
1	Land lease	13,178	11,082	10,597	10,490	9,981	10,236
2	Land Tax	247	215	189	208	193	150
3	Water Fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
<b>Totals (A+B)</b>		<b>56,314</b>	<b>42,946</b>	<b>44,488</b>	<b>42,419</b>	<b>43,080</b>	<b>37,899</b>

Source: Primary Data Processed (2022).

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds, fertilizers, growth stimulants and drug costs. Then labor costs and other support facilities like plastic mulch and stakes. These variable inputs cost about 70 percent of total farm costs. Although fixed inputs consist of income and land taxes, equipment depreciation, water costs, and interest on loan capital, no farmers used loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million to IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season. But because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

#### ***Income and Agricultural Efficiency.***

Although the chilli production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year, because this decrease was offset by a fairly high increase in chilli prices during the rainy season, farm income obtained are still quite high and agriculture is considered efficient. The highest income and agricultural efficiency in the rainy season is

obtained with the cultivation of cayenne pepper, which reaches IDR 89 million/ha with a CR ratio of 2.58; then the curly chile crop of IDR 51 million/ha with RC 2.21 and the lowest is the income from the big-red chili crop, which amounts to IDR. 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big-red cultivation of chili, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Table 8).

Table 8. Average production, prices, production value, production costs and farm income of cayenne pepper, chili pepper and curly pepper in the Lombok Island, 2021/2022

No	Component	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2,21	1.66

Source: Primary Data Analysis (2022).

When income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27 million/ha. Meanwhile, for the big-red chili crop, the difference is less than IDR 3 million/ha. This means that the big-red chile crop has a relatively stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crop is very volatile. This indicates that the cayenne pepper and curly chili crop has a high-income risk, while chili cultivation Chili cultivation has low income risk.

#### **Commercial Rent.**

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big-red chile costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD (*Least Significantly Different*) test.

Based on the results of the LSD test in Table 9, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income

from the big-red chili pepper crop. and curly chili; Meanwhile, the income from the big-red chili crop and the curly chili do not show a convincing difference in income. The results of this trial provide an explanation for the reasons why farmers in the Lombok Island, especially in East Lombok Regency, prefer to plant bird's eye chilies instead of big-red chilies or curly chilies.

Table 9. Comparative test results (LSD) Farm income from cayenne pepper, big-red chili and curly chili in Lombok Island, 2022

Comparison between	Mean Difference (IJ)	std. Error	Sig.	95% Confidence Intervals		
				Lower Bound	Upper bound	
Cayenne pepper	Big-red Chili	21367.133 *	6618730	002	8211.69	34522.58
	Curly chili	22082.767 *	6618730	001	8927.32	35238.21
Big-red Chili	Cayenne pepper	-21367.133 *	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767 *	6618730	001	-35238.21	-8927.32
	Big-red Chili	-715,633	6618730	.914	-13871.08	12439.81

\*. The mean difference is significant at the 0.05 level.

Source: Primary data processed (2022)

#### Relationship between Production Risk and Price Risk with Agricultural Income.

The results of the Pearson correlation analysis show that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship. Unlike big-red peppers, both production risk and price risk are negatively related to farm income (Table 10).

Table 10. Risk-to-return test results for Cayenne Pepper, Big Chili and Curly Chili in the Lombok Island, 2022

Type of Chili	Variable Correlation	Coef Value. Correlation (Pearson correlation)	Significance Test (P-Value)	Strength Connection
1. Cayenne Pepper	Production-Revenue Risk	0.339	0.067*	Less Strong
	Price Risk - Revenue	-0.518	0.003***	Very strong
2. Big-red Chili	Production-Revenue Account	-0.404	0.027**	Less Strong
	Price Risk - Revenue	-0.021	0.265.	Less Strong

3. Curly Chili	Production-Revenue Risk	0.071	0.708	Less Strong
	Price Risk - Revenue	-0.599	0.001***	Very strong

Source: Primary data processed (2022),

In the cultivation of cayenne pepper, chili big-red and chili de cayenne, the production risk during the rainy season is on average higher than in the dry season, which is characterized by a decrease in production, but the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than the dry season, during which production risk is lower. Meanwhile, for big-red chili peppers, a big-red production risk is indicated by a decline in production during the rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

On the other hand, in the dry season the average price risk faced by farmers of bird's eye chili peppers, big-red chili peppers and curly chili peppers increases and is greater than in the rainy season; marked by a sharp fall in prices. This drastic price reduction was not followed by a sharp increase in production, so income earned was low, even for cayenne pepper and chili peppers, much lower than income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income; Also, low risk is not always followed by high farm income. What is more decisive and logical is the courage of farmers in the face of the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production inputs, the more likely farmers are to earn higher incomes or profits (Ellis, 1988; Siddik, *et al*, 2021).

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

The cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island has fairly high and varied agricultural risks. The cayenne pepper crop has the lowest production risk (0.45) and is significantly different from the curly pepper crop (0.49) and the big-red pepper crop (0.51), which have high risk. In contrast to price risk, the cayenne pepper crop has the highest risk (0.57) compared to the big-red chili crop (0.49) and the curly chili crop (0.46). Incomes from cayenne pepper cultivation are higher and significantly different than those from

chile big-red and chile curly. The average income from cayenne pepper cultivation is IDR 59.19 million/ha; while in the great cultivation of chili it is IDR 37.82 million/ha, not significantly different from the agricultural income of curly pepper of IDR 37.10 million/ha. Production risk in the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, chile big-red, and chili curly crops.

### **Police notice**

Considering that bird's eye chillies, big-red chillies and curly chillies can be substituted to some extent, in order to reduce the production risk and price risk of chillies in the Lombok Island, this can be achieved by developing the three types of commodities in a balanced manner. in suitable places for each type of chile. There is a tendency for cayenne pepper to be better suited for development on low to medium plains; while big-red chiles and curly chiles are more suitable to develop in medium and highland areas. There is a need for technical guidance on the cultivation of chili, especially for big-red producers of chili and curly chili, because the level of production produced is still low and lower than the level of production produced by cayenne pepper. The government also needs to initiate and facilitate the establishment of cooperative associations between farmers and companies that supply and distribute chili products, as well as with insurance companies, to increase the enthusiasm of farmers for the three types of chili, so that the annual inflation contributed by this product decreases and the welfare of the farmers is guaranteed.



Prof Spencer C. Bowden <contact@oakfortressproofreading.com>

Kepada:

siddikunram60@gmail.com

Cc:

tajidan@unram.ac.id

Jum, 21 Okt 2022 jam 13.14

Ms. Number: OAK-S-22-659.NAM NGUYEN

Author: Muhamad Siddik

Ms. Title: The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Processing Fee: 268 US Dollars

Discount Fee: 28 US Dollars

Amount Payable After Discount: 240 US Dollars

Turnaround Time: 3 Days\* Effective from the day of payment

Dear Dr. M. Tajidan,

We wish to acknowledge the receipt of your manuscript by our Administrative Office.

Underneath is the payment ticket that has been generated for you to pay \$240 for your sent manuscript.

PAYMENT TICKET (Pay with your Visa/Mastercard/Diners/Amex cards direct)

<https://paystack.com/pay/nhtbdehsg>

Best regards,

Prof. Spencer C. Bowden

Editorial Board Chairman

Oak-fortress Proofreading International

<http://oakfortressproofreading.com>

## The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Muhamad Siddik; Dwi Praptomo Sudjatmiko, Bambang Dipokusumo, and Anwar Anwar; Tajidan Tajidan

Correspondence e-mail: [siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)

**Abstract:** The aim of this research is to find a comparison of production risk and price risk between types of ~~chillies~~ chili which has never been done before; and analyze the relationship between production ~~and price risk and price risk~~ with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The study ~~employed used~~ an explanatory method in three subdistricts/villages that cultivated the three types of chili in a balanced way, each representing the highlands, middle land, and lowlands. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way ~~and used~~. ~~Data collection uses~~ structured ~~and interviews~~, in-depth interviews, field observations, virtual surveys, desk study, and documentation. Risk measurement ~~useds~~ variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of ~~chillies~~ chili cultivation were statistically tested with the LSD (*Least Significantly Different*) test. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. ~~The study revealed that t~~The production risk of cayenne pepper ~~was considered as was found to be~~ the lowest and significantly different from the production risk of the curly chili crop and the big-red chili crop which have high risk. In contrast to price risk, the cayenne pepper crop falls into the high-risk category and is significantly different from the price risk of big-red chili peppers and curly chili peppers. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

**Keywords:** *comparative risk*, correlation, price, production, *type of chillies*.

## INTRODUCTION

Chili is one of the most important agricultural and food staples in Indonesia (Mariyono, and Sumarno, 2015), ~~due to it is because in addition to being~~ widely cultivated and a source of income for many residents, ~~it is~~ also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity (Frankel, 2011), because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months the price is very low and in other months the price increases sharply (Zaini, *et al*, 2014)

The fluctuating price of chili ~~wasis~~ due to the erratic production and supply of chili (Susanawati, *et al*, 2021), while the demand ~~wasis~~ relatively constant. At certain times, production and supply are very low ~~which gave an impact to the~~, ~~causing~~ chili's prices to rise sharply. Meanwhile, at other times the production and supply of chili peppers ~~wereis~~ abundant, so the price of chili peppers drops drastically (Siddik, *et al*, 2018). This condition causes the

commodity crop of chili to face production risks and price risks that are quite considerably high (Siddik, *et al*, 2019).

Theoretically, the courage of farmers to face agricultural risks determines productivity and income from agriculture (Mariyono, 2017). If farmers ~~behave~~ acts with fear of risk (risk *aversion*), then the utilization of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and farm income lower can be produced. But if farmers are risk *takers*, then resource utilization will be optimal for maximum productivity and income, but with the possibility of increased risk of loss (Ellis, 1988). Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of ~~this~~ crop production.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili (Nugroho, 2016). In ~~the~~ Lombok Island, the most cultivated type of chili is cayenne pepper (BPS, 2020). However, among the cayenne pepper plants, many farmers were also found to grow big-red chilis or curly chilis in the same stretch and season. Farmers' choice in determining the type of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study aims to: (1) analyze the differences in risk and income from the cultivation of cayenne pepper, chile big-red, and chili curly; and (2) ~~to~~ analyze the relationship between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper, and curly pepper in ~~the~~ Lombok Island.

## RESEARCH METHODS

### *Research subjects.*

This research was carried out in Lombok Island, West Nusa Tenggara Province, Indonesia. The research topics ~~wasere~~ the cultivation of cayenne pepper, chile big-red, and chili curly, which were grown during the 2021/2022 rainy and dry seasons. In the Lombok Island, the rainy season usually occurs from November to April~~1~~; and the dry season from May to October (NTB BPS in Figures, 2019-2021).

### *Research Design.*

The research was designed using an explanatory method which, ~~that is, research that~~ aims to explain and relate one variable to another that is different but interrelated and produces a causal relationship (Rodder & Lotters, 2010). The research location was determined in stages (multi-

stage purposive sampling) starting from the district/city, sub-district level to the village level (Nazir, 2010). The selection of districts/cities was based on the centers of production of the three types of chili; therefore, East Lombok Regency was chosen. In addition, three districts/villages that cultivated the three types of chili in a more balanced way were selected; and each is expected to represent lowland areas (<200 msl), midlands-plains (200-500 msl), and upland areas (>500 msl). Jerowaru District/Jerowaru Village was then selected to represent the lowland areas; then Aikmel district/Kalijaga village, representing the midlands-plains area; and Pringgasela District/Pringgasela Village representing the highlands.

**Research respondents.**

Research respondents were farmers who grow cayenne pepper, chile big-red, or chili curly during the rainy season and/or dry season in 2021/2022. In each sub-district/village, 10 farmers were selected by random sampling, each growing cayenne pepper, chili pepper or chili curly, so that the total number of respondents was 90 people.

**Data collection.**

Data collection was carried out by combining several methods simultaneously, namely the method of structured interviews using a list of questions (Newcomer, et al, 2015), in-depth interviews; field observations, virtual surveys, literature studies and documentation (Adams, et al. 2008). The structured interview was aimed at the surveyed farmers who grow cayenne pepper, chile big-red or chili curly, however, the in-depth interviews were aimed at community leaders who know about chile cultivation and the problems it faces, as well as government policies related to agricultural development.

**Data analysis.**

The farm risk studied is the production risk and the price risk. The measurement of both risks uses the variance, the standard deviation and the coefficient of variation (Anderson et al., 1977). Production variation and price variation as a measure of production risk and price risk are based on the experience of farmers carrying out chili cultivation activities before (Farianti, 2008; Siddik, 2015).

$$I_{-} = q_{ih} Q_{ih} + q_{go} Q_{go} + q_{in} Q_{in}, \dots\dots\dots [3.1]$$

$$\sigma_{-}^2 = q_{ih} [Q_{ih} - \mu_i]^2 + q_{ir} [Q_{ir} - \mu_i]^2 + q_{in} [Q_{in} - \mu_i]^2 \dots\dots\dots [3.2]$$

$$I_{-} = q_{ih} P_{ih} + q_{ir} P_{ir} + q_{in} P_{in}, \dots\dots\dots [3.3]$$

$$\sigma_{-}^2 = q_{ih} [P_{ih} - \theta_i]^2 + q_{ir} [P_{ir} - \theta_i]^2 + q_{in} [P_{in} - \theta_i]^2 \dots\dots\dots [3.4]$$

Information:

- $Q$  = Production of each type of chili ( Kg/Are)
- $\mu_i$  = Expected production of each type of chili (kg)
- $\sigma_i^2$  = Variance or risk of production of each type of chili
- $P$  = Price of each type of chili (IDR/kg)
- $\theta_i$  = Ekspektasi harga setiap jenis cabai (Rp/Kg)
- $\sigma_i^2$  = Price variation or risk for each type of chili
- $i$  = sample or respondent  $i$
- $q$  = Production opportunity or price opportunity for each type of chili (%)
- $h, r, n$  = Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

In addition, to analyze the level of production risk and price risk for each type of chili, the coefficient of variation is used as follows, with the formula:

$$CV_{qj} = \frac{\sigma_j}{Q_j} \dots \dots \dots [3.5]$$

$$CV_{pj} = \frac{\sigma_j}{P_j} \dots \dots \dots [3.6]$$

Where:

- $CV_{qj}$  = Production of variation coefficient for each type of chili
- $\sigma_j$  = Standard deviation of production for each type of chili
- $CV_{pj}$  = Price of variation coefficient for each type of chili
- $\sigma_j$  = Standard deviation of the price of each type of chili
- $j$  = Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

If the coefficient of variation of  $CV_{qj}$  or  $CV_{pj}$  is greater than 0.5, the production or price risk is in the high category, however, but if it is less than or equal to 0.5 it is included in the low risk category.

Furthermore, farm income is measured by reducing the value of production with all production costs. The value of production is the product multiplied by the price of production.

**Formatted:** Space Before: 12 pt, Border: Top: (No border), Bottom: (No border), Left: (No border), Right: (No border), Between : (No border)

$$q_j = \sum_{k=1}^m Q_k \dots\dots\dots [3.9]$$

$$tc = CV + HR \dots\dots\dots [3.10]$$

$$\Pi_j = \sum_{k=1}^m P_k \times Q_k - CT \dots\dots\dots [3.11]$$

**Information Where:**

- $Q_k$  = Production of each type of chili (kg/Ha)
- $\Pi$  = Agricultural income for each type of chili (IDR000)
- $P$  = Price of each type of chili (IDR/kg)
- $TC$  = Total cost ~~or total cost~~ of each type of chili (IDR)
- $CV$  = Variable cost ~~or variable costs~~ (IDR)
- $CF$  = Fixed cost ~~or fixed costs~~ (IDR)
- $j$  = Type of chili (cayenne pepper, big-red chili, curly chili)
- $m$  = The number of times harvested for each type of chili.
- $k$  = The k-th harvest (k = 1, 2, 3, ..... m) of each type of chili

To compare the risks and returns of growing cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical test (*analysis of variance*) or the F test; then proceed with the LSD (*Least Significantly Different*) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Table 1).

Table 1. Differences of ANOVA and F-test in risk and income of cayenne pepper, chile big-red and chile curly crops.

Origin of variance	H.H	DF	Millisecond	F account
Between Groups (b)	$SS_b$	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	$SS_w = SS_T - SS_b$	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	$SS_T$	nk-1		

**Information:**

Df = Degrees of freedom

SS= Sum of Squares  
 MS = Sum of mean squares  
 SS<sub>T</sub> = Square Sum *Total (Square Sum Total)*  
 SS<sub>b</sub> = Sum of squares between groups (*Sum of Square Between*)  
 SS<sub>w</sub> = Sum of squares in the group (*Sum of squares within*)  
 n = Number of data or samples  
 k = number of groups or types of chiles

The decision criterion, if F count > F table at an error rate ( $\alpha$ ) of 10%, then there is a difference in the risk or income of cayenne pepper, big-red chili and curly chili farming. Conversely, if F count  $\leq$  F table, then there is no difference in risk or income for the three types of chili.

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD (*Least Significantly Different*) test, to individually test the difference in risk or farm income for each type of pepper. To calculate the LSD value, some data is needed from the ANOVA calculations, namely MS<sub>E</sub> (*mean square error*) data, df (degrees of freedom), r (number of samples for each group or type of chili) and Student's t tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df} \cdot \sqrt{\frac{2(MSE)}{r}}) \dots \dots \dots [3.12]$$

The decision criterion, if the difference between two variables is greater than LSD <sub>$\alpha$</sub>  then the two variables (agricultural risk or income) show a significant difference. But if the difference between two variables is less than or equal to LSD <sub>$\alpha$</sub>  then the two variables are not significantly different.

In addition, to analyze the relationship between production risk and price risk with agricultural income for each type of chili, the Pearson correlation coefficient (r) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad [3.16]$$

Where:

- X = Production risk or price risk for each type of chili
- Y = Agricultural income for each type of chile

## RESULTS AND DISCUSSION

**Formatted:** Space Before: 0 pt, Border: Top: (No border), Bottom: (No border), Left: (No border), Right: (No border), Between : (No border)

## Differences in Risks of Cultivation of Cayenne Pepper, Chili Big-red and Chili Curly

### Production Risk.

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal and low production) based on experience in carrying out activities. chili cultivation. In addition, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big-red chili and curly chili can be seen in Table 2.

Table 2. Production risks of growing cayenne pepper, big-red chili peppers and curly chili peppers in the Lombok Island, 2022.

No	Description	Little Chili	Big-Red Chili	Curly Chili
1	Production Variations	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Source: Primary Data Analysis (2022)

Table 2 showed that the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili was quite high, but the highest was the big-red chili (0.51), then the curly chili (0.49) and the most-low was cayenne pepper (0.45). This means that the production risk of the chilli crop on the island of Lombok was quite risky, but the big-red chilli crop is included in the high-risk category ( $CVq > 0.50$ ), while the curly chillies, especially the allspice cayenne, are still included in the low production risk category.

The results of the LSD test on the differences in risk of cayenne pepper, big-red chili, and curly chili also showed that the risk of cayenne pepper production was lower and significantly different from the risk of big-red chili production., including curly pepper, with a confidence



level of more than 95 percent ( $\alpha = 5\%$ ); Meanwhile, there is no convincing difference between the production risks of big-red and curly peppers at this level of confidence (Table 3).

Table 3. Yield Risk results of the comparative test (LSD) of the cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022.

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big-red Chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684
	Big-red Chili	-.01633	.01060	.127	-.0374	.0047

\*. The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The lower value of the coefficient of variation of cayenne pepper production indicates that cayenne pepper farmers/growers are better able to control the risk (variation) of production, compared to curly pepper growers, more than big-red chilli farmers/growers. -big-red-

The results of this study are different from the results of Mala *et al. Alabama*. (2021) in the Sumberrejo district shows that there is no significant difference between the production risk and the income risk of the cultivation of chili big-red and cayenne pepper, but the price risk of chili big-red is higher compared to the cayenne pepper price risk. This condition identified shows that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of Amin and Prihantini (2021) and Alfianor, et al., (2018) who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper was considered to be a profitable and viable agricultural business (Puspitasari, 2020; Light and Wake, 2020).

### Price risk.

Price risk was also analyzed in the same way as production risk, but the results of the analysis are contradictory. Table 4 shows that the coefficient of variation of prices (CVp) for the cayenne pepper crop is the highest (0.57) compared to the big-red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

Table 4. Price risk for cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022.

No	Description	Little Chili	Big-red Chili	Curly Chili
1	Price Variations Price Standard	182,631,715	64,434,463	68,134,808
2	Deviation Price Variation	13,514	8027	8,254
3	Coefficient	0.57	0.49	0.46

Source: Primary Data Analysis (2022).

The results of this analysis indicated that the cayenne pepper crop in the Lombok Island is in the high price risk category ( $CV_p > 0.5$ ), while big-red chili peppers and curly chili peppers are not included in the price risk category of high price, although the coefficient of variation is quite big-red, but still below 0.50. The results of this study are consistent with the results of previous studies (Siddik *et al.*, 2021), that the price risk of cayenne pepper in the cayenne pepper production centers in the Lombok Island, both in the highlands, midlands-plains, and lowlands, is listed in the high-risk category.

If the difference in price risk of bird's eye peppers, big-red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, then all three types of peppers have a significantly different price risk, both between cayenne pepper and ~~chili~~ big-red ~~chilis~~ and ~~chili~~ curly peppers, or between chili peppers, big-red and chili curly peppers (Table 5).

Table 5. Price Risk from Comparative Test Results (LSD) for Cayenne, Big-red Chili and Curly Chili in the Lombok Island, 2022

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower bound	Upper bound
Cayenne pepper	Big-red Chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big-red Chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big-red Chili	-.02900	.01583	.070	-.0605	.0025

\*The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The results of the analysis and the statistical tests of production risk and price risk above, although they show that showed that there are differences in the level of risk faced, in general all three are quite high production and price risks, as indicated by the coefficients of variation. In all three, the coefficient of variation of production and the coefficient of

variation of price relatively high. However, the big-red chili st possible loss caused by production risk is faced by the big-red chili crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big-red st possible loss caused by price risk is faced by the cayenne pepper crop, then the big-red and small chili crop by the curly chili crop.

### Differences in farm income for cayenne pepper, chile big-red, and chili curly

This study assumes that when choosing and carrying out chili cultivation activities, farmers are oriented to obtain the maximum income or profit. To achieve this objective is highly dependent on the production produced, the price received and the costs incurred, the difference in income for the three types of chili cultivation also depends on these three factors.

#### Production and Prices.

Production is the total earning generated yield of chili as a whole from the first harvest to the last harvest, converted into units of hectares. While the price is the average value of production per kilogram of chili received by farmers from the first harvest to the last harvest. The results show ed that the production of cayenne pepper, chili big-red and chili curly in 2021/2022 differs quite a bit between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the dry season it is 5.1 tons/ha; chile big-red in the rainy season at 3.3 tons/ha and in the dry season at 4.7 tons/ha; and curly pepper, the production rate in the rainy season is 3.1 ton/ha and in the dry season it is 4.6 ton/ha (Table 6).

Table 6. Average production and price of cayenne pepper, big-red chili and curly chili in the Lombok Island, 2021/2022

No	Season	Cayenne pepper		Big-red Chili		Curly chili	
		Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

Source: Primary Data Processed (2022)

The data above is the If the seasonal production level is above, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average

of 4.3 tonnes/ha, then chile big-red 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three types of chilli is irrelevant for the comparison, but when compared to the production of similar chillies the previous year in East Lombok Regency, it seems that the chilli production in 2021/2022 has decreased considerably. East Lombok Regency BPS data in figures (2022) show~~eds~~ that the productivity of cayenne pepper in East Lombok Regency in 2021 is 7.8 tonnes/ha and big-red chilli (including curly chilli) is 10, 8 tons/ha. Relatively, the ~~similarame~~ results were also found in the research by Siddik, *et al.* (2021) that the productivity of cayenne pepper in the areas of the chilli production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicate~~ds~~ that chilli productivity on Lombok Island is big-red~~ly~~ determined by location, weather conditions, and other external factors.

Although the production of chili in 2021/2022 has decreased drastically, the sale price has increased considerably, ~~particularlyespeeially~~ during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR ~~20.000-thousand~~/kg and IDR 16 thousand/kg (Siddik *et al.*, 2021), while in 2021/2022 the average price received by farmers during the rainy season is IDR ~~41.000-thousand~~/kg and in the dry season an average of IDR ~~15.000-thousand~~/ha. Therefore, although during the rainy season the level of production of farmers falls drastically, farmers do not feel a loss, because it is covered by a sharp increase in sales prices. In contrast to the dry season, production did not increase much, but prices fell sharply to around IDR ~~15.000-thousand~~/kg less than in 2021, which fell to IDR ~~16.000 thousand~~/kg. Differences or fluctuations in chili prices during the rainy season and the dry season occur for all types of chili, but the most marked difference is cayenne pepper ~~which~~ reaches around IDR ~~26.000-thousand~~/kg, and around IDR ~~17.000-thousand~~/kg. While for big-red chillies, the price difference is relatively small, around IDR 7,500/kg. This difference indicate~~ds~~ that the annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili and the lowest is big-red chili.

#### **Commercial costs.**

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis show~~ed~~ that the cost of growing cayenne pepper is higher than the cost of growing big-red chili peppers and curly chili peppers, especially during the rainy season. In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of chili big-red is IDR 44

million/ha and curly pepper IDR 43 million/ha. During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, chile big-red IDR 42 million/ha and curly pepper IDR 37 million/ha (Table 7).

Table 7. Average cost of cayenne pepper, big chili and curly chili (IDR000/ha) in Lombok Island, 2022

No	Description	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
<b>A. Variable Costs</b>		<b>42,074</b>	<b>30,689</b>	<b>33,159</b>	<b>30,991</b>	<b>31,907</b>	<b>26,508</b>
1	Saprodi	16,396	13,006	13,267	13,471	11,885	11,188
2	Labor	13,212	10,555	9,117	8,298	8,397	7,047
3	Cost of Other Input Production	12,466	7,127	10,775	9,223	11,625	8,273
<b>B. Fixed Costs</b>		<b>14,240</b>	<b>12,257</b>	<b>11,329</b>	<b>11,427</b>	<b>11,173</b>	<b>11,390</b>
1	Land lease	13,178	11,082	10,597	10,490	9,981	10,236
2	Land Tax	247	215	189	208	193	150
3	Water Fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
<b>Totals (A+B)</b>		<b>56,314</b>	<b>42,946</b>	<b>44,488</b>	<b>42,419</b>	<b>43,080</b>	<b>37,899</b>

Source: Primary Data Processed (2022).

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds, fertilizers, growth stimulants and drug costs. Then labor costs and other support facilities like plastic mulch and stakes. These variable inputs cost about 70 percent of total farm costs. Although fixed inputs consist of income and land taxes, equipment depreciation, water costs, and interest on loan capital, no farmers used loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million to IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season. ~~But~~ because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

#### ***Income and Agricultural Efficiency.***

Although the chilli production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year, because this decrease was offset by a fairly high increase in chilli prices during the rainy season, farm income obtained are still quite high and agriculture is considered efficient. The highest income and agricultural efficiency in the rainy season is obtained with the cultivation of cayenne pepper, which reaches IDR 89 million/ha with a CR ratio of 2.58; then the curly chile crop of IDR 51 million/ha with RC 2.21 and the lowest is the

income from the big-red chili crop, which amounts to IDR. 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big-red cultivation of chili, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Table 8).

Table 8. Average production, prices, production value, production costs and farm income of cayenne pepper, chili pepper and curly pepper in the Lombok Island, 2021/2022

No	Component	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2,21	1.66

Source: Primary Data Analysis (2022).

The When-income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27 million/ha. Meanwhile, for the big-red chili crop, the difference is less than IDR 3 million/ha. This means that the big-red chili crop has a relatively stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crop is very volatile. This indicates that the cayenne pepper and curly chili crop has a high-income risk, while chili cultivation Chili cultivation has low income risk.

#### **Commercial Rent.**

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big-red chili costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD (*Least Significantly Different*) test.

Based on the results of the LSD test in Table 9, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income from the big-red chili pepper crop and curly chili. Meanwhile, the income from the big-red chili crop and the curly chili do not show a convincing difference in income. The results of this

trial provide an explanation for the reasons why farmers in the Lombok Island, especially in East Lombok Regency, prefer to plant bird's eye chilies instead of big-red chilies or curly chilies.

Table 9. Comparative test results (LSD) Farm income from cayenne pepper, big-red chili and curly chili in Lombok Island, 2022

Comparison between		Mean Difference (IJ)	std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	21367.133 *	6618730	002	8211.69	34522.58
	Curly chili	22082.767 *	6618730	001	8927.32	35238.21
Big-red Chili	Cayenne pepper	-21367.133 *	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767 *	6618730	001	-35238.21	-8927.32
	Big-red Chili	-715,633	6618730	.914	-13871.08	12439.81

\*. The mean difference is significant at the 0.05 level.

Source: Primary data processed (2022)

#### Relationship between Production Risk and Price Risk with Agricultural Income.

The results of the Pearson correlation analysis show that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship. Unlike big-red peppers, both production risk and price risk are negatively related to farm income (Table 10).

Table 10. Risk-to-return test results for Cayenne Pepper, Big Chili and Curly Chili in the Lombok Island, 2022

Type of Chili	Variable Correlation	Coef Value. Correlation (Pearson correlation)	Significance Test (P-Value)	Strength Connection
1. Cayenne Pepper	Production-Revenue Risk	0.339	0.067*	Less Strong
	Price Risk - Revenue	-0.518	0.003***	Very strong
2. Big-red Chili	Production-Revenue Account	-0.404	0.027**	Less Strong
	Price Risk - Revenue	-0.021	0.265.	Less Strong
3. Curly Chili	Production-Revenue Risk	0.071	0.708	Less Strong
	Price Risk - Revenue	-0.599	0.001***	Very strong

Source: Primary data processed (2022),

In the cultivation of cayenne pepper, chili big-red and ~~chili-de~~ cayenne pepper, the production risk during the rainy season is on average higher than in the dry season, which is characterized by a decrease in production, ~~however~~but the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than the dry season, during which production risk is lower. Meanwhile, for big-red chili peppers, a big-red production risk is indicated by a decline in production during the rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

On the other hand, in the dry season the average price risk faced by farmers of cayenne bird's eye chili peppers, big-red chili peppers and curly chili peppers increases and is greater than in the rainy season; marked by a sharp fall in prices. This drastic price reduction was not followed by a sharp increase in production, ~~therefore~~so income earned was low, even for cayenne pepper and chili peppers, much lower than income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income; ~~Also,~~also, low risk is not always followed by high farm income. What is more decisive and logical is the courage of farmers in the face of the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production inputs, the more likely farmers are to earn higher incomes or profits (Ellis, 1988; Siddik, *et al*, 2021).

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

The cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island has fairly high and varied agricultural risks. The cayenne pepper crop has the lowest production risk (0.45) and is significantly different from the curly pepper crop (0.49) and the big-red pepper crop (0.51), which have high risk. In contrast to price risk, the cayenne pepper crop has the highest risk (0.57) compared to the big-red chili crop (0.49) and the curly chili crop (0.46).



Incomes from cayenne pepper cultivation are higher and significantly different than those from chile big-red and chile curly. The average income from cayenne pepper cultivation is IDR 59.19 million/ha, while in the great cultivation of chili it is IDR 37.82 million/ha, not significantly different from the agricultural income of curly pepper of IDR 37.10 million/ha. Production risk in the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, chile big-red, and chili curly crops.

### **Police notice**

Considering that bird's-eye cayenne chillies, big-red chillies and curly chillies can be substituted to some extent, in order to reduce the production risk and price risk of chillies in the Lombok Island, this can be achieved by developing the three types of commodities in a balanced manner in suitable places for each type of chili. There is a tendency for cayenne pepper to be better suited for development on low to midland sedium plains, while big-red chiles and curly chiles are more suitable to develop in medium and highland areas. There is a need for technical guidance on the cultivation of chili, especially for big-red producers of chili and curly chili, because the level of production produced is still low and lower than the level of production produced by cayenne pepper. The government also needs to initiate and facilitate the establishment of cooperative associations between farmers and companies that supply and distribute chili products, as well as with insurance companies, to increase the enthusiasm of farmers for the three types of chili, so that the annual inflation contributed by this product decreases and the welfare of the farmers is guaranteed.

### **Result of Revision:**

#### **The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island**

Muhamad Siddik; Dwi Praptomo Sudjatkiko, Bambang Dipokusumo, and  
Anwar Anwar; Tajidan Tajidan

Correspondence e-mail: [siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)

**Abstract:** The aim of this research is to find a comparison of production risk and price risk between types of chillies which has never been done before; and analyze the relationship

between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The study used an explanatory method in three sub districts/villages that cultivated the three types of chili in a balanced way, each representing the highlands, middle land, and lowlands. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way. Data collection uses structured interviews, in-depth interviews, field observations, virtual surveys, desk study, and documentation. Risk measurement uses variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of chili cultivation were statistically tested with the *Least Significantly Different test*. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. The production risk of cayenne pepper was found to be the lowest and significantly different from the production risk of the curly chili crop and the big-red chili crop which have high risk. In contrast to price risk, the cayenne pepper crop falls into the high-risk category and is significantly different from the price risk of big-red chili peppers and curly chili peppers. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

**Keywords:** correlation, price, production, type of chili,

## INTRODUCTION

Chili is one of the most important agricultural and food staples in Indonesia (Mariyono, and [Sumarno](#), 2015), because in addition to being widely cultivated and a source of income for many residents, it is also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity (Frankel, 2011), because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months the price is very low and in other months the price increases sharply ([Zaini, et al](#), 2014)

The fluctuating price of chili is due to the erratic production and supply of chili ([Susanawati, et al](#), 2021), while the demand is relatively constant. At certain times, production and supply are very low, causing chili prices to rise sharply. Meanwhile, at other times the production and supply of chili peppers is abundant, so the price of chili peppers drops drastically ([Siddik, et al](#), 2018). This condition causes the commodity crop of chili to face production risks and price risks that are quite high ([Siddik, et al](#), 2019).

Theoretically, the courage of farmers to face agricultural risks determines productivity and income from agriculture (Mariyono, 2017). If farmers behave with fear of risk (risk *aversion*), then the utilization of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and lower farm income. But if farmers are risk *takers*,

then resource utilization will be optimal for maximum productivity and income, but with the possibility of increased risk of loss (Ellis, 1988). Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of this crop.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili (Nugroho, 2016). In Lombok Island, the most cultivated type of chili is cayenne pepper (BPS, 2020). However, among the cayenne pepper plants, many farmers were also found to grow big-red chilis or curly chilis in the same stretch and season. Farmers' choice in determining the type of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study aims to: (1) analyze the differences in risk and income from the cultivation of cayenne pepper, chile big-red, and chili curly; and (2) to analyze the relationship between production risk and price risk with income from the cultivation of cayenne pepper, big-red pepper, and curly pepper in the Lombok Island.

## **RESEARCH METHODS**

### ***Research subjects.***

This research was carried out in Lombok Island, West Nusa Tenggara Province, Indonesia. The research topics were the cultivation of cayenne pepper, chile big-red, and chili curly, which were grown during the 2021/2022 rainy and dry seasons. In Lombok Island, the rainy season usually occurs from November to April; and the dry season from May to October (NTB BPS in Figures, 2019-2021).

### ***Research Design.***

The research was designed using an explanatory method, that is, research that aims to explain and relate one variable to another that is different but interrelated and produces a causal relationship (Rodder & Lotters, 2010). The research location was determined in stages (*multi-stage purposive sampling*) starting from the district/city, sub-district level to the village level (Nazir, 2010). The selection of districts/cities was based on the centers of production of the three types of chili; therefore, East Lombok Regency was chosen. In addition, three districts/villages that cultivated the three types of chili in a more balanced way were selected; and each is expected to represent lowland areas (<200 msl), mid-plains (200-500 msl), and upland areas (>500 msl). Jerowaru District/Jerowaru Village was then selected to represent the lowland areas; then Aikmel district/Kalijaga village, representing the mid-plains area; and Pringgasela District/Pringgasela Village representing the highlands.

**Research respondents.**

Research respondents are farmers who grow cayenne pepper, chile big-red, or chili curly during the rainy season and/or dry season in 2021/2022. In each sub-district/village, 10 farmers were selected by random sampling, each growing cayenne pepper, chili pepper or chili curly, so that the total number of respondents was 90 people.

**Data collection.**

Data collection was carried out by combining several methods simultaneously, namely the method of structured interviews using a list of questions (Newcomer, et al, 2015), in-depth interviews; field observations, virtual surveys, literature studies and documentation (Adams, et al. 2008). The structured interview is aimed at the surveyed farmers who grow cayenne pepper, chile big-red or chili curly. The in-depth interviews were aimed at community leaders who know about chile cultivation and the problems it faces, as well as government policies related to agricultural development.

**Data analysis.** The farm risk studied is the production risk and the price risk. The measurement of both risks uses the variance, the standard deviation and the coefficient of variation (Anderson et al., 1977). Production variation and price variation as a measure of production risk and price risk are based on the experience of farmers carrying out chili cultivation activities before (Farianti, 2008; Siddik, 2015).

$I_{-}$	$= q_{ih} Q_{ih} + q_{go} Q_{go} + q_{in} Q_{in}, \dots\dots\dots$	[3.1]
$\sigma^2_{-}$	$= q_{ih} [Q_{ih} - \mu_i]^2 + q_{ir} [Q_{ir} - \mu_i]^2 + q_{in} [Q_{in} - \mu_i]^2 \dots\dots\dots$	[3.2]
$I_{-}$	$= q_{ih} P_{ih} + q_{ir} P_{ir} + q_{in} P_{in}, \dots\dots\dots$	[3.3]
$\varphi_i^2$	$= q_{ih} [P_{ih} - \theta_i]^2 + q_{ir} [P_{ir} - \theta_i]^2 + q_{in} [P_{in} - \theta_i]^2 \dots\dots\dots$	[3.4]

**Information:**

wha	=	Production of each type of chili (kg/Ha)
$I_{-}$	=	Expected production of each type of chili (kg)
$\sigma^2_{-}$	=	Variance or risk of production of each type of chili
P	=	Price of each type of chili (IDR/kg)
$I_{-}$	=	Expected price of each type of chili (IDR/kg)
$\varphi_i^2$	=	Price variation or risk for each type of chili
Yo	=	sample or respondent i

what	=	Production opportunity or price opportunity for each type of chili (%)
hrn	=	Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

In addition, to analyze the level of production risk and price risk for each type of chili, the coefficient of variation is used, with the formula:

$CV_{qj}$	=	$\frac{j}{Q_j}$ .....	[3.5]
$CN_{pj}$	=	$\frac{j}{P_j}$ .....	[3.6]

Where:

$CV_{qj}$	=	Production variation coefficient for each type of chili
$\sigma_j$	=	Standard deviation of production for each type of chili
$CV_{pj}$	=	Price variation coefficient for each type of chili
$\Theta_j$	=	Standard deviation of the price of each type of chili
j	=	Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

If the coefficient of variation of  $CV_{qj}$  or  $CV_{pj}$  is greater than 0.5, the production or price risk is in the high category; but if it is less than or equal to 0.5 it is included in the low risk category.

Furthermore, farm income is measured by reducing the value of production with all production costs. The value of production is the product multiplied by the price of production.

$q_j$	=	$\sum_{k=1}^m Q_k$ .....	[3.9]
tc	=	CV + HR .....	[3.10]
$\Pi_j$	=	$\sum_{k=1}^m P_k \times Q_k$ -CT .....	[3.11]

Where:

What	=	Production of each type of chili (kg/Ha)
$\Pi$	=	Agricultural income for each type of chili (IDR000)
P	=	Price of each type of chili (IDR/kg)
Tc	=	Total cost or total cost of each type of chili (IDR)

CV	=	Variable cost or variable costs (IDR)	
CF	=	Fixed cost or fixed costs (IDR)	
J	=	Type of chili (cayenne pepper, big-red chili, curly chili)	
Met er	=	The number of times harvested for each type of chili.	
Wh at	=	The k-th harvest (k = 1, 2, 3, ..... m) of each type of chili	

To compare the risks and returns of growing cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical test (*analysis of variance*) or the F test; then proceed with the LSD (*Least Significantly Different*) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Table 1).

Table 1. Differences of ANOVA and F-test in risk and income of cayenne pepper, chile big-red and chile curly crops.

Origin of variance	H.H	DF	Millisecond	F account
Between Groups (b)	$SS_b$	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	$SS_w = SS_T - SS_b$	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	$SS_T$	nk-1		

Information:

- Df = Degrees of freedom
- SS = Sum of Squares
- MS = Sum of mean squares
- $SS_T$  = Square Sum *Total* (*Square Sum Total*)
- $SS_b$  = Sum of squares between groups (*Sum of Square Between*)
- $SS_w$  = Sum of squares in the group (*Sum of squares within*)
- n = Number of data or samples
- k = number of groups or types of chiles

The decision criterion, if F count > F table at an error rate ( $\alpha$ ) of 10%, then there is a difference in the risk or income of cayenne pepper, big-red chili and curly chili farming. Conversely, if F count  $\leq$  F table, then there is no difference in risk or income for the three types of chili.

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD (*Least Significantly Different*) test, to individually test the difference in risk or farm income for each type of pepper. To calculate the LSD value, some data is needed from the ANOVA calculations, namely  $MS_E$  (*mean square error*) data, df (degrees of freedom), r

(number of samples for each group or type of chili) and Student's t tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df} \cdot \sqrt{\frac{2(MSE)}{r}}) \dots \dots \dots [3.12]$$

The decision criterion, if the difference between two variables is greater than  $LSD_{\alpha}$ , then the two variables (agricultural risk or income) show a significant difference. But if the difference between two variables is less than or equal to  $LSD_{\alpha}$ , then the two variables are not significantly different.

In addition, to analyze the relationship between production risk and price risk with agricultural income for each type of chili, the Pearson correlation coefficient (r) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad [3.16]$$

Where:

X = Production risk or price risk for each type of chili

Y = Agricultural income for each type of chili

## RESULTS AND DISCUSSION

### Differences in Risks of Cultivation of Cayenne Pepper, Chili Big-red and Chili Curly

#### *Production Risk.*

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal and low production) based on experience in carrying out activities. chili cultivation. In addition, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big-red chili and curly chili can be seen in Table 2.

Table 2. Production risks of growing cayenne pepper, big-red chili peppers and curly chili peppers in the Lombok Island, 2022.

No	Description	Little Chili	Big-Red Chili	Curly Chili
----	-------------	--------------	---------------	-------------

1	Production Variations	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Source: Primary Data Analysis (2022)

Table 2 shows the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili is quite high, but the highest is the big-red chili (0.51), then the curly chili (0.49) and the most-low is cayenne pepper (0.45). This means that the production risk of the chilli crop on the island of Lombok is quite risky, but the big-red chili crop is included in the high-risk category ( $CVq > 0.50$ ), while the curly chillies, especially the allspice cayenne, are still included in the low production risk category.

The results of the LSD test on the differences in risk of cayenne pepper, big-red chili, and curly chili also show that the risk of cayenne pepper production is lower and significantly different from the risk of big-red chili production., including curly pepper, with a confidence level of more than 95 percent ( $\alpha = 5\%$ ); Meanwhile, there is no convincing difference between the production risks of big-red and curly peppers at this level of confidence (Table 3).

Table 3. Yield risk results of the comparative test (LSD) of the cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022

Comparison between		Mean Differences			95% Confidence Intervals	
		(IJ)	Std. Error	Sig.	Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big-red Chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684
	Big-red Chili	-.01633	.01060	.127	-.0374	.0047

\*. The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The lower value of the coefficient of variation of cayenne pepper production indicates that cayenne pepper growers are better able to control the risk (variation) of production, compared to curly pepper growers, more than chili growers. big-red.



The results of this study are different from the results of Mala *et al. Alabama*. (2021) in the Sumberrejo district shows that there is no significant difference between the production risk and the income risk of the cultivation of chili big-red and cayenne pepper, but the price risk of chili big-red is higher compared to the cayenne pepper price risk. This condition shows that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of Amin and Prihantini (2021) and Alfianor, et al., (2018) who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper is considered. be a profitable and viable agricultural business (Puspitasari, 2020; Light and Wake, 2020).

**Price risk.** Price risk is also analyzed in the same way as production risk, but the results of the analysis are contradictory. Table 4 shows that the coefficient of variation of prices (CVp) for the cayenne pepper crop is the highest (0.57) compared to the big-red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

Table 4. Price risk for cayenne pepper, big-red chili and curly chili in Lombok Island, 2022.

No	Description	Little Chili	Big-red Chili	Curly Chili
1	Price Variations	182,631,715	64,434,463	68,134,808
2	Price Standard Deviation	13,514	8027	8,254
3	Price Variation Coefficient	0.57	0.49	0.46

Source: Primary Data Analysis (2022).

The results of this analysis indicate that the cayenne pepper crop in the Lombok Island is in the high price risk category ( $CVp > 0.5$ ), while big-red chili peppers and curly chili peppers are not included in the price risk category. high price, although the coefficient of variation is quite big-red, but still below 0.50. The results of this study are consistent with the results of previous studies (Siddik *et al.*, 2021), that the price risk of cayenne pepper in the cayenne pepper production centers in the Lombok Island, both in the highlands, mid-plains, and lowlands, is listed in the high-risk category.

If the difference in price risk of bird's eye peppers, big-red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, then all three types of peppers have a significantly different price risk, both between cayenne pepper and chile big-reds and chili curly peppers, or between chili peppers big-red and chili curly peppers (Table 5).

Table 5. Price Risk from Comparative Test Results (LSD) for Cayenne, Big-red Chili and Curly Chili in the Lombok Island, 2022

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big-red Chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big-red Chili	-.02900	.01583	.070	-.0605	.0025

\*The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The results of the analysis and the statistical tests of production risk and price risk above, although they show that there are differences in the level of risk faced, in general all three are quite high production and price risks, as indicated by the coefficients of variation. relatively big-red. in all three, the coefficient of variation of production and the coefficient of variation of price. However, the big-redst possible loss caused by production risk is faced by the big-red chili crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big-redst possible loss caused by price risk is faced by the cayenne pepper crop, then the big-red and small chili crop by the curly chili crop.

#### **Differences in farm income for cayenne pepper, chile big-red, and chili curly**

This study assumes that when choosing and carrying out chili cultivation activities, farmers are oriented to obtain the maximum income or profit. To achieve this objective is highly dependent on the production produced, the price received and the costs incurred, the difference in income for the three types of chili cultivation also depends on these three factors.

#### ***Production and Prices.***

Production is the total yield of chili as a whole from the first harvest to the last harvest, converted into units of hectares. While the price is the average value of production per kilogram of chili received by farmers from the first harvest to the last harvest. The results show that the production of cayenne pepper, chili big-red and chili curly in 2021/2022 differs quite a bit

between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the dry season it is 5.1 tons/ha; chile big-red in the rainy season at 3.3 tons/ha and in the dry season at 4.7 tons/ha; and curly pepper, the production rate in the rainy season is 3.1 ton/ha and in the dry season it is 4.6 ton/ha (Table 6).

Table 6. Average production and price of cayenne pepper, big-red chili and curly chili in the Lombok Island, 2021/2022

No	Season	Cayenne pepper		Big-red Chili		Curly chili	
		Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

Source: Primary Data Processed (2022)

If the seasonal production level is above, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average of 4.3 tonnes/ha, then chile big-red 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three types of chili is irrelevant for the comparison, but when compared to the production of similar chillies the previous year in East Lombok Regency, it seems that the chili production in 2021/2022 has decreased considerably. East Lombok Regency BPS data in figures (2022) shows that the productivity of cayenne pepper in East Lombok Regency in 2021 is 7.8 tonnes/ha and big-red chili (including curly chili) is 10, 8 tons/ha. Relatively the same results were also found in the research by Siddik, *et al.* (2021) that the productivity of cayenne pepper in the areas of the chili production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicates that chili productivity on Lombok Island is big-redly determined by location, weather conditions, and other external factors.

Although the production of chili in 2021/2022 has decreased drastically, the sale price has increased considerably, especially during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR 20 thousand/kg and IDR 16 thousand/kg (Siddik *et al.*, 2021), while in 2021/2022 the average price received by farmers during the rainy season is IDR . 41 thousand/kg and in the dry season an average of IDR 15 thousand/ha. Therefore, although during the rainy season the level of production of farmers falls drastically, farmers do not feel a loss, because it is covered by a sharp increase in sales prices. In contrast to the dry

season, production did not increase much, but prices fell sharply to around IDR 15 thousand/kg less than in 2021, which fell to IDR 16 thousand/kg. Differences or fluctuations in chili prices during the rainy season and the dry season occur for all types of chili, but the most marked difference is cayenne pepper that reaches around IDR 26 thousand/kg, and around IDR 17 thousand/kg. While for big-red chillies, the price difference is relatively small, around IDR 7,000/kg. This difference indicates that the annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili and the lowest is big-red chili.

#### **Commercial costs.**

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis show that the cost of growing cayenne pepper is higher than the cost of growing big-red chili peppers and curly chili peppers, especially during the rainy season. In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of chili big-red is IDR 44 million/ha and curly pepper IDR 43 million/ha During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, chile big-red IDR 42 million/ha and curly pepper IDR 37 million/ha (Table 7).

Table 7. Average cost of cayenne pepper, big chili and curly chili (IDR000/ha) in Lombok Island, 2022

No	Description	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
<b>A. Variable Costs</b>		<b>42,074</b>	<b>30,689</b>	<b>33,159</b>	<b>30,991</b>	<b>31,907</b>	<b>26,508</b>
1	Saprodi	16,396	13006	13,267	13,471	11,885	11.188
2	Labor	13,212	10,555	9.117	8,298	8,397	7,047
Cost of Other Input							
3	Production	12,466	7.127	10,775	9,223	11,625	8,273
<b>B. Fixed Costs</b>		<b>14,240</b>	<b>12,257</b>	<b>11,329</b>	<b>11,427</b>	<b>11.173</b>	<b>11,390</b>
1	Land lease	13.178	11,082	10,597	10,490	9,981	10,236
2	Land Tax	247	215	189	208	193	150
3	Water Fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
<b>Totals (A+B)</b>		<b>56,314</b>	<b>42,946</b>	<b>44,488</b>	<b>42,419</b>	<b>43,080</b>	<b>37,899</b>

Source: Primary Data Processed (2022).

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds, fertilizers, growth stimulants and drug costs. Then labor costs and other support facilities like plastic mulch and stakes. These variable inputs

cost about 70 percent of total farm costs. Although fixed inputs consist of income and land taxes, equipment depreciation, water costs, and interest on loan capital, no farmers used loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million to IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season. But because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

### ***Income and Agricultural Efficiency.***

Although the chili production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year, because this decrease was offset by a fairly high increase in chili prices during the rainy season, farm income obtained is still quite high and agriculture is considered efficient. The highest income and agricultural efficiency in the rainy season is obtained with the cultivation of cayenne pepper, which reaches IDR 89 million/ha with a CR ratio of 2.58; then the curly chile crop of IDR 51 million/ha with RC 2.21 and the lowest is the income from the big-red chili crop, which amounts to IDR. 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big-red cultivation of chili, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Table 8).

Table 8. Average production, prices, production value, production costs and farm income of cayenne pepper, chili pepper and curly pepper in the Lombok Island, 2021/2022

No	Component	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2.21	1.66

Source: Primary Data Analysis (2022).

When income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27 million/ha. Meanwhile, for the big-red chili crop, the difference is less than IDR 3 million/ha. This means that the big-red chile crop has a relatively

stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crop is very volatile. This indicates that the cayenne pepper and curly chili crop has a high-income risk, while chili cultivation Chili cultivation has low income risk.

### **Commercial Rent.**

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big-red chile costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD (*Least Significantly Different*) test.

Based on the results of the LSD test in Table 9, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income from the big-red chili pepper crop. and curly chili; Meanwhile, the income from the big-red chili crop and the curly chili do not show a convincing difference in income. The results of this trial provide an explanation for the reasons why farmers in the Lombok Island, especially in East Lombok Regency, prefer to plant bird's eye chilies instead of big-red chilies or curly chilies.

Table 9. Comparative test results (LSD) Farm income from cayenne pepper, big-red chili and curly chili in Lombok Island, 2022

Comparison between		Mean Difference (II)	std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	21367.133 *	6618730	002	8211.69	34522.58
	Curly chili	22082.767 *	6618730	001	8927.32	35238.21
Big-red Chili	Cayenne pepper	-21367.133 *	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767 *	6618730	001	-35238.21	-8927.32
	Big-red Chili	-715,633	6618730	.914	-13871.08	12439.81

\*. The mean difference is significant at the 0.05 level.

Source: Primary data processed (2022)

### **Relationship between Production Risk and Price Risk with Agricultural Income.**

The results of the Pearson correlation analysis show that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship. Unlike big-red peppers, both production risk and price risk are negatively related to farm income (Table 10).

Table 10. Risk-to-return test results for Cayenne Pepper, Big Chili and Curly Chili in the Lombok Island, 2022

Type of Chili	Variable Correlation	Coef Value. Correlation (Pearson correlation)	Significance Test (P-Value)	Strength Connection
1. Cayenne Pepper	Production-Revenue Risk	0.339	0.067*	Less Strong
	Price Risk - Revenue	-0.518	0.003***	Very strong
2. Big-red Chili	Production-Revenue Account	-0.404	0.027**	Less Strong
	Price Risk - Revenue	-0.021	0.265.	Less Strong
3. Curly Chili	Production-Revenue Risk	0.071	0.708	Less Strong
	Price Risk - Revenue	-0.599	0.001***	Very strong

Source: Primary data processed (2022),

In the cultivation of cayenne pepper, chili big-red and chili de cayenne, the production risk during the rainy season is on average higher than in the dry season, which is characterized by a decrease in production, but the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than the dry season, during which production risk is lower. Meanwhile, for big-red chili peppers, a big-red production risk is indicated by a decline in production during the rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

On the other hand, in the dry season the average price risk faced by farmers of bird's eye chili peppers, big-red chili peppers and curly chili peppers increases and is greater than in the rainy season; marked by a sharp fall in prices. This drastic price reduction was not followed by a

sharp increase in production, so income earned was low, even for cayenne pepper and chili peppers, much lower than income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income; Also, low risk is not always followed by high farm income. What is more decisive and logical is the courage of farmers in the face of the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production inputs, the more likely farmers are to earn higher incomes or profits (Ellis, 1988; Siddik, *et al*, 2021).

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

The cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island has fairly high and varied agricultural risks. The cayenne pepper crop has the lowest production risk (0.45) and is significantly different from the curly pepper crop (0.49) and the big-red pepper crop (0.51), which have high risk. In contrast to price risk, the cayenne pepper crop has the highest risk (0.57) compared to the big-red chili crop (0.49) and the curly chili crop (0.46). Incomes from cayenne pepper cultivation are higher and significantly different than those from chile big-red and chile curly. The average income from cayenne pepper cultivation is IDR 59.19 million/ha; while in the great cultivation of chili it is IDR 37.82 million/ha, not significantly different from the agricultural income of curly pepper of IDR 37.10 million/ha. Production risk in the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, chile big-red, and chili curly crops.

### **Police notice**

Considering that bird's eye chillies, big-red chillies and curly chillies can be substituted to some extent, in order to reduce the production risk and price risk of chillies in the Lombok Island, this can be achieved by developing the three types of commodities in a balanced manner. in suitable places for each type of chili. There is a tendency for cayenne pepper to be better suited for development on low to medium plains; while big-red chiles and curly chiles are more suitable to develop in medium and highland areas. There is a need for technical guidance on the cultivation of chili, especially for big-red producers of chili and curly chili, because the



level of production produced is still low and lower than the level of production produced by cayenne pepper. The government also needs to initiate and facilitate the establishment of cooperative associations between farmers and companies that supply and distribute chili products, as well as with insurance companies, to increase the enthusiasm of farmers for the three types of chili, so that the annual inflation contributed by this product decreases and the welfare of the farmers is guaranteed.

## REFERENCES

- [Adams, A.](#) and Cox, Anna L. (2008). Questionnaires, in-depth interviews and focus groups. In: Cairns, Paul and Cox, Anna L. eds. *Research Methods for Human Computer Interaction*. Cambridge, UK: Cambridge University Press, pp. 17–34.  
<http://www.cambridge.org/catalogue/catalogue.asp?i...>
- Alfanor, Y. Ferrianta, Hamdani. 2018. Risk analysis of cayenne pepper production in Mailing Village, Padang Badung District, Hulu Sungai Selatan Regency. " *Agribusiness Frontier* 2(4). <http://ppjp.ulm.ac.id/journals/index.php/fag/article/view/663/650>.
- Amin, M. and Prihantini. CI, 2021. Risk Analysis of Canney Chili Production and Production in Watunohu District, North Kolaka Regency. *Agribusiness Magazine Dryland Agribusiness*: p.16–21.
- Anderson, J.R.; JL Dillon and JB Hardaker, 1977. *Farm Decision Analysis*. Iowa State University Press, Ames Iowa.
- Cahya, AA and RH. Br Bangun. 2020. "Farmer characteristics and agricultural viability of chili pepper (*Capsicum annum* L) and cayenne pepper (*Capsicum frutescens* L) in North Sumatra." *Agricore: Agribusiness and Socioeconomic Agriculture Magazine UNPAD* 5(1). <http://journal.unpad.ac.id/agricore/article/view/27139/pdf>.
- Ellis, F., 1988. *Peasant economy: peasant families and agrarian development*. Cambridge University Press, Cambridge.
- Fariyaanti, A., 2008. Economic behavior of vegetable farmer households in coping with production risks and commodity prices in Pangalengan district, Bandung regency. PhD thesis. IPB Graduate School, Bogor.
- Frankel, Jeffrey A. 2011. How Can Commodity Exporters Make Fiscal and Monetary Policy Less Procyclical? HKS Faculty Research Working Paper Series RWP11-015, John F. Kennedy School of Government, Harvard University.  
<https://dash.harvard.edu/handle/1/4735392>
- Mala, N, FE Prasmatiwi and WD Sayekti, 2021. Income and risks of chilli cultivation in Sumber Rejo district, Tanggamus regency". *Magazine of Agroindustry Sciences*. 9(1): p.91–98.
- Mariyono, J. and [Sumarno](#), S. 2015. Chilli production and adoption of chilli-based agribusiness in Indonesia. *Journal of Agribusiness in Developing and Emerging Economies*. ISSN: 2044-0839. Vol. 5 No. 1, pp. 57-75. <https://doi.org/10.1108/JADEE-01-2014-0002>

<https://emeraldpublishinggroup.freshdesk.com/support/solutions/articles/3600021399>

7

- Mariyono, J. 2017. Moving to commercial production: a case of intensive chili farming in Indonesia. **Development in Practice** Volume 27 Issue 8. p.1103-1113. <https://www.tandfonline.com/doi/abs/10.1080/09614524.2017.1360841>
- Newcomer, KE; Hatry, HP and Wholey, JS., 2015. Handbook of Practical Program Evaluation, Fourth Edition. Print ISBN:9781118893609 |Online ISBN:9781119171386 |DOI:10.1002/9781119171386 <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119171386#page=528>
- Nugroho**, LH. 2016. Red pepper (*Capsicum* spp.) fruit: A model for the study of secondary metabolite product distribution and its management. AIP Conference Proceedings Voume **1744(1)** 020034 <https://doi.org/10.1063/1.4953508> <https://aip.scitation.org/doi/abs/10.1063/1.4953508>
- Puspitasari, A. 2020. Cost-income analysis of cayenne pepper cultivation in Cigalontang sub-district, Tasikmalaya district. *Agribusiness Platform: Scientific Community Thought magazine with Agribusiness Insights* 6(2): p.1130–1142.
- Siddik, M., 2015. Economic behaviors of tobacco farming households when facing agricultural risks in the Lombok Island, Indonesia. *International Journal of Applied Sociology*. Vol 5 No.5: p.180-189.
- Siddik, M.; Anas Zaini, Budastra and M. Zubair, 2018. Analysis of the Impact of the Claim of Chili Price Stabilization in West Nusa Tenggara (Research Report). Mataram University Faculty of Agriculture.
- Siddik, M., Anas Zaini, H. Hamidi, B. Dipokusumo, Anwar, 2019. Behavior and household strategies of cayenne pepper farmers to cope with agricultural risks on Lombok Island (Research Report). Mataram University Faculty of Agriculture.
- Susanawati; Akhmadi, H.; Fauzan,;and Rozaki, Z. 2021. Supply chain efficiency of red chili based on the performance measurement system in Yogyakarta, Indonesia. the journal *Open Agriculture*. Volume 6 Issue 1. p.1-12 <https://doi.org/10.1515/opag-2021-0224> <https://www.degruyter.com/document/doi/10.1515/opag-2021-0224/html>
- Zaini, A., M. Siddik, and Suparmin, 2014. Application of Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCh) models to measure price volatility and production response of chili in the Lombok Island. Lemlit Unram. Mataram.
- Zaini, A., M. Siddik, Budastra, Anwar and M. Zubair, 2016. Comparison of production responses of chili farmers in East Lombok, Sumbawa and Bima regions to price volatility. Lemlit Unram. Mataram.

Muhamd siddik <siddikunram@gmail.com>

15 Oct 2022  
12.05

kepada editorialoffice

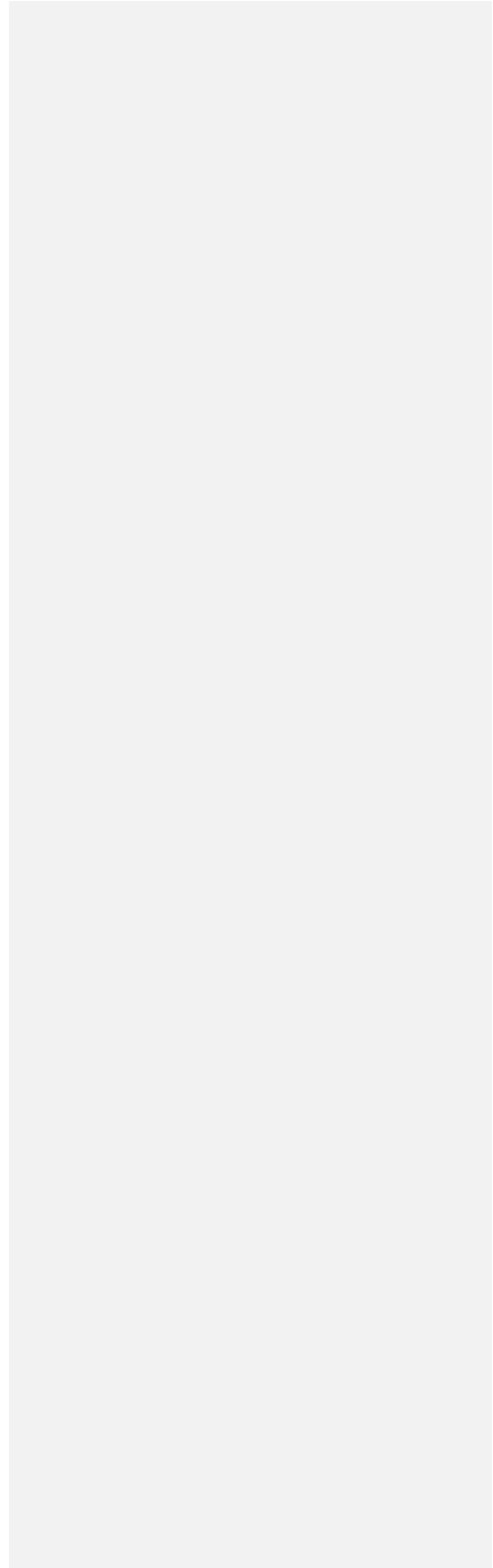
Dear Prof Ren Luquan

In the appendix, we send a manuscript entitled "The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island"

We hope that the manuscript in the attachment to this e-mail can be published in the journal Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery", Volume 53, Issue 12, December 2022.

Thank You

Muhammad Siddik



## **SJST MANUSCRIPT TEMPLATE FOR A TEXT FILE**

**Type of Article** (Original Article, ~~Review Article~~, ~~Short Communication~~)

### **The comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island**

Muhamad Siddik <sup>1\*</sup>; Dwi Praptomo Sudjatmiko<sup>1</sup>; Tajidan Tajidan<sup>1</sup>;  
Bambang Dipokusumo<sup>2</sup>, Anwar Anwar<sup>2</sup>

<sup>1</sup> **Agribisnis in Magister Study Program, Agricultural Faculty, University of Mataram, 83124, Indonesia**

<sup>2</sup> **Agribisnis Study Program, Agricultural Faculty, University of Mataram, 83124, Indonesia**

\* **Corresponding author, Email address: siddikunram60@gmail.com**

#### **Abstract**

The aim of this research is to find a comparison of production risk and price risk between types of chili which has never been done before and analyze the relationship between production and price risk with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way and used structured and in-depth interview, field observation, virtual survey, desk study, and documentation. Risk measurement used variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of chilies cultivation were statistically tested with the Least Significantly Different test. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated.

Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

**Keywords:** comparative risk, correlation, price, production, type of chilies.

## 1. Introduction

Chili is one of the most important agricultural and food staples in Indonesia (Mariyono, and [Sumarno](#), 2015), due to it is widely cultivated and a source of income for many residents also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity (Frankel, 2011), because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months the price is very low and in other months the price increases sharply (Chang, 1995; Zaini, *et al*, 2014)

The fluctuating price of chili was due to the erratic production and supply of chili (Susanawati, *et al*, 2021), while the demand was relatively constant. At certain times, production and supply are very low which gave an impact to the chili's prices to rise sharply. Meanwhile, at other times the production and supply of chili peppers were abundant, so the price of chili peppers drops drastically (Siddik, *et al*, 2018). This condition causes the commodity crop of chili to face production and price risks that are considerably high (Siddik, *et al*, 2019).

Theoretically, the courage of farmers to face agricultural risks determines productivity and income from agriculture (Mariyono, 2017). If farmers acts with fear of risk (risk *aversion*), then the utilization of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and farm income lower can be produced. But if farmers are risk *takers*, then resource utilization will be optimal for maximum productivity and income, but with the possibility of increased risk of loss (Ellis, 1988). Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of crop production.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili ([Nugroho](#), 2016). In Lombok Island, the most cultivated type of chili is cayenne pepper (BPS, 2020). However, among the cayenne pepper plants, many farmers were also found to grow big-red chilis or curly chilis in the same stretch and season. Farmers' choice in

determining the type of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study aims to: (1) analyze the differences in risk and income from the cultivation of cayenne pepper, chile big-red, and chili curly; and (2) analyze the relationship between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper, and curly pepper in Lombok Island.

## **2. Materials and Methods**

### ***Research subject.***

This research was carried out in Lombok Island, West Nusa Tenggara Province, Indonesia. The research topic was the cultivation of cayenne pepper, chile big-red, and chili curly, which were grown during the 2021/2022 rainy and dry seasons. In the Lombok Island, the rainy season usually occurs from November to April and the dry season from May to October (NTB BPS in Figures, 2019-2021).

### ***Research Design.***

The research was designed using an explanatory method which aims to explain and relate one variable to another that is different but interrelated and produces a causal relationship (Rodder & Lotters, 2010). The research location was determined in stages (*multi-stage purposive sampling*) starting from the district/city, sub-district level to the village level (Nazir, 2010). The selection of districts/cities was based on the centers of production of the three types of chili; therefore, East Lombok Regency was chosen. In addition, three districts/villages that cultivated the three types of chili in a more balanced way were selected; and each is expected to represent lowland areas (<200 msl), midlands (200-500 msl), and upland areas (>500 msl). Jerowaru District/Jerowaru Village was then selected to represent the lowland areas; then Aikmel district/Kalijaga village, representing the midlands area; and Pringgasela District/Pringgasela Village representing the highlands.

### ***Research respondents.***

Research respondents were farmers who grow cayenne pepper, chile big-red, or chili curly during the rainy season and/or dry season in 2021/2022. In each sub-district/village, 10 farmers were selected by random sampling, each growing cayenne pepper, chili pepper or chili curly, so that the total number of respondents was 90 people.

### ***Data collection.***

Data collection was carried out by combining several methods simultaneously, namely the method of structured interview using a list of questions (Newcomer, et al, 2015), in-depth interview, field observation, virtual survey, literature studies and documentation (Adams, et al. 2008). The structured interview was aimed at the surveyed farmers who grow cayenne pepper, chile big-red or chili curly, however, the in-depth interview were aimed at community leaders who know about chile cultivation and the problems it faces, as well as government policies related to agricultural development.

**Data analysis.**

The farm risk studied is the production risk and the price risk. The measurement of both risks used the variance, the standard deviation and the coefficient of variation (Anderson *et al.*, 1977). Production variation and price variation as a measure of production risk and price risk are based on the experience of farmers carrying out chili cultivation activities before (Farianti, 2008; Siddik, 2015).

$$I_{-} = q_{ih} Q_{ih} + q_{go} Q_{go} + q_{in} Q_{in}, \dots \dots \dots [3.1]$$

$$\int_{i}^{2} = q_{ih} [Q_{ih} - \mu_i]^2 + q_{ir} [Q_{ir} - \mu_i]^2 + q_{in} [Q_{in} - \mu_i]^2 \dots \dots \dots [3.2]$$

$$I_{-} = q_{ih} P_{ih} + q_{ir} P_{ir} + q_{in} P_{in}, \dots \dots \dots [3.3]$$

$$\prod_{i}^{2} = q_{ih} [P_{ih} - \theta_i]^2 + q_{ir} [P_{ir} - \theta_i]^2 + q_{in} [P_{in} - \theta_i]^2 \dots \dots \dots [3.4]$$

**Information:**

- Q = Production of each type of chili (kg/Are)
- $\mu_i$  = Expected production of each type of chili (kg)
- $\int_{i}^{2}$  = Variance or risk of production of each type of chili
- P = Price of each type of chili (IDR/kg)
- $\theta_i$  = Ekspektasi harga setiap jenis cabai (Rp/kg)
- $\prod_{i}^{2}$  = Price variation or risk for each type of chili
- i = sample or respondent-i
- q = Production opportunity or price opportunity for each type of chili (%)
- h, r, n = Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

In addition, to analyze the level of production risk and price risk for each type of chili, the coefficient of variation is used as followa:

$$CV_{qj} = \frac{j}{Qj} \dots \dots \dots [3.5]$$



$$CVpj = \frac{j}{Pj} \dots \dots \dots [3.6]$$

Where:

- CVqj = Production of variation coefficient for each type of chili
- σ<sub>qj</sub> = Standard deviation of production for each type of chili
- CVpj = Price of variation coefficient for each type of chili
- σ<sub>pj</sub> = Standard deviation of the price of each type of chili
- j = Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

If the coefficient of variation of CVqj or CVpj is greater than 0.5, the production or price risk is in the high category, however, if it is less than or equal to 0.5 it is included in the low risk category. Furthermore, farm income is measured by reducing the value of production with all production costs. The value of production is the product multiplied by the price of production.

$$qj = \sum_{k=1}^m Q_k \dots \dots \dots [3.7]$$

$$tc = CV + HR \dots \dots \dots [3.8]$$

$$\Pi j = \sum_{k=1}^m Pk \times Q_{-CT} \dots \dots \dots [3.9]$$

Information:

- Q = Production of each type of chili (kg/Ha)
- Π = Agricultural income for each type of chili (IDR000)
- P = Price of each type of chili (IDR/kg)
- TC = Total cost of each type of chili (IDR)
- VC = Variable cost (IDR)
- FC = Fixed cost (IDR)
- j = Type of chili (cayenne pepper, big-red chili, curly chili)
- m = The number of times harvested for each type of chili.
- k = The k-th harvest (k = 1, 2, 3, ..... m) of each type of chili

To compare the risks and returns of growing cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical test (*analysis of variance*) or the F test then proceed with the LSD (*Least Significantly Different*) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Table 1).

Origin of variance	H.H	DF	Millisecond	F account
Between Groups (b)	SS <sub>b</sub>	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	SS <sub>w</sub> =SS <sub>T</sub> -SS <sub>b</sub>	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	SS <sub>T</sub>	nk-1		

Table 1. Differences of ANOVA and F-test in risk and income of cayenne pepper, chile big-red and chile curly crops.

Information:

- Df = Degrees of freedom
- SS = Sum of Squares
- MS = Sum of mean squares
- SS<sub>T</sub> = Square Sum *Total (Square Sum Total)*
- SS<sub>b</sub> = Sum of squares between groups (*Sum of Square Between*)
- SS<sub>w</sub> = Sum of squares in the group (*Sum of squares within*)
- n = Number of data or samples
- k = number of groups or types of chiles

The decision criterion, if F count > F table at an error rate ( $\alpha$ ) of 10%, then there is a difference in the risk or income of cayenne pepper, big-red chili and curly chili farming. Conversely, if F count  $\leq$  F table, then there is no difference in risk or income for the three types of chili.

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD (*Least Significantly Different*) test, to individually test the difference in risk or farm income for each type of pepper. To calculate the LSD value, some data is needed from the ANOVA calculations, namely MS<sub>E</sub> (*mean square error*) data, df (degrees of freedom), r (number of samples for each group or type of chili) and Student's t tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df} \cdot \sqrt{\frac{2(MSE)}{r}}) \dots \dots \dots [3.10]$$

The decision criterion, if the difference between two variables is greater than LSD <sub>$\alpha$</sub> , then the two variables (agricultural risk or income) show a significant difference. But if the difference between two variables is less than or equal to LSD <sub>$\alpha$</sub> , then the two variables are not significantly different. In addition, to analyze the relationship between production risk and price risk with agricultural income for each type of chili, the Pearson correlation coefficient (r) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad [3.11]$$

Where:

X = Production risk or price risk for each type of chili

Y = Agricultural income for each type of chili

### 3. Results and Discussion

#### Differences in risks of cultivation of cayenne pepper, chili big-red and chili curly

##### *Production Risk.*

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal and low production) based on experience in carrying out activities. chili cultivation. In addition, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big-red chili and curly chili can be seen in Table 2.

No	Description	Little Chili	Big-Red Chili	Curly Chili
1	Production Variation	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Source: Primary Data Analysis (2022)

Table 2. Production risks of growing cayenne pepper, big-red chili peppers and curly chili peppers in the Lombok Island, 2022.

Table 2 showed that the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili was quite high, but the highest was the big-red chili (0.51), then the curly chili (0.49) and the most-low was cayenne pepper (0.45). This means that the production risk of the chilli crop on the island of Lombok was quite risky, but the big-red chilli crop is included in the high-risk category (CVq > 0.50), while the curly chillies, especially the allspice cayenne, are still included in the low production risk category.

The results of the LSD test on the differences in risk of cayenne pepper, big-red chili, and curly chili also showed that the risk of cayenne pepper production was lower and significantly

different from the risk of big-red chili production., including curly pepper, with a confidence level of more than 95 percent ( $\alpha = 5\%$ ); Meanwhile, there is no convincing difference between the production risks of big-red and curly peppers at this level of confidence (Table 3).

Comparison		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower bound	Upper bound
Cayenne pepper	Big-red Chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big-red Chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684
	Big-red Chili	-.01633	.01060	.127	-.0374	.0047

\*. The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

Table 3. Risk results of the comparative test (LSD) of the cultivation of cayenne pepper, big-red chili and curly chili in Lombok Island, 2022.

The lower value of the coefficient of variation of cayenne pepper production indicated that cayenne pepper farmers are better able to control the risk (variation) of production, compared to curly pepper more than big -red chilli farmers.

The results of this study are different from the results of Mala *et al. Alabama*. (2021) in the Sumberrejo district showed that there is no significant difference between the production risk and the income risk of the cultivation of chili big-red and cayenne pepper, but the price risk of chili big-red is higher compared to the cayenne pepper price risk. This condition identified that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of Amin and Prihantini (2021) and Alfianor, et al., (2018) who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper was considered be a profitable and viable agricultural business (Puspitasari, 2020; Light and Wake, 2020).

### Price risk.

Price risk was also analyzed in the same way as production risk, but the results of the analysis are contradictory. Table 4 showed that the coefficient of variation of prices (CV<sub>p</sub>) for the cayenne pepper crop is the highest (0.57) compared to the big-red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

No	Description	Little Chili	Big-red Chili	Curly Chili
1	Price Variation	182,631,715	64,434,463	68,134,808

2	Price Standard Deviation	13,514	8027	8,254
3	Price Variation Coefficient	0.57	0.49	0.46

Source: Primary Data Analysis (2022).

Table 4. Price risk for cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022.

The results of this analysis indicated that the cayenne pepper crop in Lombok Island is in the high price risk category ( $CV_p > 0.5$ ), while big-red chili peppers and curly chili peppers are not included in the price risk category of high price, although the coefficient of variation is quite but still below 0.50. The results of this study are consistent with the results of previous studies (Siddik *et al.*, 2021), that the price risk of cayenne pepper in the cayenne pepper production centers in Lombok Island, both in the highlands, midlands, and lowlands, is listed in the high-risk category.

If the difference in price risk of bird's eye peppers, big-red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, then all three types of peppers have a significantly different price risk, both between cayenne pepper and big-red chili and curly peppers, or between chili peppers, big-red and chili curly peppers (Table 5).

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower bound	Upper bound
Cayenne pepper	Big-red chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big-red chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big-red Chili	-.02900	.01583	.070	-.0605	.0025

\*The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

Table 5. Price risk from comparative test results (LSD) for cayenne, big-red chili and curly chili in the Lombok Island, 2022

The results of the analysis and the statistical tests of production risk and price risk above showed that there are differences in the level of risk faced, in general all three are quite high production and price risks, as indicated by the coefficients of variation. In all three, the coefficient of variation of production and the coefficient of variation of price relatively high. However, the big-red chili possible loss caused by production risk is faced by the big-red chili

crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big-red possible loss caused by price risk is faced by the cayenne pepper crop, then the big-red and small chili crop by the curly chili crop.

### **Differences in farm income for cayenne pepper, chile big-red, and chili curly**

This study assumes that when choosing and carrying out chili cultivation activities, farmers are oriented to obtain the maximum income or profit. To achieve this objective is highly dependent on the production produced, the price received and the costs incurred, the difference in income for the three types of chili cultivation also depends on these three factors.

#### ***Production and Prices.***

Production is the total earning generated of chili as a whole from the first harvest to the last harvest, converted into units of hectares. While the price is the average value of production per kilogram of chili received by farmers from the first harvest to the last harvest. The results showed that the production of cayenne pepper, chili big-red and chili curly in 2021/2022 differs quite a bit between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the dry season it is 5.1 tons/ha; chile big-red in the rainy season at 3.3 tons/ha and in the dry season at 4.7 tons/ha; and curly pepper, the production rate in the rainy season is 3.1 ton/ha and in the dry season it is 4.6 ton/ha (Table 6).

No	Season	Cayenne pepper		Big-red Chili		Curly chili	
		Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

Source: Primary Data Processed (2022)

Table 6. Average production and price of cayenne pepper, big-red chili and curly chili in Lombok Island, 2021/2022

The data above is the seasonal production level, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average of 4.3 tonnes/ha, then chile big-red 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three types of chili is irrelevant for the comparison, but when compared to the production of similar chilies the previous year in East Lombok Regency, it seems that the chili production in 2021/2022 has decreased considerably. East Lombok Regency BPS data in figures (2022) showed that the productivity of cayenne pepper in East Lombok Regency in

2021 is 7.8 tonnes/ha and big-red chili (including curly chili) is 10, 8 tons/ha. Relatively, the similar results were also found in the research by Siddik, *et al.* (2021) that the productivity of cayenne pepper in the areas of the chili production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicated that chili productivity on Lombok Island is big-red determined by location, weather conditions, and other external factors.

Although the production of chili in 2021/2022 has decreased drastically, the sale price has increased considerably, particularly during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR 20.000/kg and IDR 16 thousand/kg (Siddik *et al*, 2021), while in 2021/2022 the average price received by farmers during the rainy season is IDR 41.000/kg and in the dry season an average of IDR 15.000/ha. Therefore, although during the rainy season the level of production of farmers falls drastically, farmers do not feel a loss, because it is covered by a sharp increase in sales prices. In contrast to the dry season, production did not increase much, but prices fell sharply to around IDR 15.000/kg less than in 2021, which fell to IDR 16.000/kg. Differences or fluctuations in chili prices during the rainy season and the dry season occur for all types of chili, but the most marked difference is cayenne pepper that reaches around IDR 26.000/kg, and around IDR 17.000/kg. While for big-red chilies, the price difference is relatively small, around IDR 7.000/kg. This difference indicated that the annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili and the lowest is big-red chili.

**Commercial costs.**

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis showed that the cost of growing cayenne pepper is higher than the cost of growing big-red chili peppers and curly chili peppers, especially during the rainy season. In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of chili big-red is IDR 44 million/ha and curly pepper IDR 43 million/ha During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, chile big-red IDR 42 million/ha and curly pepper IDR 37 million/ha (Table 7).

No	Description	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
<b>A.</b>	<b>Variable Costs</b>	<b>42,074</b>	<b>30,689</b>	<b>33,159</b>	<b>30,991</b>	<b>31,907</b>	<b>26,508</b>

1	Production facilities	16,396	13006	13,267	13,471	11,885	11.188
2	Labor	13,212	10,555	9.117	8,298	8,397	7,047
3	Cost of Other Input Production	12,466	7.127	10,775	9,223	11,625	8,273
<b>B. Fixed Costs</b>		<b>14,240</b>	<b>12,257</b>	<b>11,329</b>	<b>11,427</b>	<b>11.173</b>	<b>11,390</b>
1	Land lease	13.178	11,082	10,597	10,490	9,981	10,236
2	Land Tax	247	215	189	208	193	150
3	Water Fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
<b>Totals (A+B)</b>		<b>56,314</b>	<b>42,946</b>	<b>44,488</b>	<b>42,419</b>	<b>43,080</b>	<b>37,899</b>

Source: Primary Data Processed (2022).

Table 7. Average cost of cayenne pepper, big chili and curly chili (IDR000/ha) in Lombok Island, 2022

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds, fertilizers, growth stimulants and drug costs. Then labor costs and other support facilities like plastic mulch and stakes. These variable inputs cost about 70 percent of total farm costs. Although fixed inputs consist of income and land taxes, equipment depreciation, water costs, and interest on loan capital, no farmers used loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million to IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

#### ***Income and Agricultural Efficiency.***

Although the chili production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year, because this decrease was offset by a fairly high increase in chili prices during the rainy season, farm income obtained are still quite high and agriculture is considered efficient. The highest income and agricultural efficiency in the rainy season is obtained with the cultivation of cayenne pepper, which reaches IDR 89 million/ha with a CR ratio of 2.58; then the curly chile crop of IDR 51 million/ha with RC 2.21 and the lowest is the income from the big-red chili crop, which amounts to IDR. 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big-red cultivation of chili, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Table 8).



No	Component	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2.21	1.66

Source: Primary Data Analysis (2022).

Table 8. Average production, prices, production value, production costs and farm income of cayenne pepper, chili pepper and curly pepper in the Lombok Island, 2021/2022

The income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27 million/ha. Meanwhile, for the big-red chili crop, the difference is less than IDR 3 million/ha. This means that the big-red chili crop has a relatively stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crop is very volatile. This indicated that the cayenne pepper and curly chili crop has a high-income risk, while chili cultivation has low income risk.

#### **Commercial Rent.**

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big-red chili costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD (*Least Significantly Different*) test.

Based on the results of the LSD test in Table 9, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income from the big-red chili pepper crop and curly chili. Meanwhile, the income from the big-red chili crop and the curly chili do not show a convincing difference in income. The results of this trial provide an explanation for the reasons why farmers in Lombok Island, especially in East Lombok Regency, prefer to plant bird's eye chilies instead of big-red chilies or curly chilies.

Comparison between		Mean Difference (IJ)	std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	21367.133 *	6618730	002	8211.69	34522.58
	Curly chili	22082.767 *	6618730	001	8927.32	35238.21
Big-red Chili	Cayenne pepper	-21367.133 *	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767 *	6618730	001	-35238.21	-8927.32
	Big-red Chili	-715,633	6618730	.914	-13871.08	12439.81

\*. The mean difference is significant at the 0.05 level.

Source: Primary data processed (2022)

Table 9. Comparative test results (LSD) Farm income from cayenne pepper, big-red chili and curly chili in Lombok Island, 2022

#### Relationship between Production Risk and Price Risk with Agricultural Income.

The results of the Pearson correlation analysis show that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship. Unlike big-red peppers, both production risk and price risk are negatively related to farm income (Table 10).

Type of Chili	Variable Correlation	Coef Value Correlation (Pearson correlation)	Significance Test (P-Value)	Strength Connection
1. Cayenne Pepper	Production-Revenue Risk	0.339	0.067*	Less Strong
	Price Risk - Revenue	-0.518	0.003***	Very strong
2. Big-red Chili	Production-Revenue Account	-0.404	0.027**	Less Strong
	Price Risk - Revenue	-0.021	0.265.	Less Strong
3. Curly Chili	Production-Revenue Risk	0.071	0.708	Less Strong
	Price Risk - Revenue	-0.599	0.001***	Very strong

Source: Primary data processed (2022),

Table 10. Risk-to-return test results for Cayenne Pepper, Big Chili and Curly Chili in Lombok Island, 2022

In the cultivation of cayenne pepper, chili big-red and cayenne pepper, the production risk during the rainy season is on average higher than in the dry season, which is characterized by

a decrease in production, however the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than the dry season, during which production risk is lower. Meanwhile, for big-red chili peppers, a big-red production risk is indicated by a decline in production during the rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

On the other hand, in the dry season the average price risk faced by farmers of cayenne chili peppers, big-red chili peppers and curly chili peppers increases and is greater than in the rainy season marked by a sharp fall in prices. This drastic price reduction was not followed by a sharp increase in production, therefore income earned was low, even for cayenne pepper and chili peppers, much lower than income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income, also, low risk is not always followed by high farm income. What is more decisive and logical is the courage of farmers in the face of the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production input, the more likely farmers are to earn higher incomes or profits (Ellis, 1988; Siddik, *et al*, 2021).

#### **4. Conclusions and Recommendations**

The cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island has fairly high and varied agricultural risks. The cayenne pepper crop has the lowest production risk (0.45) and is significantly different from the curly pepper crop (0.49) and the big-red pepper crop (0.51), which have high risk. In contrast to price risk, the cayenne pepper crop has the highest risk (0.57) compared to the big-red chili crop (0.49) and the curly chili crop (0.46). Incomes from cayenne pepper cultivation are higher and significantly different than those from chile big-red and chile curly. The average income from cayenne pepper cultivation is IDR 59.19 million/ha, while in the great cultivation of chili it is IDR 37.82 million/ha, not significantly different from the agricultural income of curly pepper of IDR 37.10 million/ha. Production risk in the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is

negatively correlated with farm income, both for the cayenne pepper, chile big-red, and chili curly crops.

Considering that cayenne chilies, big-red chilies and curly chilies can be substituted to some extent, in order to reduce the production risk and price risk of chilies in Lombok Island, this can be achieved by developing the three types of commodities in a balanced manner in suitable places for each type of chili. There is a tendency for cayenne pepper to be better suited for development on low to midlands, while big-red chiles and curly chiles are more suitable to develop in medium and highland areas. There is a need for technical guidance on the cultivation of chili, especially for big-red producers of chili and curly chili, because the level of production produced is still low and lower than the level of production produced by cayenne pepper. The government also needs to initiate and facilitate the establishment of cooperative associations between farmers and companies that supply and distribute chili products, as well as with insurance companies, to increase the enthusiasm of farmers for the three types of chili, so that the annual inflation contributed by this product decreases and the welfare of the farmers is guaranteed.

### Acknowledgments

Thank you to the Chancellor and Chair of the Institute for Research and Community Service at the University of Mataram for facilitating the funding so that this manuscript can be published.

### References

- [Adams, A.](#) and Cox, Anna L. (2008). Questionnaires, in-depth interviews and focus groups. In: Cairns, Paul and Cox, Anna L. eds. *Research Methods for Human Computer Interaction*. Cambridge, UK: Cambridge University Press, pp. 17–34.  
<http://www.cambridge.org/catalogue/catalogue.asp?i...>
- Alfanor, Y. Ferrianta, Hamdani. 2018. Risk analysis of cayenne pepper production in Mailing Village, Padang Badung District, Hulu Sungai Selatan Regency. " *Agribusiness Frontier* 2(4). <http://ppjp.ulm.ac.id/journals/index.php/fag/article/view/663/650>.
- Amin, M. and Prihantini. CI. 2021. Risk Analysis of Canney Chili Production and Production in Watunohu District, North Kolaka Regency. *Agribusiness Magazine Dryland Agribusiness*: p.16–21. <https://media.neliti.com/media/publications/361509-analysis-of-production-and-production-ri-878daa02.pdf>
- Anderson, J.R.; Dillon, J.L. and Hardaker, J.B. 1977. *Farm Decision Analysis*. Iowa State University Press, Ames Iowa.  
<https://econpapers.repec.org/bookchap/agsagsaem/288652.htm>

- Cahya, AA and Bangun, RH. Br. 2020. "Farmer characteristics and agricultural viability of chili pepper (*Capsicum annum* L) and cayenne pepper (*Capsicum frutescens* L) in North Sumatra." *Agricore: Agribusiness and Socioeconomic Agriculture Magazine UNPAD* 5(1). <http://journal.unpad.ac.id/agricore/article/view/27139/pdf>.
- Chang, T, 1995. An Application of Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Modelling on Taiwan's Time-Series Data: Three Essays. *All Graduate Theses and Dissertations*. 3916. p.129. <https://digitalcommons.usu.edu/etd/3916>
- Ellis, F. 1988. Peasant economy: peasant families and agrarian development. Cambridge University Press, Cambridge. <https://www.cambridge.org/core/journals/experimental-agriculture/article/abs/peasant-economics-farm-households-and-agrarian-development-second-edition-by-frank-ellis-cambridge-cambridge-university-press-1993-pp-309-1595-us3295-isbn-0521457114/3F5CC663DC4C86A2B200ED1D63152660>
- Fariyanti, A. 2008. Economic behavior of vegetable farmer households in coping with production risks and commodity prices in Pangalengan district, Bandung regency. PhD thesis. IPB Graduate School, Jurnal Agroekonomi. Bogor. <https://ejournal.litbang.pertanian.go.id/index.php/jae/article/view/4719>
- Frankel, Jeffrey A. 2011. How Can Commodity Exporters Make Fiscal and Monetary Policy Less Procyclical? HKS Faculty Research Working Paper Series RWP11-015, John F. Kennedy School of Government, Harvard University. <https://dash.harvard.edu/handle/1/4735392>
- Mala, N. Prasmatiwi, FE. and Sayekti, WD. 2021. Income and risks of chilli cultivation in Sumber Rejo district, Tanggamus regency". *Magazine of Agroindustry Sciences*. 9(1): p.91–98.
- Mariyono, J. and Sumarno, S. 2015. Chilli production and adoption of chilli-based agribusiness in Indonesia. *Journal of Agribusiness in Developing and Emerging Economics*. ISSN: 2044-0839. Vol. 5 No. 1, pp. 57-75. <https://doi.org/10.1108/JADEE-01-2014-0002> <https://emeraldpublishinggroup.freshdesk.com/support/solutions/articles/36000213997>
- Mariyono, J. 2017. Moving to commercial production: a case of intensive chili farming in Indonesia. *Development in Practice* Volume 27 Issue 8. p.1103-1113. <https://www.tandfonline.com/doi/abs/10.1080/09614524.2017.1360841>
- Newcomer, KE; Hatry, HP and Wholey, JS., 2015. Handbook of Practical Program Evaluation, Fourth Eddition. Print ISBN:9781118893609 |Online ISBN:9781119171386 |DOI:10.1002/9781119171386 <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119171386#page=528>
- Nugroho, LH. 2016. Red pepper (*Capsicum* spp.) fruit: A model for the study of secondary metabolite product distribution and its management. AIP Conference Proceedings Voume **1744(1)** 020034 <https://doi.org/10.1063/1.4953508> <https://aip.scitation.org/doi/abs/10.1063/1.4953508>
- Puspitasari, A. 2020. Cost-income analysis of cayenne pepper cultivation in Cigalontang sub-district, Tasikmalaya district. *Agribusiness Platform: Scientific Community Thought*

*magazine with Agribusiness Insights* 6(2): p.1130–1142.  
<https://jurnal.unigal.ac.id/index.php/mimbaragribisnis/article/view/3692/0>

- Siddik, M. 2015. Economic behaviors of tobacco farming households when facing agricultural risks in the Lombok Island, Indonesia. *International Journal of Applied Sociology*. Vol 5 No.5: p.180-189.
- Siddik, M. Zaini, A. Budastra and Zubair, M. 2018. Analysis of the Impact of the Claim of Chili Price Stabilization in West Nusa Tenggara (Research Report). Mataram University Faculty of Agriculture. <https://jurnal.lppm.unram.ac.id/article/download>
- Siddik, M., Zaini, A. Hamidi, H. Dipokusumo, B. Anwar, A. 2019. Behavior and household strategies of cayenne pepper farmers to cope with agricultural risks on Lombok Island (Research Report). Mataram University Faculty of Agriculture. <http://agrimansion.unram.ac.id/Agri/article/view>
- Susanawati; Akhmedi, H.; Fauzan, and Rozaki, Z. 2021. Supply chain efficiency of red chili based on the performance measurement system in Yogyakarta, Indonesia. the journal *Open Agriculture*. Volume 6 Issue 1. p.1-12 <https://doi.org/10.1515/opag-2021-0224> <https://www.degruyter.com/document/doi/10.1515/opag-2021-0224/html>
- Zaini, A., Siddik, M. and Suparmin, S. 2014. Application of Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCH) models to measure price volatility and production response of chili in the Lombok Island. *Lemlit Unram*. Mataram. <http://agrimansion.unram.ac.id/article/download>
- Zaini, A., M. Siddik, Budastra, Anwar and M. Zubair, 2016. Comparison of production responses of chili farmers in East Lombok, Sumbawa and Bima regions to price volatility. *Lemlit Unram*. Mataram. <http://agrimansion.unram.ac.id/article/download>

Dari: <[editorialoffice@nyjxb.net](mailto:editorialoffice@nyjxb.net)>  
Date: Jum, 9 Des 2022 17.00  
Subject: Re: Paper Submission  
To: <[siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)>

Dear Authors,

Greetings from the Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery. Thank you very much for submitting your manuscript to the Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery.

Your paper has been reviewed by 2 independent experts. Having considered the reviews, we have reached a decision regarding your submission.  
Our decision is to: Revision Required.

If you want to publish in Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery, Volume 53, Issue 12, December 2022, you need to send the following to the editorial office by e-mail at the following address: [editorialoffice@nyjxb.net](mailto:editorialoffice@nyjxb.net) :

1. The article strictly formatted according to the template recommendations for authors and correct the article on the reviewers' recommendations, see [http://nyjxb.net/paper\\_template.docx](http://nyjxb.net/paper_template.docx) . All revisions should be highlighted in the article.
2. Payment receipt.

Please highlight the corrections in this article in Red. We hope you'll do great.

The reviewers recommend you:

Reviewer #1:

- 1 - We recommend that the authors rewrite the abstract.

Template:

The article describes a new method/idea (etc.) ..., based on ..., enabling to .... Using (describe the methods), the authors (describe the obtained results)..... As an example, we illustrate the proposed method/technique... Our method/proposal allows to improve (any quantitative indicators by XX, X%)... The new method effectiveness evaluation is confirmed by the calculation .... New research results develop/supplement/improve ... and can be used for.... The novelty of the results.....

- 2 - Authors should explain better the criteria for selecting the research object and the limitations of the application of the results obtained should be specified.

3 - Much more explanations and interpretations should be added to the result. It is suggested to compare the results of the present study with previous studies and analyze the results completely.

Reviewer # 2:

1. Please add the Flowchart of the research methodology (The main steps of research process are summarized in Figure .....)
2. The Conclusion section needs to justify the effectiveness of the approaches you propose (100 WORDS). Describe the Implications of study.
3. Please cite sources under the tables. If they were developed by the authors, indicate "developed by the authors".
4. Please shorten the old sources in the reference. If possible, the authors should use relevant sources on the research topic from the last 5-7 years.

Please consider the reviewer's comments, and revise that as soon as possible.

Deadline for providing revised article and payment: December 15, 2022.

The article will be published until January 30, 2023.

Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery charges Publication Fee at the rate of EUR 400.00. All articles published in our journal are open access and freely available online, immediately upon publication.

We recommend that the authors use the academic text editing service for the scientific articles, not just proofreading. Please use the American English option. We recommend the use of large, trusted companies with editors having a Ph.D. degree. You should also attach an editing certificate or use the editorial office services. Articles that native English speakers do not edit are not allowed for publication. The editorial team provides academic proofreading services for the authors at an additional cost - EUR 150, if you don't attach an official English editing certificate. The fee's already included in the invoice.

Articles published in the Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery will be Open-Access articles distributed under the terms and conditions of the Creative Commons Attribution License (CC BY). The copyright is retained by the author(s).

Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery ranks number 14 among China's agricultural engineering academic journals, and it has been in the Q2 zone: Agricultural and Biological Sciences (miscellaneous) and Mechanical Engineering for nine consecutive years. Citescore Scopus is 2.9.

If you have any questions, please do not hesitate to contact us.

We thank you!

Sincerely,

Editor-in-Chief: Prof. Ren Luquan (主编：任露泉)

<http://nyjxxb.net>



Sponsored by: Chinese Society for Agricultural Machinery (CSAM) and Chinese Academy of Agricultural Machinery Sciences (CAAMS).  
Address: No.1 Beishatan, Deshengmenwai, Beijing , P.R. China Postd code: 100083.  
E-mail: [editorialoffice@nyjxxb.net](mailto:editorialoffice@nyjxxb.net)

----- Original Message -----

Subject: Paper Submission

Date: 2022-11-26 02:44

From: Nongye Jixie Xuebao/Transactions of the Chinese Society of Agricultural Machinery <[admin@nyjxxb.net](mailto:admin@nyjxxb.net)>

To: [editorialoffice@nyjxxb.net](mailto:editorialoffice@nyjxxb.net)

Title of your paper: The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Corresponding Author's Email Address: [siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)

Author(s): Muhamad Siddik; Dwi Praptomo Sudjatmiko, Bambang Dipokusumo, and Anwar Anwar; Tajidan Tajidan

Keywords: correlation, price, production, type of chili,

Abstract: The aim of this research is to find a comparison of production risk and price risk between types of chilies which has never been done before; and analyze the relationship between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The study used an explanatory method in three sub districts/villages that cultivated the three types of chili in a balanced way, each representing the highlands, middle land, and lowlands. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way. Data collection uses structured interviews, in-depth interviews, field observations, virtual surveys, desk study, and documentation. Risk measurement uses variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of chili cultivation were statistically tested with the Least Significantly Different test. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. The production risk of cayenne pepper was found to be the lowest and significantly different from the production risk of the curly chili crop and the big-red chili crop which have high risk. In contrast to price risk, the cayenne pepper crop falls into the high-risk category and is significantly different from the price risk of big-red chili peppers and curly chili peppers. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

â” The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in Comments to the Editor).

â” The submission file is in OpenOffice, Microsoft Word, or RTF document file format.

â” Where available, URLs for the references have been provided.

â” The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.

â” The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

**2 Lampiran** • Dipindai dengan Gmail

----- Forwarded message -----

Dari: <[editorialoffice@nyjxb.net](mailto:editorialoffice@nyjxb.net)>

Date: Jum, 9 Des 2022 17.00

Subject: Re: Paper Submission

To: <[siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)>

Dear Authors,

Greetings from the Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery. Thank you very much for submitting your manuscript to the Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery.

Your paper has been reviewed by 2 independent experts. Having considered the reviews, we have reached a decision regarding your submission.

Our decision is to: Revision Required.

If you want to publish in Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery, Volume 53, Issue 12, December 2022, you need to send the following to the editorial office by e-mail at the following address: [editorialoffice@nyjxb.net](mailto:editorialoffice@nyjxb.net) :

1. The article strictly formatted according to the template recommendations for authors and correct the article on the reviewers' recommendations, see [http://nyjxb.net/paper\\_template.docx](http://nyjxb.net/paper_template.docx) . All revisions should be highlighted in the article.
2. Payment receipt.

Please highlight the corrections in this article in Red. We hope you'll do great.

The reviewers recommend you:

Reviewer #1:

1 - We recommend that the authors rewrite the abstract.

Template:

The article describes a new method/idea (etc.) ..., based on ..., enabling to .... Using (describe the methods), the authors (describe the obtained results)..... As an example, we illustrate the proposed method/technique... Our method/proposal allows to improve (any quantitative indicators by XX, X%)... The new method effectiveness evaluation is confirmed by the calculation .... New research results develop/supplement/improve ... and can be used for.... The novelty of the results.....

2 - Authors should explain better the criteria for selecting the research object and the limitations of the application of the results obtained should be specified.

3 - Much more explanations and interpretations should be added to the result. It is suggested to compare the results of the present study with previous studies and analyze the results completely.

Reviewer # 2:

1. Please add the Flowchart of the research methodology (The main steps of research process are summarized in Figure .....)

2. The Conclusion section needs to justify the effectiveness of the approaches you propose (100 WORDS). Describe the Implications of study.

3. Please cite sources under the tables. If they were developed by the authors, indicate "developed by the authors".

4. Please shorten the old sources in the reference. If possible, the authors should use relevant sources on the research topic from the last 5-7 years.

Please consider the reviewer's comments, and revise that as soon as possible.

Deadline for providing revised article and payment: December 15, 2022.

The article will be published until January 30, 2023.

Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery charges Publication Fee at the rate of EUR 400.00. All articles published in our journal are open access and freely available online, immediately upon publication.

We recommend that the authors use the academic text editing service for the scientific articles, not just proofreading. Please use the American English option. We recommend the use of large, trusted companies with editors having a Ph.D. degree. You should also attach an editing certificate or use the editorial office services. Articles that native English speakers do not edit are not allowed for publication. The editorial team provides academic proofreading services for the authors at an additional cost - EUR 150, if you don't attach an official English editing certificate. The fee's already included in the invoice.

Articles published in the Nongye Jixie Xuebao/ Transactions of the

Chinese Society of Agricultural Machinery will be Open-Access articles distributed under the terms and conditions of the Creative Commons Attribution License (CC BY). The copyright is retained by the author(s).

Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery ranks number 14 among China's agricultural engineering academic journals, and it has been in the Q2 zone: Agricultural and Biological Sciences (miscellaneous) and Mechanical Engineering for nine consecutive years. Citescore Scopus is 2.9.

If you have any questions, please do not hesitate to contact us.  
We thank you!

Sincerely,

Editor-in-Chief: Prof. Ren Luquan (主编：任露泉)

<http://nyjxxb.net>

Sponsored by: Chinese Society for Agricultural Machinery (CSAM) and Chinese Academy of Agricultural Machinery Sciences (CAAMS).

Address: No.1 Beishatan, Deshengmenwai, Beijing, P.R. China Postd code: 100083.

E-mail: [editorialoffice@nyjxxb.net](mailto:editorialoffice@nyjxxb.net)

----- Original Message -----

Subject: Paper Submission

Date: 2022-11-26 02:44

From: Nongye Jixie Xuebao/Transactions of the Chinese Society of Agricultural Machinery <[admin@nyjxxb.net](mailto:admin@nyjxxb.net)>

To: [editorialoffice@nyjxxb.net](mailto:editorialoffice@nyjxxb.net)

Title of your paper: The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Corresponding Author's Email Address: [siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)

Author(s): Muhamad Siddik; Dwi Praptomo Sudjatmiko, Bambang Dipokusumo, and Anwar Anwar; Tajidan Tajidan

Keywords: correlation, price, production, type of chili,

Abstract: The aim of this research is to find a comparison of production risk and price risk between types of chilies which has never been done before; and analyze the relationship between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The study used an explanatory method in three sub districts/villages that cultivated the three types of chili in a balanced way, each representing the highlands, middle land, and lowlands. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way. Data collection uses structured interviews, in-depth interviews, field observations, virtual surveys, desk study, and documentation. Risk measurement uses variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of chili cultivation were statistically tested

with the Least Significantly Different test. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. The production risk of cayenne pepper was found to be the lowest and significantly different from the production risk of the curly chili crop and the big-red chili crop which have high risk. In contrast to price risk, the cayenne pepper crop falls into the high-risk category and is significantly different from the price risk of big-red chili peppers and curly chili peppers. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

â€” The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in Comments to the Editor).

â€” The submission file is in OpenOffice, Microsoft Word, or RTF document file format.

â€” Where available, URLs for the references have been provided.

â€” The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.

â€” The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

Muhamd siddik <siddikunram@gmail.com>

15 Dec 2022  
14.15

kepada editorialoffice

Dear Prof Ren Luquan

We have revised our manuscript entitled "The comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island". Manuscript is in the attachment.

If something is still not appropriate, then we are willing to revise it.

Best regards,

Muhammad Siddik

## The comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Muhamad Siddik<sup>1\*</sup>; Dwi Praptomo Sudjarmiko<sup>1</sup>; Tajidan Tajidan<sup>1</sup>;  
Bambang Dipokusumo<sup>2</sup>; and Anwar Anwar<sup>2</sup>

<sup>1</sup> Agribisnis in Magister Study Program, Agricultural Faculty, University of Mataram,  
83124, Indonesia

<sup>2</sup> Agribisnis Study Program, Agricultural Faculty, University of Mataram, 83124,  
Indonesia

\*Correspondence: Muhamad Siddik

**Abstract:** The objective of this research is to find a comparative model of production risk and price risk and its relationship with the farming income of cayenne, chile grande and curly chili in the tropics, as well as the relationship between the level of risk and the entry. In order to find a comparative model of production risk and price risk, an analysis of variance, standard deviation and coefficient of variation between types of chilies was carried out, as well as the relationship between the level of risk and income, an analysis of Pearson correlation. Data was collected from 90 sampling units consisting of 30 sampling units for each chili crop type. The sampling unit for each crop type was selected using a simple random sampling technique, while data was collected through structured interviews, in-depth interviews, and observations at each chili growing site. The results of the analysis show that the comparative model of production risk and price risk can be used to determine the level of risk for each type of chili crop. The production risk of the cayenne pepper crop is lower compared to the production risk of the curly pepper crop and the grande pepper crop; otherwise price risk Cayenne pepper falls into the high-risk category compared to the price risk of large and curly peppers. Pearson correlation analysis can be used to determine the relationship between the level of risk and income from the chili crop, i.e. The higher the production risk of the cayenne pepper and curly chili crop, the higher the income of the agricultural business, while the greater the production risk, lower business income. Chile grande, while the higher the price risk, the lower the farm income.

The aim of this research is to find a comparison of production risk and price risk between types of chili which has never been done before and analyze the relationship between production and price risk with the income from the cultivation of cayenne pepper, big-red pepper and curly pepper. The study employed an explanatory method in three subdistricts/villages that cultivated the three types of chili in a balanced way, each representing the highland, middle land, and lowland. The surveyed farmers were determined up to 90 people who were chosen at random and in a balanced way and used structured and in-depth interview, field observation, virtual survey, desk study, and documentation. Risk measurement used variance, standard deviation, and coefficient of variation. The differences in risk and income of the three types of chilies cultivation were statistically tested with the LSD (*Least Significantly Different*) test. The relationship between risk and farm income was analyzed using Pearson's Correlation Analysis. The study revealed that the production risk of cayenne pepper was considered as the lowest and significantly different from the production risk of the curly chili crop and the big-red chili crop which have high risk. In contrast to price risk, the cayenne pepper crop falls into the high-risk category and is significantly different from the price risk of big-red chili peppers and curly

chili peppers. The average income from the cayenne pepper crop is higher and significantly different from that of chile big-red and chili curly. The production risk of the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, big-red chili, and curly chili crops.

**Keywords:** *comparative risk*, correlation, price, production, type of chilies.

## INTRODUCTION

Chili is one of the most important agricultural and food staples in Indonesia (Mariyono, and [Sumarno](#), 2015), due to it is widely cultivated and a source of income for many residents also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity (Frankel, 2011), because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months the price is very low and in other months the price increases sharply (Zaini, *et al*, 2014)

The fluctuating price of chili was due to the erratic production and supply of chili (Susanawati, *et al*, 2021), while the demand was relatively constant. At certain times, production and supply are very low which gave an impact to the chilli's prices to rise sharply. Meanwhile, at other times the production and supply of chili peppers were abundant, so the price of chili peppers drops drastically (Siddik, *et al*, 2018). This condition causes the commodity crop of chili to face production and price risks that are considerably high (Siddik, *et al*, 2019).

Theoretically, the courage of farmers to face agricultural risks determines productivity and income from agriculture (Mariyono, 2017). If farmers acts with fear of risk (*risk aversion*), then the utilization of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and farm income lower can be produced. But if farmers are *risk takers*, then resource utilization will be optimal for maximum productivity and income, but with the possibility of increased risk of loss (Ellis, 1988). Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of crop production.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili (Nugroho, 2016). In Lombok Island, the most cultivated type of chili is cayenne pepper (BPS, 2020). However, among the cayenne pepper plants, many farmers were also found to grow big-red chilis or curly chilis in the same stretch and season. Farmers' choice in



determining the type of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study aims to: (1) analyze the differences in risk and income from the cultivation of cayenne pepper, chile big-red, and chili curly; and (2) analyze the relationship between production risk and price risk with the income from the cultivation of cayenne pepper, big-red pepper, and curly pepper in Lombok Island.

## **RESEARCH METHOD**

### ***Research subject.***

This research was carried out in Lombok Island, West Nusa Tenggara Province, Indonesia. The research topic was the cultivation of cayenne pepper, chile big-red, and chili curly, which were grown during the 2021/2022 rainy and dry seasons. In the Lombok Island, the rainy season usually occurs from November to April and the dry season from May to October (NTB BPS in Figures, 2019-2021).

### ***Research Design.***

The research was designed using an explanatory method which aims to explain and relate one variable to another that is different but interrelated and produces a causal relationship (Rodder & Lotters, 2010). The research location was determined in stages (*multi-stage purposive sampling*) starting from the district/city, sub-district level to the village level (Nazir, 2010). The selection of districts/cities was based on the centers of production of the three types of chili; therefore, East Lombok Regency was chosen. In addition, three districts/villages that cultivated the three types of chili in a more balanced way were selected; and each is expected to represent lowland areas (<200 mpl), midlands (200-500 mpl), and upland areas (>500 mpl). Jerowaru District/Jerowaru Village was then selected to represent the lowland areas; then Aikmel district/Kalijaga village, representing the midlands area; and Pringgasela District/Pringgasela Village representing the highlands.

### ***Research respondents.***

Research respondents were farmers who grow cayenne pepper, chile big-red, or chili curly during the rainy season and/or dry season in 2021/2022. In each sub-district/village, 10 farmers were selected by random sampling, each growing cayenne pepper, chili pepper or chili curly, so that the total number of respondents was 90 people.

### ***Data collection.***

Data collection was carried out by combining several methods simultaneously, namely the method of structured interview using a list of questions (Newcomer, et al, 2015), in-depth interview, field observation, virtual survey, literature studies and documentation (Adams, et al. 2008). The structured interview was aimed at the surveyed farmers who grow cayenne pepper, chile big-red or chili curly, however, the in-depth interview were aimed at community leaders who know about chile cultivation and the problems it faces, as well as government policies related to agricultural development.

**Data analysis.**

The farm risk studied is the production risk and the price risk. The measurement of both risks used the variance, the standard deviation and the coefficient of variation (Anderson *et al.*, 1977). Production variation and price variation as a measure of production risk and price risk are based on the experience of farmers carrying out chili cultivation activities before (Farianti, 2008; Siddik, 2015).

$$I_{-} = q_{ih} Q_{ih} + q_{go} Q_{go} + q_{in} Q_{in}, \dots \dots \dots [3.1]$$

$$\sigma_{i}^2 = q_{ih} [Q_{ih} - \mu_i]^2 + q_{ir} [Q_{ir} - \mu_i]^2 + q_{in} [Q_{in} - \mu_i]^2 \dots \dots \dots [3.2]$$

$$I_{-} = q_{ih} P_{ih} + q_{ir} P_{ir} + q_{in} P_{in}, \dots \dots \dots [3.3]$$

$$\sigma_{i}^2 = q_{ih} [P_{ih} - \theta_i]^2 + q_{ir} [P_{ir} - \theta_i]^2 + q_{in} [P_{in} - \theta_i]^2 \dots \dots \dots [3.4]$$

**Information:**

- Q = Production of each type of chili (Kg/Are)
- $\mu_i$  = Expected production of each type of chili (kg)
- $\sigma_i^2$  = Variance or risk of production of each type of chili
- P = Price of each type of chili (IDR/kg)
- $\theta_i$  = Ekspektasi harga setiap jenis cabai (Rp/Kg)
- $\sigma_{i}^2$  = Price variation or risk for each type of chili
- i = sample or respondent i
- q = Production opportunity or price opportunity for each type of chili (%)
- h, r, n = Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

In addition, to analyze the level of production risk and price risk for each type of chili, the coefficient of variation is used as followa:

$$CV_{qj} = \frac{j}{Qj} \dots \dots \dots [3.5]$$

$$CVpj = \frac{j}{Pj} \dots\dots\dots [3.6]$$

Where:

- CVqj = Production of variation coefficient for each type of chili
- σ<sub>qj</sub> = Standard deviation of production for each type of chili
- CVpj = Price of variation coefficient for each type of chili
- σ<sub>pj</sub> = Standard deviation of the price of each type of chili
- j = Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

If the coefficient of variation of CVqj or CVpj is greater than 0.5, the production or price risk is in the high category, however, if it is less than or equal to 0.5 it is included in the low risk category. Furthermore, farm income is measured by reducing the value of production with all production costs. The value of production is the product multiplied by the price of production.

$$qj = \sum_{k=1}^m Q_k \dots\dots\dots [3.9]$$

$$tc = CV + HR \dots\dots\dots [3.10]$$

$$\Pi j = \sum_{k=1}^m Pk \times Q -CT \dots\dots\dots [3.11]$$

Information:

- Q = Production of each type of chili (kg/Ha)
- Π = Agricultural income for each type of chili (IDR000)
- P = Price of each type of chili (IDR/kg)
- TC = Total cost of each type of chili (IDR)
- VC = Variable cost (IDR)
- FC = Fixed cost (IDR)
- j = Type of chili (cayenne pepper, big-red chili, curly chili)
- m = The number of times harvested for each type of chili.
- k = The k-th harvest (k =1,2,3, .....m) of each type of chili

To compare the risks and returns of growing cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical test (*analysis of variance*) or the F test then proceed with the LSD (*Least Significantly Different*) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Table 1).

Table 1. Differences of ANOVA and F-test in risk and income of cayenne pepper, chile big-red and chile curly crops.

Origin of variance	H.H	DF	Millisecond	F account
Between Groups (b)	SS <sub>b</sub>	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	SS <sub>w</sub> =SS <sub>T</sub> -SS <sub>b</sub>	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	SS <sub>T</sub>	nk-1		

Information:

- Df = Degrees of freedom
- SS = Sum of Squares
- MS = Sum of mean squares
- SS<sub>T</sub> = Square Sum Total (*Square Sum Total*)
- SS<sub>b</sub> = Sum of squares between groups (*Sum of Square Between*)
- SS<sub>w</sub> = Sum of squares in the group (*Sum of squares within*)
- n = Number of data or samples
- k = number of groups or types of chiles

The decision criterion, if F count > F table at an error rate (α) of 10%, then there is a difference in the risk or income of cayenne pepper, big-red chili and curly chili farming. Conversely, if F count ≤ F table, then there is no difference in risk or income for the three types of chili.

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD (*Least Significantly Different*) test, to individually test the difference in risk or farm income for each type of pepper. To calculate the LSD value, some data is needed from the ANOVA calculations, namely MS<sub>E</sub> (*mean square error*) data, df (degrees of freedom), r (number of samples for each group or type of chili) and Student's t tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df} \cdot \sqrt{\frac{2(MSE)}{r}}) \dots\dots\dots [3.12]$$

The decision criterion, if the difference between two variables is greater than LSD<sub>α</sub>, then the two variables (agricultural risk or income) show a significant difference. But if the difference between two variables is less than or equal to LSD<sub>α</sub>, then the two variables are not significantly different. In addition, to analyze the relationship between production risk and price risk with agricultural income for each type of chili, the Pearson correlation coefficient (r) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad [3.16]$$

Where:

X = Production risk or price risk for each type of chili

Y = Agricultural income for each type of chili

## RESULTS AND DISCUSSION

### Differences in risks of cultivation of cayenne pepper, chili big-red and chili curly

#### *Production Risk.*

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal and low production) based on experience in carrying out activities. chili cultivation. In addition, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big-red chili and curly chili can be seen in Table 2.

Table 2. Production risks of growing cayenne pepper, big-red chili peppers and curly chili peppers in the Lombok Island, 2022.

No	Description	Little Chili	Big-Red Chili	Curly Chili
1	Production Variation	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Source: Primary Data Analysis (2022)

Table 2 showed that the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili was quite high, but the highest was the big-red chili (0.51), then the curly chili (0.49) and the most-low was cayenne pepper (0.45). This means that the production risk of the chilli crop on the island of Lombok was quite risky, but the big-red chilli

crop is included in the high-risk category ( $CVq > 0.50$ ), while the curly chillies, especially the allspice cayenne, are still included in the low production risk category.

The results of the LSD test on the differences in risk of cayenne pepper, big-red chili, and curly chili also showed that the risk of cayenne pepper production was lower and significantly different from the risk of big-red chili production., including curly pepper, with a confidence level of more than 95 percent ( $\alpha = 5\%$ ); Meanwhile, there is no convincing difference between the production risks of big-red and curly peppers at this level of confidence (Table 3).

Table 3. Risk results of the comparative test (LSD) of the cultivation of cayenne pepper, big-red chili and curly chili in Lombok Island, 2022.

Comparison		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower bound	Upper bound
Cayenne pepper	Big-red Chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big-red Chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684
	Big-red Chili	-.01633	.01060	.127	-.0374	.0047

\*. The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The lower value of the coefficient of variation of cayenne pepper production indicated that cayenne pepper farmers are better able to control the risk (variation) of production, compared to curly pepper more than big -red chilli farmers.

The results of this study are different from the results of Mala *et al. Alabama.* (2021) in the Sumberrejo district showed that there is no significant difference between the production risk and the income risk of the cultivation of chili big-red and cayenne pepper, but the price risk of chili big-red is higher compared to the cayenne pepper price risk. This condition identified that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of Amin and Prihantini (2021) and Alfianor, et al., (2018) who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper was considered be a profitable and viable agricultural business (Puspitasari, 2020; Light and Wake, 2020).

#### **Price risk.**

Price risk was also analyzed in the same way as production risk, but the results of the analysis are contradictory. Table 4 showed that the coefficient of variation of prices (CV<sub>p</sub>) for the cayenne pepper crop is the highest (0.57) compared to the big-red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

Table 4. Price risk for cayenne pepper, big-red chili and curly chili in the Lombok Island, 2022.

No	Description	Little Chili	Big-red Chili	Curly Chili
1	Price Variation	182,631,715	64,434,463	68,134,808
2	Price Standard Deviation	13,514	8027	8,254
3	Price Variation Coefficient	0.57	0.49	0.46

Source: Primary Data Analysis (2022).

The results of this analysis indicated that the cayenne pepper crop in Lombok Island is in the high price risk category (CV<sub>p</sub>>0.5), while big-red chili peppers and curly chili peppers are not included in the price risk category of high price, although the coefficient of variation is quite but still below 0.50. The results of this study are consistent with the results of previous studies (Siddik *et al.*, 2021), that the price risk of cayenne pepper in the cayenne pepper production centers in Lombok Island, both in the highlands, midlands, and lowlands, is listed in the high-risk category.

If the difference in price risk of bird's eye peppers, big-red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, then all three types of peppers have a significantly different price risk, both between cayenne pepper and big-red chili and curly peppers, or between chili peppers, big-red and chili curly peppers (Table 5).

Table 5. Price risk from comparative test results (LSD) for cayenne, big-red chili and curly chili in the Lombok Island, 2022

Comparison between		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower bound	Upper bound
Cayenne pepper	Big-red chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big-red chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big-red Chili	-.02900	.01583	.070	-.0605	.0025

\*The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

The results of the analysis and the statistical tests of production risk and price risk above showed that there are differences in the level of risk faced, in general all three are quite high production and price risks, as indicated by the coefficients of variation. In all three, the coefficient of variation of production and the coefficient of variation of price relatively high. However, the big-red chili possible loss caused by production risk is faced by the big-red chili crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big-red possible loss caused by price risk is faced by the cayenne pepper crop, then the big-red and small chili crop by the curly chili crop.

#### **Differences in farm income for cayenne pepper, chile big-red, and chili curly**

This study assumes that when choosing and carrying out chili cultivation activities, farmers are oriented to obtain the maximum income or profit. To achieve this objective is highly dependent on the production produced, the price received and the costs incurred, the difference in income for the three types of chili cultivation also depends on these three factors.

#### ***Production and Prices.***

Production is the total earning generated of chili as a whole from the first harvest to the last harvest, converted into units of hectares. While the price is the average value of production per kilogram of chili received by farmers from the first harvest to the last harvest. The results showed that the production of cayenne pepper, chili big-red and chili curly in 2021/2022 differs quite a bit between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the



dry season it is 5.1 tons/ha; chile big-red in the rainy season at 3.3 tons/ha and in the dry season at 4.7 tons/ha; and curly pepper, the production rate in the rainy season is 3.1 ton/ha and in the dry season it is 4.6 ton/ha (Table 6).

Table 6. Average production and price of cayenne pepper, big-red chili and curly chili in Lombok Island, 2021/2022

No	Season	Cayenne pepper		Big-red Chili		Curly chili	
		Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)	Production (kg)	Price (kg/ha)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

Source: Primary Data Processed (2022)

The data above is the seasonal production level, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average of 4.3 tonnes/ha, then chile big-red 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three types of chilli is irrelevant for the comparison, but when compared to the production of similar chillies the previous year in East Lombok Regency, it seems that the chilli production in 2021/2022 has decreased considerably. East Lombok Regency BPS data in figures (2022) showed that the productivity of cayenne pepper in East Lombok Regency in 2021 is 7.8 tonnes/ha and big-red chilli (including curly chilli) is 10, 8 tons/ha. Relatively, the similar results were also found in the research by Siddik, *et al.* (2021) that the productivity of cayenne pepper in the areas of the chilli production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicated that chilli productivity on Lombok Island is big-red determined by location, weather conditions, and other external factors.

Although the production of chili in 2021/2022 has decreased drastically, the sale price has increased considerably, particularly during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR 20.000/kg and IDR 16 thousand/kg (Siddik *et al.*, 2021), while in 2021/2022 the average price received by farmers during the rainy season is IDR 41.000/kg and in the dry season an average of IDR 15.000/ha. Therefore, although during the rainy season the level of production of farmers falls drastically, farmers do not feel a loss, because it is covered by a sharp increase in sales prices. In contrast to the dry season, production did not increase much, but prices fell sharply to around IDR 15.000/kg less than in 2021, which

fell to IDR 16.000/kg. Differences or fluctuations in chili prices during the rainy season and the dry season occur for all types of chili, but the most marked difference is cayenne pepper that reaches around IDR 26.000/kg, and around IDR 17.000/kg. While for big-red chillies, the price difference is relatively small, around IDR 7.000/kg. This difference indicated that the annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili and the lowest is big-red chili.

#### **Commercial costs.**

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis showed that the cost of growing cayenne pepper is higher than the cost of growing big-red chili peppers and curly chili peppers, especially during the rainy season. In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of chili big-red is IDR 44 million/ha and curly pepper IDR 43 million/ha. During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, chile big-red IDR 42 million/ha and curly pepper IDR 37 million/ha (Table 7).

Table 7. Average cost of cayenne pepper, big chili and curly chili (IDR000/ha) in Lombok Island, 2022

No	Description	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
<b>A. Variable Costs</b>		<b>42,074</b>	<b>30,689</b>	<b>33,159</b>	<b>30,991</b>	<b>31,907</b>	<b>26,508</b>
1	Production facilities	16,396	13006	13,267	13,471	11,885	11.188
2	Labor	13,212	10,555	9.117	8,298	8,397	7,047
3	Cost of Other Input Production	12,466	7.127	10,775	9,223	11,625	8,273
<b>B. Fixed Costs</b>		<b>14,240</b>	<b>12,257</b>	<b>11,329</b>	<b>11,427</b>	<b>11.173</b>	<b>11,390</b>
1	Land lease	13.178	11,082	10,597	10,490	9,981	10,236
2	Land Tax	247	215	189	208	193	150
3	Water Fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
<b>Totals (A+B)</b>		<b>56,314</b>	<b>42,946</b>	<b>44,488</b>	<b>42,419</b>	<b>43,080</b>	<b>37,899</b>

Source: Primary Data Processed (2022).

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds, fertilizers, growth stimulants and drug costs. Then labor costs and other support facilities like plastic mulch and stakes. These variable inputs cost about 70 percent of total farm costs. Although fixed inputs consist of income and land

taxes, equipment depreciation, water costs, and interest on loan capital, no farmers used loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million to IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

### ***Income and Agricultural Efficiency.***

Although the chilli production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year, because this decrease was offset by a fairly high increase in chilli prices during the rainy season, farm income obtained are still quite high and agriculture is considered efficient. The highest income and agricultural efficiency in the rainy season is obtained with the cultivation of cayenne pepper, which reaches IDR 89 million/ha with a CR ratio of 2.58; then the curly chile crop of IDR 51 million/ha with RC 2.21 and the lowest is the income from the big-red chili crop, which amounts to IDR. 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big-red cultivation of chili, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Table 8).

Table 8. Average production, prices, production value, production costs and farm income of cayenne pepper, chili pepper and curly pepper in the Lombok Island, 2021/2022

No	Component	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2.21	1.66

Source: Primary Data Analysis (2022).

The income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27 million/ha. Meanwhile, for the big-red chili crop, the difference is less than IDR 3 million/ha. This means that the big-red chile crop has a relatively stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crop

is very volatile. This indicated that the cayenne pepper and curly chili crop has a high-income risk, while chili cultivation Chili cultivation has low income risk.

### **Commercial Rent.**

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big-red chile costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD (*Least Significantly Different*) test.

Based on the results of the LSD test in Table 9, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income from the big-red chili pepper crop and curly chili. Meanwhile, the income from the big-red chili crop and the curly chili do not show a convincing difference in income. The results of this trial provide an explanation for the reasons why farmers in Lombok Island, especially in East Lombok Regency, prefer to plant bird's eye chilies instead of big-red chilies or curly chilies.

Table 9. Comparative test results (LSD) Farm income from cayenne pepper, big-red chili and curly chili in Lombok Island, 2022

Comparison between		Mean Difference (IJ)	std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	21367.133 *	6618730	002	8211.69	34522.58
	Curly chili	22082.767 *	6618730	001	8927.32	35238.21
Big-red Chili	Cayenne pepper	-21367.133 *	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767 *	6618730	001	-35238.21	-8927.32
	Big-red Chili	-715,633	6618730	.914	-13871.08	12439.81

\*. The mean difference is significant at the 0.05 level.

Source: Primary data processed (2022)

### **Relationship between Production Risk and Price Risk with Agricultural Income.**

The results of the Pearson correlation analysis show that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship.

Unlike big-red peppers, both production risk and price risk are negatively related to farm income (Table 10).

Table 10. Risk-to-return test results for Cayenne Pepper, Big Chili and Curly Chili in Lombok Island, 2022

Type of Chili	Variable Correlation	Coef Value. Correlation (Pearson correlation)	Significance Test (P-Value)	Strength Connection
1. Cayenne Pepper	Production-Revenue Risk	0.339	0.067*	Less Strong
	Price Risk - Revenue	-0.518	0.003***	Very strong
2. Big-red Chili	Production-Revenue Account	-0.404	0.027**	Less Strong
	Price Risk - Revenue	-0.021	0.265.	Less Strong
3. Curly Chili	Production-Revenue Risk	0.071	0.708	Less Strong
	Price Risk - Revenue	-0.599	0.001***	Very strong

Source: Primary data processed (2022),

In the cultivation of cayenne pepper, chili big-red and cayenne pepper, the production risk during the rainy season is on average higher than in the dry season, which is characterized by a decrease in production, however the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than the dry season, during which production risk is lower. Meanwhile, for big-red chili peppers, a big-red production risk is indicated by a decline in production during the rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

On the other hand, in the dry season the average price risk faced by farmers of cayenne chili peppers, big-red chili peppers and curly chili peppers increases and is greater than in the rainy season marked by a sharp fall in prices. This drastic price reduction was not followed by a sharp increase in production, therefore income earned was low, even for cayenne pepper and chili peppers, much lower than income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income, also, low risk is not always followed by high farm income. What is more decisive and

logical is the courage of farmers in the face of the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production input, the more likely farmers are to earn higher incomes or profits (Ellis, 1988; Siddik, *et al.*, 2021).

## CONCLUSIONS AND RECOMMENDATIONS

The cultivation of cayenne pepper, big-red chili and curly chili in the Lombok Island has fairly high and varied agricultural risks. The cayenne pepper crop has the lowest production risk (0.45) and is significantly different from the curly pepper crop (0.49) and the big-red pepper crop (0.51), which have high risk. In contrast to price risk, the cayenne pepper crop has the highest risk (0.57) compared to the big-red chili crop (0.49) and the curly chili crop (0.46). Incomes from cayenne pepper cultivation are higher and significantly different than those from chile big-red and chile curly. The average income from cayenne pepper cultivation is IDR 59.19 million/ha, while in the great cultivation of chili it is IDR 37.82 million/ha, not significantly different from the agricultural income of curly pepper of IDR 37.10 million/ha. Production risk in the cayenne pepper and curly pepper crops is positively correlated with farm income, while the big-red pepper crop is negatively correlated. Meanwhile, price risk is negatively correlated with farm income, both for the cayenne pepper, chile big-red, and chili curly crops.

Considering that cayenne chillies, big-red chillies and curly chillies can be substituted to some extent, in order to reduce the production risk and price risk of chillies in Lombok Island, this can be achieved by developing the three types of commodities in a balanced manner in suitable places for each type of chili. There is a tendency for cayenne pepper to be better suited for development on low to midlands, while big-red chiles and curly chiles are more suitable to develop in medium and highland areas. There is a need for technical guidance on the cultivation of chili, especially for big-red producers of chili and curly chili, because the level of production produced is still low and lower than the level of production produced by cayenne pepper. The government also needs to initiate and facilitate the establishment of cooperative associations between farmers and companies that supply and distribute chili products, as well as with insurance companies, to increase the enthusiasm of farmers for the three types of chili, so that the annual inflation contributed by this product decreases and the welfare of the farmers is guaranteed.

## References

- [Adams, A.](#) and Cox, Anna L. (2008). Questionnaires, in-depth interviews and focus groups. In: Cairns, Paul and Cox, Anna L. eds. *Research Methods for Human Computer Interaction*. Cambridge, UK: Cambridge University Press, pp. 17–34.  
<http://www.cambridge.org/catalogue/catalogue.asp?i...>
- Alfanor, Y. Ferrianta, Hamdani. 2018. Risk analysis of cayenne pepper production in Mailing Village, Padang Badung District, Hulu Sungai Selatan Regency. " *Agribusiness Frontier* 2(4). <http://ppjp.ulm.ac.id/journals/index.php/fag/article/view/663/650>.
- Amin, M. and Prihantini, CI. 2021. Risk Analysis of Canney Chili Production and Production in Watunohu District, North Kolaka Regency. *Agribusiness Magazine Dryland Agribusiness*: p.16–21. <https://media.neliti.com/media/publications/361509-analysis-of-production-and-production-ri-878daa02.pdf>
- Anderson, J.R.; Dillon, J.L. and Hardaker, J.B. 1977. Farm Decision Analysis. Iowa State University Press, Ames Iowa.  
<https://econpapers.repec.org/bookchap/agsagsaem/288652.htm>
- Cahya, AA and Bangun, R.H. Br. 2020. "Farmer characteristics and agricultural viability of chili pepper (*Capsicum annum* L) and cayenne pepper (*Capsicum frutescens* L) in North Sumatra." *AgriCore: Agribusiness and Socioeconomic Agriculture Magazine UNPAD* 5(1). <http://journal.unpad.ac.id/agricore/article/view/27139/pdf>.
- Chang, T, 1995. An Application of Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Modelling on Taiwan's Time-Series Data: Three Essays. *All Graduate Theses and Dissertations*. 3916. p.129.  
<https://digitalcommons.usu.edu/etd/3916>
- Ellis, F. 1988. Peasant economy: peasant families and agrarian development. Cambridge University Press, Cambridge. <https://www.cambridge.org/core/journals/experimental-agriculture/article/abs/peasant-economics-farm-households-and-agrarian-development-second-edition-by-frank-ellis-cambridge-cambridge-university-press-1993-pp-309-1595-us3295-isbn-0521457114/3F5CC663DC4C86A2B200ED1D63152660>
- Fariyanti, A. 2008. Economic behavior of vegetable farmer households in coping with production risks and commodity prices in Pangalengan district, Bandung regency. PhD thesis. IPB Graduate School, Jurnal Agroekonomi. Bogor.  
<https://ejournal.litbang.pertanian.go.id/index.php/jae/article/view/4719>
- Frankel, Jeffrey A. 2011. How Can Commodity Exporters Make Fiscal and Monetary Policy Less Procyclical? HKS Faculty Research Working Paper Series RWP11-015, John F. Kennedy School of Government, Harvard University.  
<https://dash.harvard.edu/handle/1/4735392>
- Mala, N. Prasmatiwi, FE. and Sayekti, WD. 2021. Income and risks of chilli cultivation in Sumber Rejo district, Tanggamus regency". *Magazine of Agroindustry Sciences*. 9(1): p.91–98.
- Mariyono, J. and [Sumarno](#), S. 2015. Chilli production and adoption of chilli-based agribusiness in Indonesia. [Journal of Agribusiness in Developing and Emerging](#)

[Economics](#). ISSN: 2044-0839. Vol. 5 No. 1, pp. 57-75. <https://doi.org/10.1108/JADEE-01-2014-0002>  
<https://emeraldpublishinggroup.freshdesk.com/support/solutions/articles/36000213997>

- Mariyono, J. 2017. Moving to commercial production: a case of intensive chili farming in Indonesia. [Development in Practice](#) Volume 27 Issue 8. p.1103-1113. <https://www.tandfonline.com/doi/abs/10.1080/09614524.2017.1360841>
- Newcomer, KE; Hatry, HP and Wholey, JS., 2015. Handbook of Practical Program Evaluation, Fourth Edition. Print ISBN:9781118893609 |Online ISBN:9781119171386 |DOI:10.1002/9781119171386 <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119171386#page=528>
- [Nugroho](#), LH. 2016. Red pepper (*Capsicum* spp.) fruit: A model for the study of secondary metabolite product distribution and its management. AIP Conference Proceedings Voume **1744(1)** 020034 <https://doi.org/10.1063/1.4953508>  
<https://aip.scitation.org/doi/abs/10.1063/1.4953508>
- Puspitasari, A. 2020. Cost-income analysis of cayenne pepper cultivation in Cigalontang sub-district, Tasikmalaya district. *Agribusiness Platform: Scientific Community Thought magazine with Agribusiness Insights* 6(2): p.1130–1142. <https://jurnal.unigal.ac.id/index.php/mimbaragribisnis/article/view/3692/0>
- Siddik, M. 2015. Economic behaviors of tobacco farming households when facing agricultural risks in the Lombok Island, Indonesia. *International Journal of Applied Sociology*. Vol 5 No.5: p.180-189.
- Siddik, M. Zaini, A. Budastra and Zubair, M. 2018. Analysis of the Impact of the Claim of Chili Price Stabilization in West Nusa Tenggara (Research Report). Mataram University Faculty of Agriculture. <https://jurnal.lppm.unram.ac.id/article/download>
- Siddik, M., Zaini, A. Hamidi, H. Dipokusumo, B. Anwar, A. 2019. Behavior and household strategies of cayenne pepper farmers to cope with agricultural risks on Lombok Island (Research Report). Mataram University Faculty of Agriculture. <http://agrimansion.unram.ac.id/Agri/article/view>
- Susanawati; Akhmedi, H.; Fauzan, and Rozaki, Z. 2021. Supply chain efficiency of red chili based on the performance measurement system in Yogyakarta, Indonesia. the journal [Open Agriculture](#). Volume 6 Issue 1. p.1-12 <https://doi.org/10.1515/opag-2021-0224> <https://www.degruyter.com/document/doi/10.1515/opag-2021-0224/html>
- Zaini, A., Siddik, M. and Suparmin, S. 2014. Application of Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCH) models to measure price volatility and production response of chili in the Lombok Island. Lemlit Unram. Mataram. <http://agrimansion.unram.ac.id/article/download>
- Zaini, A., M. Siddik, Budastra, Anwar and M. Zubair, 2016. Comparison of production responses of chili farmers in East Lombok, Sumbawa and Bima regions to price volatility. Lemlit Unram. Mataram. <http://agrimansion.unram.ac.id/article/download>



Dari: <[editorialoffice@nyjxxb.net](mailto:editorialoffice@nyjxxb.net)>  
Date: Jum, 17 Des 2022 19.00  
Subject: Re: Paper Submission  
To: <[siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)>

Dear Authors

Please revise some editorials and phrases by completing them with reference literacy and following the guidelines.

Chief Editor.

Des 20, 2022  
12.05

**Muhamad Siddik <siddikunram60@gmail.com>**  
kepada editorialoffice

Dear Prof Ren Luquan

On this day Thursday, December 20, 2022, the internet network is not available making it difficult to access the web and download templates. we ask for an extension of the delivery time for repairs to the manuscript and payment of the article publication fee.

Muhammad Siddik

muhammad siddik

Article Type

Research article (see Author Guidelines)

Category

Please select the most suitable subject area from the approved list of the journal (see Focus and Scope)

## The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Muhamad Siddik<sup>1\*</sup>; Dwi Praptomo Sudjatkiko<sup>1</sup>; Tajidan Tajidan<sup>1</sup>;  
Bambang Dipokusumo<sup>2</sup>; and Anwar Anwar<sup>2</sup>

<sup>1</sup>) Agribusiness in Magister Study Program, Agricultural Faculty, University of Mataram, 83124, Indonesia

<sup>2</sup>) Agribusiness Study Program, Agricultural Faculty, University of Mataram, 83124, Indonesia

Correspondence e-mail: siddikunram60@gmail.com

**Abstract:** The aim of this research is to find a comparative model of production risk and price risk and its relation to the farming income of cayenne pepper, big chili and curly chili in the tropical areas. To find the comparative model of production and price risk, an analysis of variance, standard deviation and coefficient of variation between types of chili were carried out and also the relationship between the level of risk and income by means of a Pearson correlation analysis. Data was collected from 90 sampling units consisted of 30 sampling units for each type of chili farming. The sampling unit for each type of farming was selected using a simple random sampling technique, while the data were using structured interviews, in-depth interviews, and observations at each chili farming location. The research found that the production risk of cayenne pepper farming is lowest when compared to the production risk of curly chili farming and big chili farming; conversely, the price risk of cayenne pepper is in the high risk category compared to the price risk of big chilies and curly chilies. Pearson correlation analysis can be used to determine the relationship between the level of risk and chili farming income, the higher the production risk, the higher the income of cayenne pepper and curly chili farming. Meanwhile, the higher the production risk, the lower the income from big chili farming, while the higher the price risk, the lower the farming income

**Keywords:** coefficient, correlation, deviation, farming, model

Commented [A1]:

Commented [A2R1]:

Commented [A3R1]:

## 文章标题

名姓<sup>1</sup>,名姓<sup>2</sup>,名姓<sup>3</sup>

(1. 部门、单位、城市、邮政编码、国家

2. 部门、单位、城市、邮政编码、国家

3. 部门、单位、城市、邮政编码、国家)

摘要: 摘要的总字数不得超过 200 字。摘要应该是一个单独的段落, 并且应该遵循结构化摘要的风格, 但没有标题: 1) 背景: 将所解决的问题置于广泛的背景中并突出研究的目的; 2) 方法: 简要描述应用的主要方法或处理方法。包括任何相关的预注册编号, 以及使用的任何动物的物种和品系。3) 结果: 总结文章的主要发现; 4) 结论: 指出主要结论或解释。摘要应该是文章的客观表示: 它不能包含在正文中没有呈现和证实的结果, 也不应该夸大主要结论。

**关键词:** 关键字 1; 关键字 2; 关键字 3 (Authors do not need to translate the article title, abstract, keywords, and references into Chinese)

### 1 Introduction

Chili is one of the most important agricultural and food staples in Indonesia [1], because in addition to being widely cultivated and a source of income for many residents, it is also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity [2], because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months the price is very low and in other months the price increases sharply.

The fluctuating price of chili is due to the erratic production and supply of chili [3], while the

demand is relatively constant. At certain times, production and supply are very low, causing chili prices to rise sharply. Meanwhile, at other times the production and supply of chili peppers is abundant, so the price of chili peppers drops drastically [4]. This condition causes the commodity crop of chili to face production risks and price risks that are quite high.

Theoretically, the courage of farmers to face agricultural risks determines productivity and income from agriculture [5]. If farmers behave with fear of risk (risk *aversion*), then the utilization of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and lower farm income. But if farmers are risk *takers*, then

resource utilization will be optimal for maximum productivity and income, but with the possibility of increased risk of loss. Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of this crop.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili [6]. In Lombok Island, the most cultivated type of chili is cayenne pepper. However, among the cayenne pepper plants, many farmers were also found to grow big-red chilis or curly chilis in the same stretch and season. Farmers' choice in determining the type of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study aims to find a comparative model of production risk and price risk and its relation to the farming income of cayenne pepper, big chili and curly chili in the tropical areas as well as the relationship between risk level and income in the Lombok Island.

## 2 Research Method

### 2.1 Research subjects

This research was carried out in Lombok Island, West Nusa Tenggara Province, Indonesia. The research topics were the cultivation of cayenne pepper, chile big-red, and chili curly, which were grown during the 2021/2022 rainy and dry seasons. In Lombok Island, the rainy season usually occurs from November to April; and the dry season from May to October [7].

### 2.2 Research Design

The research was designed using an explanatory method, that is, research that aims to explain and relate one variable to another that is different but interrelated and produces a causal relationship [8]. The main variables that are connected and sought for correlation are the level of production and price risk with the farming income of each type of chili.

The research locations were determined in stages (multistage purposive sampling) starting from the district, sub-district to village levels. The selection of districts was based on the production centers of the three types of chili, thus, East Lombok

Regency was selected. In addition, three sub-districts/villages were selected which cultivated the three types of chili; each sub-district/village is expected to represent lowland areas (<200 mpl), midland (200-500 mpl) and highland areas (>500 mpl). The location selected was based on the height of the area and the results of previous research that the altitude of the area affects the production and income of cayenne pepper farming and this is expected to apply to big-red chili and curly chili farming (Figure 1). On the basis of these considerations, Jerowaru Village in Jerowaru District, was chosen to represent the lowland area; Kalijaga Village in Aikmel District, representing the midland area; and Pringgasela village in Pringgasela District representing the highland.

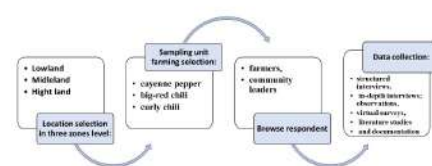


Figure 1. Stages of Research

### 2.3 Research respondents.

Farmers who were the object of research were farmers who cultivate cayenne pepper, big-red chili, and curly chili during the rainy season and/or dry season in 2021/2022 and had experience cultivating these chilies for at least three growing seasons. Initial information about the chili farmers was obtained from farmer groups in each sample village, then randomly selected (random sampling) each of 10 respondent farmers with the criteria according to the aforementioned provisions. Therefore, this research obtained 90 respondents.

### 2.4 Data collection

Data collection was carried out by combining several methods simultaneously, namely the method of structured interviews using a list of questions [10], in-depth interviews; field observations, virtual surveys, literature studies and documentation. The structured interview is

aimed at the surveyed farmers who grow cayenne pepper, chile big-red or chili curly. The in-depth interviews were aimed at community leaders who know about chile cultivation and the problems it faces, as well as government policies related to agricultural development.

**2.5 Procedure of Data analysis**

The farm risk studied is the production risk and the price risk. The measurement of both risks uses the variance, the standard deviation and the coefficient of variation [11]. Production variation and price variation as a measure of production risk and price risk are based on the experience of farmers carrying out chili cultivation activities before. The procedure for finding a comparative model is shown in Figure 2:

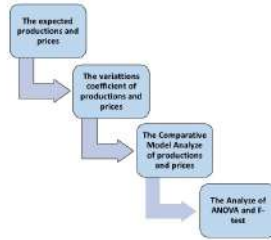


Figure 2: Stages of Comparative Model Analysis of Production Risk and Price Risk

**2.5.1 Expected productions and prices**

To estimate the production and price of each type of chili using the following formula:

$$\mu_i = q_{ih}Q_{ih} + q_{ir}Q_{ir} + q_{in}Q_{in}, \dots \dots \dots [3.1]$$

$$\sigma_i^2 = q_{ih}[Q_{ih} - \mu_i]^2 + q_{ir}[Q_{ir} - \mu_i]^2 + q_{in}[Q_{in} - \mu_i]^2 \dots \dots \dots [3.2]$$

$$\theta_i = q_{ih}P_{ih} + q_{ir}P_{ir} + q_{in}P_{in}, \dots \dots \dots [3.3]$$

$$\phi_i^2 = q_{ih}[P_{ih} - \theta_i]^2 + q_{ir}[P_{ir} - \theta_i]^2 + q_{in}[P_{in} - \theta_i]^2 \dots \dots \dots [3.4]$$

**Information:**

- Q = Production of each type of chili (kg/Ha)
- $\mu_i$  = Expected production of each type of chili (kg)
- $\sigma_i^2$  = Variance or risk of production of each type of chili
- P = Price of each type of chili (IDR/kg)
  
- $\theta_i$  = Expected price of each type of chili (IDR/kg)
- $\phi_i^2$  = Price variation or risk for each type of chili
- i = sample or respondent i
- q = Production opportunity or price opportunity for each type of chili (%)
- h, r, n = Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

**2.5.2 The variations coefficient of productions and prices**

In addition, to analyze the level of production risk and price risk for each type of chili, the coefficient of variation is used, with the formula:

$$CV_{qj} = \frac{\sigma_j}{Q_j} \dots \dots \dots [3.5]$$

$$CN_{pj} = \frac{\theta_j}{P_j} \dots \dots \dots [3.6]$$

**Where:**

- $CV_{qj}$  = Production variation coefficient for each type of chili
- $\sigma_{qj}$  = Standard deviation of production for each type of chili
- $CV_{pj}$  = Price variation coefficient for each type of chili
- $\sigma_{pj}$  = Standard deviation of the price of each type of chili
- $j$  = Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

**If the coefficient of variation of  $CV_{qj}$  or  $CV_{pj}$  is greater than 0.5, the production or price risk is in the high category; but if it is less than or equal to 0.5 it is included in the low risk category.**

**2.5.3 The Comparative Model Analyze of productions and prices**

1. The comparative model productions risk:

Comparison	Cayenne Pepper	Big-Red Chili	Curly Chili
Cayenne Pepper	1.000	$CM_{q21} = CV_{q2}/CV_{q1}$	$CM_{q31} = CV_{q3}/CV_{q1}$
Big-Red Chili	$CM_{q12} = CV_{q1}/CV_{q2}$	1.000	$CM_{q32} = CV_{q3}/CV_{q2}$
Curly Chili	$CM_{q13} = CV_{q1}/CV_{q3}$	$CM_{q23} = CV_{q2}/CV_{q3}$	1.000

2. The comparative model prices risk:

Comparison	Cayenne Pepper	Big-Red Chili	Curly Chili
Cayenne Pepper	1.000	$CM_{p21} = CV_{p2}/CV_{p1}$	$CM_{p31} = CV_{p3}/CV_{p1}$
Big-Red Chili	$CM_{p12} = CV_{p1}/CV_{p2}$	1.000	$CM_{p32} = CV_{p3}/CV_{p2}$
Curly Chili	$CM_{p13} = CV_{p1}/CV_{p3}$	$CM_{p23} = CV_{p2}/CV_{p3}$	1.000

Information:

$CM_q$  = comparative model productions risk

$CM_p$  = comparative model prices risk

$CV_q$  = coefficient variation productions

$CV_p$  = coefficient variation prices

**2.5.4 The Analyze of ANOVA and F-test**  $CM$  = comparative model

To compare the risks cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical test (analysis of variance) or the F test; then proceed with the LSD (Least Significantly Different) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Table 1).

Table 1. Differences of ANOVA and F-test in risk of cayenne pepper, chile big-red and chile curly crops

Origin of variance	SS	DF	MS	F-Test
Between Groups (b)	SS <sub>b</sub>	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	SS <sub>w</sub> = SS <sub>T</sub> - SS <sub>b</sub>	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	SS <sub>T</sub>	nk-1		

## Information:

DF = Degrees of freedom

SS= Sum of Squares

MS = Sum of mean squares

SS<sub>T</sub> = Square Sum Total (Square Sum Total)

SS<sub>b</sub> = Sum of squares between groups (Sum of Square Between)

SS<sub>w</sub> = Sum of squares in the group (Sum of squares within)

n = Number of data or samples

k = number of groups or types of chiles

The decision criterion, if F count > F table at an error rate ( $\alpha$ ) of 10%, then there is a difference in the risk or income of cayenne pepper, big-red chili and curly chili farming. Conversely, if F count  $\leq$  F table, then there is no difference in risk or income for the three types of chili.

## 2.6 Farming income analysis

Furthermore, farm income is measured by reducing the value of production with all production costs. The value of production is the product multiplied by the price of production.

$$Q_j = \sum_{k=1}^m Q_k \quad \dots\dots\dots (3.7)$$

$$TC = VC + FC \quad \dots\dots\dots (3.8)$$

$$\Pi_j = \sum_{k=1}^m P_k \times Q_k - TC_k \quad (3.9)$$

Where:

Q = Production of each type of chili (kg/Ha)

$\Pi$  = Farming Income for each type of chili (IDR000)

P = Price of each type of chili (IDR/kg)

TC = Total cost or total cost of each type of chili (IDR)

VC = Variable cost or variable costs (IDR)

FC = Fixed cost or fixed costs (IDR)

j = Type of chili (cayenne pepper, big-red chili, curly chili)

m = The number of times harvested for each type of chili.

k = The k-th harvest (k=1,2,3, .....m) of each type of chili

To compare the risks and returns of growing cayenne peppers, big-red peppers, and curly peppers, use the ANOVA statistical

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD (*Least Significantly Different*) test, to individually test the difference in risk or farm income for each type of pepper. To calculate the



LSD value, some data is needed from the ANOVA calculations, namely  $MS_{\epsilon}$  (mean square error) data,  $df$  (degrees of freedom),  $r$  (number of samples for each group or type of chili) and Student's  $t$  tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df} \sqrt{\frac{2(MSE)}{r}}) \dots \dots \dots (3.10)$$

The decision criterion, if the difference between two variables is greater than  $LSD_{\alpha}$ , then the two variables (agricultural risk or income) show a significant difference. But if the difference between two variables is less than or equal to  $LSD_{\alpha}$ , then the two variables are not significantly different [12].

In addition, to analyze the relationship between production risk and price risk with Farming Income for each type of chili, the Pearson correlation coefficient ( $r$ ) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad (3.11)$$

Where:

X = Production risk or price risk for each type of chili

Y = Farming Income for each type of chile

### 3 Result

Differences in Risks of Cultivation of Cayenne Pepper, Chili Big-red and Chili Curly

#### 3.1 Production Risk

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal and low production) based on experience in carrying out activities. chili cultivation.

**Table 2. Production risks of farming cayenne pepper, big-red chili peppers and curly chili**

No	Description	Cayenne Pepper	Big-Red Chili	Curly Chili
1	Production Variations	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Source: Primary Data Analysis (2022)

In addition, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big-red chili and curly chili can be seen in Table 2.

**Table 3. The Analysis of comparison production risks of farming cayenne pepper, big-red chili peppers and curly chili**

Comparison	Cayenne Pepper	Big-Red Chili	Curly Chili
Cayenne Pepper	1.00	1.33*	1.09*
Big-Red Chili	0.88*	1.00	0.96
Curly Chili	0.92*	1.04	1.00

Source: Primary data analyze

The results of the comparative analysis of production risk between chili types are shown in Table 3 and the comparative significance can be read in Table 4. The risk of producing big-red chili is almost the same as the risk of producing curly chili, and production risk of cayenne pepper is lower than curly chili and big-red chili or big-red chili highest production risk.

**Table 4. Productions risk results of the comparative test (LSD) of the cultivation of cayenne pepper, big-red chili and curly chili**

Comparison between	Mean Differences (U)	Std. Error	Sig.	95% Confidence Intervals		
				Lower Bound	Upper Bound	
Cayenne pepper	Big-red Chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big-red Chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684
	Big-red Chili	-.01633	.01060	.127	-.0374	.0047

Source: Primary Data Analysis (2022).

\* The mean difference is significant at the 0.05 level.

### 3.2 Price risk

Price risk is also analyzed in the same way as production risk, but the results of the analysis are contradictory. Table 4 shows that the coefficient of variation of prices (CVp) for the cayenne pepper crop is the highest (0.57) compared to the big-red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

Table 5. Price risk for cayenne pepper, big-red chili and curly chili

No	Description	Cayenne pepper	Big-red Chili	Curly Chili
1	Price Variation (IDR x1000)	182,631	64,434	68,134
2	Price Standard Deviation	13,514	8,027	8,254

3	Price Variation Coefficient	0.57	0.49	0.46
---	-----------------------------	------	------	------

Source: Primary Data Analysis (2022).

The results of this analysis indicate that the cayenne pepper crop in the Lombok Island is in the high price risk category (CVp>0.5), while big-red chili peppers and curly chili peppers are not included in the price risk category. high price, although the coefficient of variation is quite big-red, but still below 0.50. The results of this study are consistent with the results of previous studies, that the price risk of cayenne pepper in the cayenne pepper production centers in the Lombok Island, both in the highlands, mid-plains, and lowlands, is listed in the high-risk category.

Table 6. The Analysis of comparison price risks of farming cayenne pepper, big-red chili peppers and curly chili

Comparison	Cayenne Pepper	Big-Red Chili	Curly Chili
Cayenne Pepper	1.00	0.85*	0.81*
Big-Red Chili	1.16*	1.00	0.94
Curly Chili	1.23*	1.07	1.00

Source: Primary data analyze

The comparison of price risk of cayenne pepper larger than price risk of big-red chili and curly chili (Table 6), differs significantly from the price risk of big-red chili and curly chili.

Table 7. Price Risk from Comparative Test Results (LSD) for Cayenne, Big-red Chili and Curly Chili

Comparison between		Mean Differences	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big-red Chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big-red Chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big-red Chili	-.02900	.01583	.070	-.0605	.0025

\*The mean difference is significant at the 0.05 level.

Source: Primary Data Analysis (2022).

If the difference in price risk of curly peppers, big-red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, then all three types of peppers have a significantly different price risk, both between cayenne pepper and chile big-reds and chili curly peppers, or between chili peppers big-red and chili curly peppers (Table 7).

The results of the analysis and the statistical tests of production risk and price risk (Table 4), although they show that there are differences in the level of risk faced, in general all three are quite high production and price risks, as indicated by the coefficients of variation. relatively big-red chili in all three, the coefficient of variation of production and the coefficient of variation of price. However, the big-red chili possible loss caused by production risk is faced by the big-red chili crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big-red pepper possible loss caused by price risk is faced by the cayenne pepper crop, then the big-red and small chili crop by the curly chili crop.

### 3.3 Differences in farm income for cayenne pepper, chile big-red, and chili curly

This study assumes that when choosing and carrying out chili cultivation activities, farmers are oriented to obtain the maximum income or

profit. To achieve this objective is highly dependent on the production produced, the price received and the costs incurred, the difference in income for the three types of chili cultivation also depends on these three factors.

#### 3.2.1 Production and Prices

If the seasonal production level is above, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average of 4.3 tonnes/ha, then chile big-red 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three types of chili is irrelevant for the comparison, but when compared to the production of similar chillies the previous year in East Lombok Regency, it seems that the chili production in 2021/2022 has decreased considerably.

Table 8. Average production and price of cayenne pepper, big-red chili and curly chili

No	Season	Cayenne pepper		Big-red Chili		Curly chili	
		Production (kg)	Price (IDR/kg)	Production (kg)	Price (IDR/kg)	Production (kg)	Price (IDR/kg)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

Source: Primary Data Processed (2022)

East Lombok Regency BPS data in figures (2022) shows that the productivity of cayenne pepper in East Lombok Regency in 2021 is 7.8 tonnes/ha and big-red chili (including curly chili) is 10.8 tons/ha. Relatively the same results were also found in the research by [3] that the productivity of cayenne pepper in the areas of the chili production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicates that chili productivity on Lombok Island is big-redly determined by location, weather conditions, and other external factors.

### 3.2.2 Commercial costs

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis show that the cost of growing cayenne pepper is higher than the cost of growing big-red chili peppers and curly chili peppers, especially during the rainy season.

**Table 9. Average cost of cayenne pepper, big chili and curly chili (IDR000/ha)**

No	Description	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
<b>A. Variable Costs</b>							
		<b>42,074</b>	<b>30,689</b>	<b>33,159</b>	<b>30,991</b>	<b>31,907</b>	<b>26,508</b>
1	Production facilities	16,396	13006	13,267	13,471	11,885	11,188
2	Labor	13,212	10,555	9,117	8,298	8,397	7,047
3	Cost of Other Input Production	12,466	7,127	10,775	9,223	11,625	8,273
<b>B. Fixed Costs</b>							
		<b>14,240</b>	<b>12,257</b>	<b>11,329</b>	<b>11,427</b>	<b>11,173</b>	<b>11,390</b>
1	Land lease	13,178	11,082	10,597	10,490	9,981	10,236
2	Land Tax	247	215	189	208	193	150
3	Water Fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
<b>Totals (A+B)</b>		<b>56,314</b>	<b>42,946</b>	<b>44,488</b>	<b>42,419</b>	<b>43,080</b>	<b>37,899</b>

Source: Primary Data Processed (2022).

In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of chili big-red is IDR 44 million/ha and curly pepper IDR 43 million/ha. During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, chile big-red IDR 42 million/ha and curly pepper IDR 37 million/ha (Table 9).

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds,

fertilizers, growth stimulants and drug costs. Then labor costs and other support facilities like plastic mulch and stakes. These variable inputs cost **about 70%** of total farm costs. Although fixed inputs consist of income and land taxes, equipment depreciation, water costs, and interest on loan capital (**30%**), no farmers used loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million to IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season. But because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

### 3.2.3 Income and Farming Efficiency.

Although the chili production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year, because this decrease was offset by a fairly high increase in chili prices during the rainy season, farm income obtained is still quite high and farming is considered efficient.

**Table 10. Average production, prices, production value, production costs and farm income**

No	Component	Cayenne pepper		Big-red Chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2,21	1.66

Source: Primary Data Analysis (2022).

The highest income and agricultural efficiency in the rainy season is obtained with the cultivation of cayenne pepper, which reaches IDR 89

million/ha with a CR ratio of 2.58; then the curly chile crop of IDR 51 million/ha with RC 2.21 and the lowest is the income from the big-red chili crop, which amounts to IDR. 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big-red cultivation of chili, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Table 10).

When income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27 million/ha. Meanwhile, for the big-red chili crop, the difference is less than IDR 3 million/ha. This means that the big-red chile crop has a relatively stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crop is very volatile. This indicates that the cayenne pepper and curly chili crop has a high-income risk, while chili cultivation Chili cultivation has low income risk.

### 3.2.4 Commercial Rent

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big-red chile costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD (*Least Significantly Different*) test.

**Table 11. Comparative test results (LSD) Farm income from cayenne pepper, big-red chili and curly chili**

Comparison between	Mean Difference (I)	std. Error	Sig.	95% Confidence Intervals		
				Lower Bound	Upper bound	
Cayenne pepper	Big-red Chili	21367.133	661873	002	8211.69	34522.58
	Curly chili	22082.767	661873	001	8927.32	35238.21
Big-red Chili	Cayenne pepper	-21367.133	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767	6618730	001	-35238.21	-8927.32
	Big-red Chili	-715,633	6618730	.914	-13871.08	12439.81

\*. The mean difference is significant at the 0.05 level.

Source: Primary data processed (2022)

Based on the results of the LSD test in Table 9, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income from the big-red chili pepper crop. and curly chili; Meanwhile, the income from the big-red chili crop and the curly chili do not show a convincing difference in income. The results of this trial provide an explanation for the reasons why farmers in the Lombok Island, especially in East Lombok Regency, prefer to plant bird's eye chilies instead of big-red chilies or curly chilies.

### 3.3 Relationship between Production Risk and Price Risk with Farming Income.

In the cultivation of cayenne pepper, big-red chili, and curly chili, the production risk during the rainy season is on average higher than in the dry season, which is characterized by a decrease in production, but the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than the dry season, during which production risk is lower. Meanwhile, for big-red chili peppers, a big-red production risk is indicated by a decline in production during the

Commented [A4]: CR Ratio atau R/C ?

rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

Table 12. Risk-to-return test results for Cayenne Pepper, Big Chili and Curly Chili

Type of Chili	Variable Correlation	Coef Value. Correlation	Significance Test (P-Value)	Strength Connection
1. Cayenne Pepper	Production-Risk-Income	0.339	0.067*	Less Strong
	Price Risk – Income	-0.518	0.003***	Very strong
2. Big-red Chili	Production-Risk - Income	-0.404	0.027**	Less Strong
	Price Risk – Income	-0.021	0.265	Less Strong
3. Curly Chili	Production-Risk - Income	0.071	0.708	Less Strong
	Price Risk - Income	-0.599	0.001**	Very strong

Source: Primary data processed (2022)

## 4 Discussion

### 4.1 Productions Risk

Table 2 shows the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili is quite high, but the highest is the big-red chili (0.51), then the curly chili (0.49) and the most-low is cayenne pepper (0.45). This means that the production risk of the chilli crop on the island of Lombok is quite risky, but the big-red chili crop is included in the high-risk category (CVq > 0.50), while the curly chillies, especially the allspice cayenne, are still included in the low production risk category.

Production is the total yield of chili as a whole from the first harvest to the last harvest, converted into units of hectares. While the price is the average value of production per kilogram of chili received by farmers from the first harvest to the last harvest. The results show that the production of cayenne pepper, chili big-red and chili curly in 2021/2022 differs quite a bit

between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the dry season it is 5.1 tons/ha; chili big-red in the rainy season at 3.3 tons/ha and in the dry season at 4.7 tons/ha; and curly pepper, the production rate in the rainy season is 3.1 ton/ha and in the dry season it is 4.6 ton/ha (Table 8).

The average cayenne pepper production in Thailand is 13.96 tons, higher than the cayenne pepper production in Lombok Island (3.5 tons/ha). In Thailand, environmentally friendly technology has been implemented with an environmental index of 0.0142 [13]. The low production of cayenne pepper in Lombok Island is suspected as a result of pest disturbances and the application of conventional technology, and result of poor pest management practices and the use of toxic. [14] states that Indonesia has the potential to produce curly chillies, each tree can produce 0.75 - 1 kg/harvest period. Such a low production achievement means a high level of risk. As explained by [15] that production risks and cost risks are caused by poor pest management and the low quality of pest control management by farmers.

The results of the LSD test on the differences in risk of cayenne pepper, big-red chili, and curly chili also show that the risk of cayenne pepper production is lower and significantly different from the risk of big-red chili production., including curly pepper, with a confidence level of more than 95 percent ( $\alpha = 5\%$ ); Meanwhile, there is no convincing difference between the production risks of big-red and curly peppers at this level of confidence (Table 5).

The lower value of the coefficient of variation of cayenne pepper production indicates that cayenne pepper farm is better able to control the risk (variation) of production, compared to curly pepper farm, more than big-red chili farm.

### 4.2 Prices Risk

The results of this study are different from the results of [16] in the Sumberrejo district shows that there is no significant difference between the production risk and the income risk of the

cultivation of chili big-red and cayenne pepper, but the price risk of chili big-red is higher compared to the cayenne pepper price risk. This condition shows that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of [17] and [18] who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper is considered. be a profitable and viable agricultural business [17].

Farmers are affected by transaction and price risk caused by oversupply. Price risk can be avoided by selecting the right marketing channels [19]. In accordance with the results of this study, the decline in chili production compared to last year's production had an impact on increasing chili prices. Although the production of chili in 2021/2022 has decreased drastically, the sale price has increased considerably, especially during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR 20 thousand/kg and IDR 16 thousand/kg [20] the average price received by farmers during the rainy season is IDR 41 thousand/kg and in the dry season an average of IDR 15 thousand/ha. Price risk follows the volatility of retail chili prices. The traders hope that building up somewhat higher margins will offset the price risk for stockholders [21]

Therefore, although during the rainy season the level of production of farmers falls drastically, farmers do not feel a loss, because it is covered by a sharp increase in sales prices. In contrast to the dry season, production did not increase much, but prices fell sharply to around IDR 15 thousand/kg less than in 2021, which fell to IDR 16 thousand/kg. Differences or fluctuations in chili prices during the rainy season and the dry season occur for all types of chili, but the most marked difference is cayenne pepper that reaches around IDR 26 thousand/kg, and around IDR 17 thousand/kg. While for big-red chillies, the price difference is relatively small, around IDR 7,000/kg. This difference indicates that the

annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili and the lowest is big-red chili [18]

#### **4.3 Correlation Production Risk with Farming Income**

The farmers who are willing to business on chili farming that is indicate they have the courage to face risks. The attitude towards risk is related to income, because farmers who dare to face risks have the opportunity to earn income, therefore it should be suspected that there is a relationship between the level of risk and income. Production risk related to climate risk and loss of income borne by farmers due to crop failure, heavy rain, and wind [22].

correlation analysis show that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship. Unlike big-red peppers, both production risk and price risk are negatively related to farm income (Table 12).

#### **4.4 Correlation Price Risk with Farming Income**

A decrease in income occurs due to a decrease in prices or a decrease in the level of production. This shows that farmers can reduce income risk by reducing the relative importance of fixed cost allocations to the farm [23].

The complexity of revenue risk is closely related to production risk and price risk, because revenue risk can be part of production risk, on the one hand, because it depends on farmers' decisions, and on the other hand, can be linked to markets or prices [24].

On the other hand, in the dry season the average price risk faced by farmers of bird's eye chili peppers, big-red chili peppers and curly chili peppers increases and is greater than in the rainy

season; marked by a sharp fall in prices [25]. This drastic price reduction was not followed by a sharp increase in production, so income earned was low, even for cayenne pepper and chili peppers, much lower than income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income; Also, low risk is not always followed by high farm income. What is more decisive and logical is the courage of farmers in the face of the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production inputs, the more likely farmers are to earn higher incomes or profits [25].

## **5 Conclusions and Implications**

### **5.1 Conclusions**

The comparative model of production and price risk could be used to analyze the comparison of the risk level of various types of chili farming in the tropical areas .The risk of cayenne pepper production is the lowest when compared to the production risk of curly chili farming and big-red chili farming, conversely, the price risk of cayenne pepper

is in the high risk category compared to the price risk of big chilies and curly chilies. The higher of the production risk of cayenne pepper and curly chili farming indicate that the greater the farming income [8], while the higher the production risk, the lower the big chili farming income and also the higher the price risk, the lower the farming income.

### **5.2 Implications**

Cayenne pepper farming and curly chili farming are risky but profitable businesses in an effort to increase farmers' income and for the government in ensuring price stability and controlling inflation, while big chili farming has relatively stable prices, however is not profitable for farmers. Hence, the planting area is limited according to market demand.

### **Acknowledgement**

Thank you very much to the Rector of the University of Mataram and the Head of the Research and Community Service Institute for facilitating research funding through the State Revenue Non-Tax allocation in 2022, so that we can be publishing our manuscript of the research results.



## References

### 参考文献

- [1] MARIYONO, J. AND SUMARNO, S. 2015. *Chilli production and adoption of chilli-based agribusiness in Indonesia*. *Journal of Agribusiness in Developing and Emerging Economies*. ISSN: 2044-0839. Vol. 5 No. 1, pp. 57-75. <https://doi.org/10.1108/JADEE-01-2014-0002>  
<https://emeraldpublishinggroup.freshdesk.com/support/solutions/articles/36000213997>
- [2] FRANKEL, JEFFREY A. 2011. *How Can Commodity Exporters Make Fiscal and Monetary Policy Less Procyclical?* HKS Faculty Research Working Paper Series RWP11-015, John F. Kennedy School of Government, Harvard University. <https://dash.harvard.edu/handle/1/4735392>
- [3] SUSANAWATI; AKHMADI, H.; FAUZAN,; and ROZAKI, Z. 2021. *Supply chain efficiency of red chili based on the performance measurement system in Yogyakarta, Indonesia*. the journal *Open Agriculture*. Volume 6 Issue 1. p.1-12 <https://doi.org/10.1515/opag-2021-0224>  
<https://www.degruyter.com/document/doi/10.1515/opag-2021-0224/html>
- [4] SIDDK, M; ZAINI, A; BUDASTRA, I KETUR; ZUBAIR, M. 2018. *Analysis of the Impact of the Claim of Chili Price Stabilization in West Nusa Tenggara*. Mataram University Faculty of Agriculture. <https://jurnal.lppm.unram.ac.id/article/download>
- [5] MARIYONO, J. 2017. *Moving to commercial production: a case of intensive chili farming in Indonesia*. *Development in Practice* Volume 27 Issue8. p.1103-1113. <https://www.tandfonline.com/doi/abs/10.1080/09614524.2017.1360841>
- [6] NUGROHO, LH. 2016. *Red pepper (Capsicum spp.) fruit: A model for the study of secondary metabolite product distribution and its management*. AIP Conference Proceedings Voume 1744(1) 020034 <https://doi.org/10.1063/1.4953508> <https://aip.scitation.org/doi/abs/10.1063/1.4953508>
- [7] BPS, 2021. *West Nusa Tenggara in Figures*. Central Bureau of Statistics of West Nusa Tenggara Province. Mataram. <https://ntb.bps.go.id/publication/2021/02/26/2031d130d7ffc9ed4b9b47ce/provinsi-nusa-tenggara-barat-dalam-angka-2021.html>
- [8] GEORGE, T, and MARKUS, J. 2022. *Explanatory Research | Definition, Guide, & Examples*. SCCRIBbs Publisher. p.652 <https://www.scribbr.com/methodology/explanatory-research/>
- [9] SEVERINI, S, TANTTRI, A. and TOMMASO, GD. 2017. *Effect of agricultural policy on income and revenue risks in Italian farms: implications for the use of risk management policies*. *Agricultural Finance Review*. Volume 77 Issue 2 , pp. 295-311. <https://www.emerald.com/insight/content/doi/10.1108/AFR-07-2016-0067/full/html>
- [10] NEWCOMER, KE; HATRY, HP AND WHOLEY, JS., 2015. *HANDBOOK OF PRACTICAL PROGRAM EVALUATION*, FOURTH EDITION. PRINT ISBN:9781118893609 ONLINE ISBN:9781119171386

DOI:10.1002/9781119171386

[HTTPS://ONLINELIBRARY.WILEY.COM/DOI/BOOK/10.1002/9781119171386#PAGE=528](https://onlinelibrary.wiley.com/doi/book/10.1002/9781119171386#page=528)

- [11] HAYES, A. 2022. *CO-EFFICIENT OF VARIATION MEANING AND HOW TO USE IT*. UPDATED SEPTEMBER 16, 2022. P.1-10 REVIEWED BY SOMER ANDERSON. [HTTPS://WWW.INVESTOPEDIA.COM/TERMS/C/COEFFICIENTOFVARIATION.ASP#](https://www.investopedia.com/terms/c/coefficientofvariation.asp#)
- [12] GUJARATI, DN, 2015. *Basic Econometrics*. New York McGraw-Hill p.686. <http://kin.perpusnas.go.id/DisplayData.aspx?pld=107156&pRegionCode=UN11MAR&pClientId=112>
- [13] **SITTICHINAWING, A. PANITARN, ND. and PEERAPTANA, P.2012. Green productivity index of cayenne pepper production (case study in Nongkhai province). Mae Fah Luang University International Conference 2012** [https://mfuic2012.mfu.ac.th/electronic\\_proceeding/Documents/00\\_PDF/O-SC-D/O-SC-D-005.pdf](https://mfuic2012.mfu.ac.th/electronic_proceeding/Documents/00_PDF/O-SC-D/O-SC-D-005.pdf)
- [14] WIJAYA, C.H; HARDA, M. and RANA, B. 2020. *Capsikum: Diversity and Potency of Capsocum spp Grown in Indonesia*. p.146 [https://books.google.co.id/books?hl=id&lr=&id=9pUtEAAAQBAJ&oi=fnd&pg=PA3&dq=The+low+production+of+cayenne+pepper+on+Lombok+Island+is+suspected+as+a+result+of+pest+disturbances+and+the+application+of+conventional+technology&ots=kBp6gcqVk&sig=2k9WE1VPTU0AEo4so0PolMto k&redir\\_esc=y#v=onepage&q&f=false](https://books.google.co.id/books?hl=id&lr=&id=9pUtEAAAQBAJ&oi=fnd&pg=PA3&dq=The+low+production+of+cayenne+pepper+on+Lombok+Island+is+suspected+as+a+result+of+pest+disturbances+and+the+application+of+conventional+technology&ots=kBp6gcqVk&sig=2k9WE1VPTU0AEo4so0PolMto k&redir_esc=y#v=onepage&q&f=false)
- [15] KARYANI, T.; SUSANTO, A; DJUWEDAH, E. and HAPSARI, H. 2020. *Red Chili Agribusiness and the Risks Faced by the Farmers*. IOP Conference Series: Earth and Environmental Science. IOP Conf. Series: Earth and Environmental Science 466 (2020) 012002 IOP Publishing doi:10.1088/1755-1315/466/1/012002 <https://iopscience.iop.org/article/10.1088/1755-1315/466/1/012002/pdf>
- [16] MALA, N.; PRASMATIWI, FE., and SAYEKTI, WD. 2021. *Income and risks of chilli cultivation in Sumber Rejo district, Tanggamus regency*. Magazine of Agroindustry Sciences. 9(1): p.91–98. <https://jurnal.fp.unila.ac.id/index.php/JIA/article/view/4984/3498>
- [17] AMIN, M. and PRIHANTINI, CI. 2021. *Risk Analysis of Canney Chili Production and Production in Watunohu District, North Kolaka Regency*. Agribusiness Magazine Dryland Agribusiness: p.16–21. <https://media.neliti.com/media/publications/361509-analysis-of-production-and-production-ri-878daa02.pdf>
- [18] ALFANOR, Y. FERRIANTA, HAMDANI. 2018. *Risk analysis of cayenne pepper production in Mailing Village, Padang Badung District, Hulu Sungai Selatan Regency*. Agribusiness Frontier 2(4). <http://ppjp.ulm.ac.id/journals/index.php/fag/article/view/663/650>.
- [19] PUSPASARI, A. 2020. *Cost-income analysis of cayenne pepper cultivation in Cigalontang sub-district, Tasikmalaya district*. Agribusiness Platform: Scientific Community Thought magazine with Agribusiness Insights 6(2): p.1130–1142. <https://jurnal.unigal.ac.id/index.php/mimbaragribisnis/article/view/3692/0>
- [20] **SIDDIK, M. TAJIDAN, T, DIPOKUSUMO, B. SUDJATMIKO, DP. And ANWAR, A. 2022. The environmental adaptation to production and price risks of cayenne pepper: Learning from the Lombok Island – Indonesia. 2nd International Conference on Environmental Ecology of Food Security IOP**

*Conf. Series: Earth and Environmental Science 1107 (2022) 012007.*  
<https://iopscience.iop.org/article/10.1088/1755-1315/1107/1/012007/pdf>

- [21] HUNG, PQ., KHAI, HV. 2020. Transaction cost, price risk perspective and marketing channel decision of small-scale chili farmers in Tra Vinh Province, Vietnam. *Asian Journal of Agriculture and Rural.* Voume 10 (1). 2224-4433 p.68-80.  
<https://archive.aessweb.com/index.php/5005/article/view/1962>
- [22] WEBB, AJ. KARTIKASARI, F. and KOSASIH, I. 2012. Do chili traders make price volatility worse? a qualitative analysis of East Java trading practices. A Qualitative Analysis of East [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2176153](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2176153)
- [23] AKBAR, S. GU-CHENG, LI. NAZIR, A. RAZZA, MH. 2019. Maize production under risk: The simultaneous adoption of off-farm income diversification and agricultural credit to manage risk. *Journal of Integrative Agriculture* Volume 18, Issue , February 2019, p.460-470.  
<https://www.sciencedirect.com/science/article/pii/S2095311918619689>
- [24] SEVERINI, S. TANTARI, A. and TOMMASO, G. 2017. *EFFECT OF AGRICULTURAL POLICY ON INCOME AND REVENUE RISKS IN ITALIAN FARMS: IMPLICATIONS FOR THE USE OF RISK MANAGEMENT POLICIES.* *AGRICULTURAL FINANCE REVIEW.* [HTTPS://WWW.EMERALD.COM/INSIGHT/CONTENT/DOI/10.1108/AFR-07-2016-0067/FULL/HTML](https://www.emerald.com/insight/content/doi/10.1108/AFR-07-2016-0067/full/html)
- [25] NOVICKYTE, L. 2018. Income risk management in agriculture using financial support. *European Journal of Sustainable Development.* 7(4) p.191-202. ISSN: 2239-5938  
<https://www.ecsdev.org/ojs/index.php/eisd/article/view/682/677>
- [26] CAHAYA, AA and BANGUN, RH. Br. 2020. *Farmer characteristics and agricultural viability of chili pepper (Capsicum annum L) and cayenne pepper (Capsicum frutescens L) in North Sumatra.* *Agricore: Agribusiness and Socioeconomic Agriculture Magazine UNPAD* 5(1).  
<http://journal.unpad.ac.id/agricore/article/view/27139/pdf>.

## COVER LETTER

### **The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island**

**Abstract:** The aim of this research is to find a comparative model of production risk and price risk and its relation to the farming income of cayenne pepper, big chili and curly chili in the tropical areas. To find the comparative model of production and price risk, an analysis of variance, standard deviation and coefficient of variation between types of chili were carried out and also the relationship between the level of risk and income by means of a Pearson correlation analysis. Data was collected from 90 sampling units consisted of 30 sampling units for each type of chili farming. The sampling unit for each type of farming was selected using a simple random sampling technique, while the data were using structured interviews, in-depth interviews, and observations at each chili farming location. The research found that the production risk of cayenne pepper farming is lowest when compared to the production risk of curly chili farming and big chili farming; conversely, the price risk of cayenne pepper is in the high risk category compared to the price risk of big chilies and curly chilies. Pearson correlation analysis can be used to determine the relationship between the level of risk and chili farming income, the higher the production risk, the higher the income of cayenne pepper and curly chili farming. Meanwhile, the higher the production risk, the lower the income from big chili farming, while the higher the price risk, the lower the farming income.

**Keywords:** coefficient, correlation, deviation, farming, model

#### **Type of manuscript (please specify):**

- Research article
- Research communication
- Review article


Full name and address of the Corresponding author: MUHAMAD SIDDIK

Telephone# +62370621435

WhatsApp# +62818546703

Email: siddikunram60@gmail.com

- I hereby confirm that the manuscript was prepared in accordance with the instructions for authors of scientific publications, and that the content of this manuscript, or most of it, was not published in the journal indicated, and the manuscript was not submitted for publication elsewhere.
- I hereby confirm my consent to pay the Article Processing Charges (APC) EUR 400 in the case of the manuscript acceptance for publication. I am aware and hereby confirm that the APC is non-refundable.
- I hereby confirm my consent to make all payments for English Language Editing Services (EUR 150).

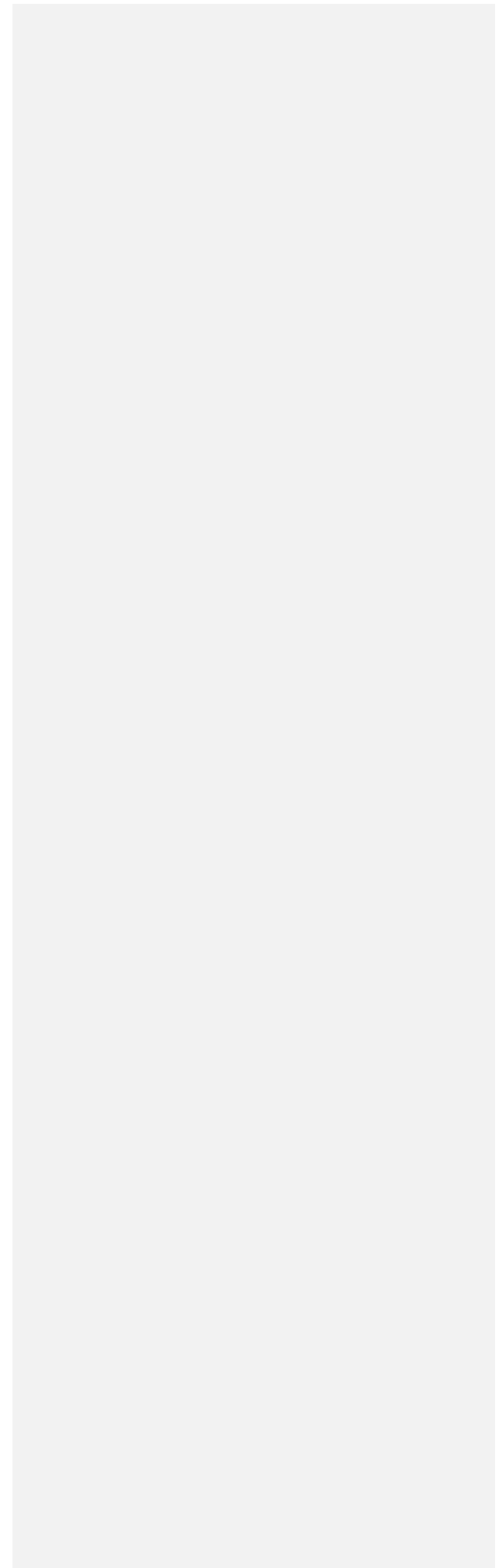


MUHAMAD SIDDIK

Signature of the Corresponding author

2022

Date: December, 15,



## Copyright Agreement

Manuscript title: The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Full names of all authors: Muhamad Siddik; Dwi Praptomo Sudjatmiko; Tajidan Tajidan; Bambang Dipokusumo; and Anwar Anwar

### Full name and address of the corresponding author:

Muhamad Siddik; Mulawarman Street, Number 26<sup>th</sup>; Kekalik Jaya Urban Village; Sekarbela District; Mataram City; West Nusa Tenggara Barat; Indonesia

Telephone: +62370-621435 WhatsApp: +62818546703 Email: siddikunram@gmail.com

### License Agreement

- (1) ✓ Authors own all the copyright rights for the paper.
- (2) ✓ Submitted manuscript is an original paper.
- (3) ✓ Authors hereby grant the Issues of Nongye Jixie Xuebao/Transactions of the Chinese Society of Agricultural Machinery with an exclusive, royalty-free, worldwide license to email the paper to all who will ask for it.
- (4) ✓ All authors have made a significant contribution to the research and are ready to assume joint responsibility for the paper.
- (5) ✓ All authors have seen and approved the manuscript in the final form as it is submitted for publication.
- (6) ✓ This manuscript has not been published and also has neither been submitted nor considered for publication elsewhere
- (7) ✓ The text, illustrations and any other materials, included into the manuscript, do not infringe any existing intellectual property rights or other rights of any person or entity.
- (8) ✓ The editors of the Issues of Nongye Jixie Xuebao/Transactions of the Chinese Society of Agricultural Machinery, its personnel or the Editorial Board members accept no responsibility for the quality of the idea expressed in this publication.

---

**I am the Corresponding author and have full authority to enter into this agreement.**

Full name, affiliation and position: Muhamad Siddik, Agribusiness in Magister Study Program, Agricultural Faculty, University of Mataram; Lecturer

Signature: \_\_\_\_\_



Date: December 15, 2022

## Bill Payment Invoice-173 anf revision manucript Muhamad Siddik

---

editorialoffice@nyjxxb.net <editorialoffice@nyjxxb.net>

23 Desember 2022 pukul  
17.08

Kepada: siddikunram60@gmail.com

Dear Authors,

Thank you for your revision and payment.

Your article will be published in Nongye Jixie Xuebao/ Transactions of the Chinese Society of Agricultural Machinery, Volume 53, Issue 12, 2022 at the end of January.

Wish you good health and a nice day!

Sincerely,

Editor-in-Chief: Prof. Ren Luquan (主编 : 任露泉 )

<http://nyjxxb.net>

Sponsored by: Chinese Society for Agricultural Machinery (CSAM) and Chinese Academy of Agricultural Machinery Sciences (CAAMS).

Address: No.1 Beishatan, Deshengmenwai, Beijing , P.R. China Postd code: 100083.

E-mail: [editorialoffice@nyjxxb.net](mailto:editorialoffice@nyjxxb.net)

[Kutipan teks disembunyikan]

Muhamad Siddik <siddikunram60@gmil.com>

Lampiran

Kam, 15 Des 22.40 (12 hari yang lalu)

kepada editorialoffice

Dear Editor-in-Chief: Prof. Ren Luquan (主编 : 任露泉 )

Muhmad Siddik has paid the Payment article processing charge for the title The comparative risk and income analysis of the cultivation of caynne pepper, big-red chili, and curly chili in the Lombok Island. It is Invoice - AM 173. Proof of payment there is in attached. Sum of payment 550 euros. We will send the revised manuscript soon.

If the payment fee has been received, please inform us.

Thank you

Muhamad Siddik

Muhamad Siddik <siddikunram60@gmil.com>

Sel, 20 Des 15.37 (7 hari yang lalu)

kepada editorialoffice

Dear Prof Ren Luquan

Muhamad Siddik has paid a fee to publish an article in the journal that you manage.  
Please reply when payment of the fee has been received.

Thank you very much

Muhammad Siddik

Muhamad Siddik <siddikunram60@gmil.com>

23 Des 2022 14.55 (4 hari yang lalu)

kepada editorialoffice

This is a bill payment for the article publish an invoice - AM 173

**Satu lampiran** • Dipindai dengan Gmail



53 Issue 12 (2022)<sup>2</sup>

---

**MUHAMAD SIDDIK** <siddikunram60@gmail.com>

**Kepada:** editorialoffice@nyjxxb.net

Rab, 1 Feb jam 10.41

Dear Prof Ren Luquan

I haven't seen our article entitled

The Comparative risk and income analysis of the cultivation of cayenne pepper, big-red chili, and curly chili in the Lombok Island

Muhamad Siddik<sup>1</sup>; Dwi Praptomo Sudjarmiko<sup>1</sup>; Tajidan Tajidan<sup>1</sup>;

Bambang Dipokusumo<sup>2</sup>; and Anwar Anwar<sup>2</sup>

<sup>3</sup>) Agribusiness in Magister Study Program, Agricultural Faculty, University of Mataram, 83124, Indonesia

<sup>4</sup>) Agribusiness Study Program, Agricultural Faculty, University of Mataram, 83124, Indonesia

Correspondence e-mail: siddikunram60@gmail.com

in volume 53 issue 12 of 2022.

Please publish according to the information we received that our manuscript will be published in volume 53 Number 12 of 2022

For your understanding, we thank you.

Best regards,

Muhamad siddik

**Invoic-AM 173**

---

o

Vol 53, No 12 (2022).pdf

550.8kB

---

---

•  
**editorialoffice@nyjxb.net**

**Kepada:**siddikunram60@gmail.com

Rab, 1 Feb jam 23.30

Dear Authors,

<http://nyjxb.net/index.php/journal/article/view/1525>

Sincerely,

Editor-in-Chief: Prof. Ren Luquan (主编：任露泉)

<http://nyjxb.net>

---

Research article

Rural management and agricultural development: Trade

## The Comparative Risk and Income Analysis of the Cultivation of Cayenne Pepper, Big Red Chili, and Curly Chili on the Lombok Island

Muhamad Siddik, Dwi Praptomo Sudjtmiko, Tajidan Tajidan, Bambang Dipokusumo, Anwar Anwar  
(Agricultural Faculty, University of Mataram, 83124, Indonesia)

**Abstract:** The aim of this research is to develop a comparative model of production risk and price risk and determine its relation to the income from cayenne pepper, big chili, and curly chili farming in the tropical areas. To find the comparative model of production and price risk, an analysis of variance, standard deviation, and coefficient of variation between types of chili was carried out and the relationship between the level of risk and income by using a Pearson correlation analysis. The data were collected from 90 sampling units consisting of 30 sampling units for each type of chili farming. The sampling unit for each type of farming was selected using a simple random sampling technique, while the data were using structured interviews, in-depth interviews, and observations at each chili farming location. The research found that the production risk of cayenne pepper farming is lowest compared to the production risk of curly chili farming and big chili farming; conversely, the price risk of cayenne pepper is in the high-risk category compared to the price risk of big chilies and curly chilies. Pearson correlation analysis can be used to determine the relationship between the level of risk and chili farming income, the higher the production risk, the higher the income of cayenne pepper and curly chili farming. Meanwhile, the higher the production risk, the lower the income from big chili farming, while the higher the price risk, the lower the farming income.

**Keywords:** coefficient; correlation; deviation; farming; model

## 龙目岛辣椒、大红辣椒、卷辣椒种植的风险与收益比较分析

Muhamad Siddik, Dwi Praptomo Sudjtmiko, Tajidan Tajidan, Bambang Dipokusumo, Anwar Anwar  
( 马塔兰大学农业学院, 83124, 印度尼西亚 )

**摘要:** 本研究的目的是开发生产风险和价格风险的比较模型, 并确定其与热带地区辣椒、大辣椒和卷辣椒种植收入的关系。为了找到生产和价格风险的比较模型, 使用皮尔逊相关分析对辣椒类型之间的方差、标准差和变异系数进行分析, 并分析风险水平与收入之间的关系。数据收集自 90

---

Received: October 5, 2022 / Revised: November 7, 2022 / Accepted: December 3, 2022 / Published: December 30, 2022

**Fund projects:** The Rector of the University of Mataram and the Head of the Research and Community Service Institute (Research funding through the state non-tax revenue allocation in 2022)

**About the authors:** Muhamad Siddik, Dwi Praptomo Sudjtmiko, Tajidan Tajidan, Bambang Dipokusumo, Anwar Anwar, Agricultural Faculty, University of Mataram, Indonesia

**Corresponding author:** Muhamad Siddik, Agricultural Faculty, University of Mataram, Indonesia, E-mail: [siddikunram60@gmail.com](mailto:siddikunram60@gmail.com)

This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)

个抽样单位，其中每种辣椒种植类型有 30 个抽样单位。每种种植类型的抽样单位是使用简单的随机抽样技术选择的，而数据使用的是结构化访谈、深度访谈和每个辣椒种植地点的观察。研究发现，与卷辣椒种植和大辣椒种植相比，辣椒种植的生产风险最低；相反，与大辣椒和卷辣椒的价格风险相比，辣椒的价格风险属于高风险类别。皮尔逊相关分析可以确定风险水平与辣椒种植收入之间的关系，风险水平越高 生产风险大，辣椒和花椒种植的收入较高。同时，生产风险越高，大辣椒种植收益越低，而价格风险越高，种植辣椒收益越低。

**关键词：**系数; 相关性; 偏差; 农业; 模型

## 1 Introduction

Chili is one of the most important agricultural and food staples in Indonesia<sup>[1]</sup> because, in addition to being widely cultivated and a source of income for many residents, it is also used all the time and throughout the year by the people of Indonesia. Also, the government always monitors the development of this commodity<sup>[2]</sup> because it is a commodity that contributes to high inflation in Indonesia. This arises because the price of chili always fluctuates every year; in certain months, the price is very low; in other months, the price increases sharply<sup>[25]</sup>.

The fluctuating price of chili is due to the erratic production and supply of chili<sup>[3]</sup>, while the demand is relatively constant. At certain times, production and supply are extremely low, causing chili prices to rise sharply. Meanwhile, at other times, the production and supply of chili peppers is abundant, so the price of chili peppers drops drastically<sup>[4]</sup>. This condition causes the commodity crop of chili to face production and price risks that are quite high.

Theoretically, the courage of farmers to face agricultural risks determines their productivity and income from agriculture<sup>[5]</sup>. If farmers behave with fear of risk (risk *aversion*), the usage of resources (land, labor and other production facilities) is not carried out optimally, resulting in lower productivity and lower farm income. But if farmers are risk *takers*, then resource usage will be optimal for maximum productivity and income, but with the possibility of increased risk of loss. Therefore, to increase the productivity and income of chili cultivation, it is highly determined by the courage of farmers to face the risks of this crop.

In Indonesia, the types of chili that many farmers grow are cayenne pepper, big chili and curly chili<sup>[6]</sup>. On Lombok Island, the most cultivated type of chili is cayenne pepper. However, among the cayenne pepper plants, many farmers were also found to grow big red chilies or curly chilies in the same stretch and season. Farmers' choice in determining the type

of chili plants to grow certainly has its own reasons, believed to be related to the risks and income of farming. This study develops a comparative model of production and price risks and determines its relation to the farming income of cayenne pepper, big chili, and curly chili in the tropical areas and the relationship between risk level and income on the Lombok Island.

## 2 Research Method

### 2.1 Research Subjects

This research was carried out on Lombok Island, West Nusa Tenggara Province, Indonesia. The research topics were the cultivation of cayenne pepper, big red chili, and curly chili, which were grown during the 2021/2022 rainy and dry seasons. On Lombok Island, the rainy season usually occurs from November to April; the dry season is from May to October<sup>[7]</sup>.

### 2.2 Research Design

The research was designed using an explanatory method, that is, research that explains and relates one variable to another that is different but interrelated and produces a causal relationship<sup>[8]</sup>.

The main variables that are connected and sought for correlation are the level of production and price risk with the farming income of each type of chili.

The research locations were determined in stages (multistage purposive sampling) starting from the district, sub-district to village levels. The selection of districts was based on the production centers of the three types of chili, thus, East Lombok Regency was selected. Additionally, three sub-districts/villages were selected which cultivated the three types of chili; each sub-district/village is expected to represent lowland (< 200 mpl), midland (200-500 mpl) and highland areas (> 500 mpl). The location selection was based on the height of the area and the results of previous research that the altitude of the area affects the production and income of

cayenne pepper farming and this is expected to apply to big red chili and curly chili farming (Fig. 1). On the basis of these considerations, Jerowaru Village in Jerowaru District was chosen to represent the lowland area, Kalijaga Village in Aikmel District to represent the midland area, and Pringgasela village in Pringgasela District to represent the highland.

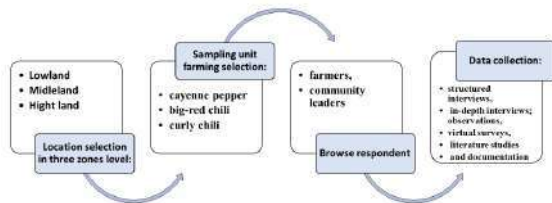


Fig. 1 Stages of the research

### 2.3 Research Respondents

Farmers who were the object of research were farmers who cultivate cayenne pepper, big red chili, and curly chili during the rainy season and/or dry season in 2021/2022 and had experience cultivating these chilies for at least three growing seasons. Initial information about the chili farmers was obtained from farmer groups in each sample village. Then, we randomly selected (random sampling) each of 10 respondent farmers with the criteria according to the aforementioned provisions. Therefore, this research obtained 90 respondents.

### 2.4 Data Collection

The data collection was carried out by combining several methods simultaneously, namely the method of structured interviews using a list of questions<sup>[10]</sup>, in-depth interviews, field observations, virtual surveys, literature studies, and documentation. The structured interview is aimed at the surveyed farmers who grow cayenne

pepper, big red chili, or curly chili. The in-depth interviews were aimed at community leaders who know about chili cultivation and the problems it faces, as well as government policies related to agricultural development.

### 2.5 Procedure for the Data Analysis

The farm risk studied is the production risk and the price risk. The measurement of both risks uses the variance, the standard deviation and the coefficient of variation<sup>[11]</sup>. Production and price variations as measures of production and price risks are based on the experience of farmers conducting chili cultivation activities before. The procedure for finding a comparative model is shown in Fig. 2.

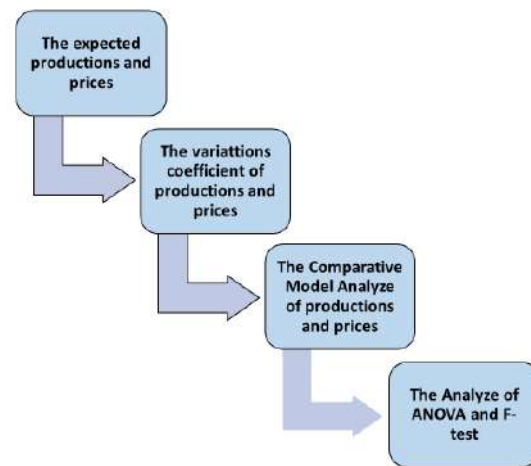


Fig. 2 Stages of the comparative production risk and price risk analysis

#### 2.5.1 Expected Production and Prices

The production and price of each type of chili was measured using the following formula:

$$\mu_i = q_{ih}Q_{ih} + q_{ir}Q_{ir} + q_{in}Q_{in}, \dots \quad [3.1]$$

$$\sigma_i^2 = q_{ih}[Q_{ih} - \mu_i]^2 + q_{ir}[Q_{ir} - \mu_i]^2 + q_{in}[Q_{in} - \mu_i]^2 \dots \quad [3.2]$$

$$\theta_i = q_{ih}P_{ih} + q_{ir}P_{ir} + q_{in}P_{in}, \dots \quad [3.3]$$

$$\varphi_i^2 = q_{ih}[P_{ih} - \theta_i]^2 + q_{ir}[P_{ir} - \theta_i]^2 + q_{in}[P_{in} - \theta_i]^2 \dots \quad [3.4]$$

where:

- Q = Production of each type of chili (kg/Ha)
- $\mu_i$  = Expected production of each type of chili (kg)
- $\sigma_i^2$  = Variance or risk of production of each type of chili
- P = Price of each type of chili (IDR/kg)
- $\theta_i$  = Expected price of each type of chili (IDR/kg)
- $\varphi_i^2$  = Price variation or risk for each type of chili
- i = sample or respondent i
- q = Production opportunity or price opportunity for each type of chili (%)
- h, r, n = Shows high (h), normal (r) and low (n) production opportunities or prices for each type of chili

#### 2.5.2 The Variation Coefficient of the Production and Prices

Additionally, to analyze the level of

production risk and price risk for each type of chili, the coefficient of variation is used, with the formula:

$$CV_{qj} = \frac{\sigma_j}{Q_j} \dots \dots \dots [3.5]$$

$$CN_{pj} = \frac{\theta_j}{P_j} \dots \dots \dots [3.6]$$

where:

- CV<sub>qj</sub>** = Production variation coefficient for each type of chili
- σ<sub>j</sub>** = Standard deviation of production for each type of chili
- CV<sub>pj</sub>** = Price variation coefficient for each type of chili
- θ<sub>j</sub>** = Standard deviation of the price of each type of chili
- j** = Type of chili (1 = cayenne pepper, 2 = big-red chili and 3 = curly chili)

If the coefficient of variation of CV<sub>qj</sub> or CV<sub>pj</sub> is greater than 0.5, the production or price risk is in the high category; but if it is less than or equal to 0.5, it is included in the low-risk category.

### 2.5.3 The Comparative Analysis of the Production and Prices

**Tab. 1 The comparative model of production risk**

Comparison	Cayenne Pepper	Big Red Chili	Curly Chili
Cayenne Pepper	1.000	CM <sub>q21</sub> = CV <sub>q2</sub> /CV <sub>q1</sub>	CM <sub>q31</sub> = CV <sub>q3</sub> /CV <sub>q1</sub>
Big Red Chili	CM <sub>q12</sub> = CV <sub>q1</sub> /CV <sub>q2</sub>	1.000	CM <sub>q32</sub> = CV <sub>q3</sub> /CV <sub>q2</sub>
Curly Chili	CM <sub>q13</sub> = CV <sub>q1</sub> /CV <sub>q3</sub>	CM <sub>q23</sub> = CV <sub>q2</sub> /CV <sub>q3</sub>	1.000

**Tab. 2 The comparative model of price risk**

Comparison	Cayenne Pepper	Big Red Chili	Curly Chili
Cayenne Pepper	1.000	CM <sub>p21</sub> = CV <sub>p2</sub> /CV <sub>p1</sub>	CM <sub>p31</sub> = CV <sub>p3</sub> /CV <sub>p1</sub>
Big Red Chili	CM <sub>p12</sub> = CV <sub>p1</sub> /CV <sub>p2</sub>	1.000	CM <sub>p32</sub> = CV <sub>p3</sub> /CV <sub>p2</sub>
Curly Chili	CM <sub>p13</sub> = CV <sub>p1</sub> /CV <sub>p3</sub>	CM <sub>p23</sub> = CV <sub>p2</sub> /CV <sub>p3</sub>	1.000

Notes: CM<sub>q</sub> - comparative model of production risk; CM<sub>p</sub> - comparative model of price risk; CV<sub>q</sub> - production coefficient variation; CV<sub>p</sub> - price coefficient variation; CM - comparative model

### 2.5.4 The Analysis of ANOVA and F-Test

To compare the risks of cayenne peppers, big red peppers, and curly peppers, use the ANOVA statistical test (analysis of variance) or the F test;

then proceed with the LSD (least significant difference) test. ANOVA or F test is used to analyze and test the difference in the average count of the sample as a whole (Tab. 3).

**Tab. 3 Differences in ANOVA and F-test of risks of cayenne pepper, big red chili, and curly chili crops**

Origin of variance	SS	DF	MS	F-Test
Between Groups (b)	SS <sub>b</sub>	k-1	$\frac{SS_b}{k-1}$	$\frac{MS_b}{MS_w}$
In group (w)	SS <sub>w</sub> = SS <sub>T</sub> - SS <sub>b</sub>	k(n-1)	$\frac{SS_w}{k(n-1)}$	
Total	SS <sub>T</sub>	nk-1		

Notes: DF - degrees of freedom; SS - sum of squares; MS - sum of mean squares; SS<sub>T</sub> - total square sum; SS<sub>b</sub> - sum of squares between the groups; SS<sub>w</sub> - sum of squares in the group; n - number of data or samples; k - number of groups or types of chili

The decision criterion is if F count > F table at an error rate (α) of 10%, then there is a difference in the risk or income of cayenne pepper, big red chili, and curly chili farming. Conversely, if F count ≤ F table, then there is no difference in risk or income for the three types of chili.

### 2.6 Farming Income Analysis

Furthermore, farm income is measured by reducing the value of production, considering all production costs. The value of production is the product multiplied by the price of production.

$$Q_j = \sum_{k=1}^m Q_k \dots \dots \dots (3.7)$$

$$TC = VC + FC \dots \dots \dots (3.8)$$

$$\Pi_j = \sum_{k=1}^m P_k \times Q_k - TC_k \dots \dots \dots (3.9)$$

where:

- Q - production of each type of chili (kg/Ha);
- Π - farming income for each type of chili (IDR000);

P - price of each type of chili (IDR/kg);  
 TC - total cost or total cost of each type of chili (IDR);  
 VC - variable costs (IDR);  
 FC - fixed costs (IDR);  
 j - type of chili (cayenne pepper, big red chili, curly chili);  
 m - number of times harvested for each type of chili;  
 k - the k-th harvest (k =1,2,3, .....m) of each type of chili.

To compare the risks and returns of growing cayenne peppers, big red peppers, and curly peppers, use the ANOVA statistics.

If the results of the ANOVA or F test show that there is a significant difference, then proceed to the LSD test, to individually test the difference in risk or farm income for each type of pepper. To calculate the LSD value, some data are needed from the ANOVA calculations, namely  $MS_E$  (mean square error) data, df (degrees of freedom), r (number of samples for each group or type of chili) and Student's t tables. The full formula of LSD is as follows:

$$LSD_{\alpha} = (t_{1/2\alpha, df}) \sqrt{\frac{2(MSE)}{r}} \quad (3.10)$$

The decision criterion, if the difference between two variables is greater than  $LSD_{\alpha}$ , the two variables (agricultural risk or income) show a significant difference. But if the difference between them is less than or equal to  $LSD_{\alpha}$ , they are not significantly different<sup>[12]</sup>.

Additionally, to analyze the relationship between production risk and price risk with Farming Income for each type of chili, the Pearson correlation coefficient (r) is used with the following formula:

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{[\sum (x - \bar{x})^2][\sum (y - \bar{y})^2]}} \quad (3.11)$$

where:

X - production risk or price risk for each type of chili;

Y - farming income for each type of chili.

### 3 Result

There are differences in risks of cultivation of

cayenne pepper, big red chili, and curly chili.

#### 3.1 Production Risk

The production risk analyzed by the production variance is measured by adding the difference in the production squares with the production expectations multiplied by the probability of each event (high, normal, and low production) based on the experience in chili cultivation.

**Tab. 4 Production risks of farming cayenne pepper, big red chili peppers, and curly chili (Primary data analysis, 2022)**

No.	Description	Cayenne Pepper	Big Red Chili	Curly Chili
1	Production Variations	6,272,348	7,699,396	6,019,674
2	Standard Deviation of Production	2,504	2,775	2,454
3	Production Variation Coefficient	0.45	0.51	0.49

Additionally, from the variance value obtained, the standard deviation and the coefficient of variation are calculated to determine the level of risk faced by farmers. The results of the production risk analysis of cayenne pepper, big red chili, and curly chili can be seen in Tab. 4.

**Tab. 5 Comparative analysis of production risks of farming cayenne pepper, big red chili peppers, and curly chili (Primary data analysis)**

Comparison	Cayenne Pepper	Big Red Chili	Curly Chili
Cayenne Pepper	1.00	1.33*	1.09*
Big Red Chili	0.88*	1.00	0.96
Curly Chili	0.92*	1.04	1.00

The results of the comparative analysis of production risk between chili types are shown in Tab. 5 and the comparative significance can be read in Tab. 6. The risk of producing big red chili is almost the same as the risk of producing curly chili, and production risk of cayenne pepper is lower than curly chili and big red chili or big red chili highest production risk.

**Tab. 6 The comparative test (LSD) results on the risks of the cultivation of cayenne pepper, big red chili, and curly chili (Primary data analysis, 2022)**

Comparison		Mean Differences (I)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big red chili	-.06367 *	.01060	.000	-.0847	-.0426
	Curly chili	-.04733 *	.01060	.000	-.0684	-.0263
Big red chili	Cayenne pepper	.06367 *	.01060	.000	.0426	.0847
	Curly chili	.01633	.01060	.127	-.0047	.0374
Curly chili	Cayenne pepper	.04733 *	.01060	.000	.0263	.0684

Continuation of Tab. 6						
	Big red chili	-.01633	.01060	.127	-.0374	.0047

\* The mean difference is significant at the 0.05 level.

### 3.2 Price Risk

Price risk is also analyzed in the same way as production risk, but the results of the analysis are contradictory. Tab. 6 shows that the coefficient of variation of prices (CVp) for the cayenne pepper crop is the highest (0.57) compared to the big red pepper (0.49) and the curly pepper (0.46), although both also have a fairly high coefficient of variation.

**Tab. 7 Price risk for cayenne pepper, big red chili, and curly chili (Primary data analysis, 2022)**

No.	Description	Cayenne pepper	Big red Chili	Curly Chili
1	Price Variation (IDR x1000)	182,631	64,434	68,134
2	Price Standard Deviation	13,514	8,027	8,254
3	Price Variation Coefficient	0.57	0.49	0.46

The results of this analysis indicate that the cayenne pepper crop in the Lombok Island is in the high price risk category (CVp > 0.5), while

big red chili peppers and curly chili peppers are excluded from it. Although the coefficient of variation is quite high, it is still below 0.50. The results of this study are consistent with the results of previous studies; that the price risk of cayenne pepper in the cayenne pepper production centers in the Lombok Island, both in the highlands, mid-plains, and lowlands, is listed in the high-risk category.

**Tab. 8 Comparative analysis of price risks of farming cayenne pepper, big red chili peppers, and curly chili (Primary data analysis)**

Comparison	Cayenne Pepper	Big Red Chili	Curly Chili
Cayenne Pepper	1.00	0.85*	0.81*
Big Red Chili	1.16*	1.00	0.94
Curly Chili	1.23*	1.07	1.00

The price risk of cayenne pepper is significantly larger than that of big red chili and curly chili (Tab. 8).

**Tab. 9 Price risk from comparative test results (LSD) for cayenne, big red chili, and curly chili (Primary data analysis, 2022)**

Comparison		Mean Differences (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big red chili	.08367 *	.01583	.000	.0522	.1151
	Curly chili	.11267 *	.01583	.000	.0812	.1441
Big red chili	Cayenne pepper	-.08367 *	.01583	.000	-.1151	-.0522
	Curly chili	.02900	.01583	.070	-.0025	.0605
Curly chili	Cayenne pepper	-.11267 *	.01583	.000	-.1441	-.0812
	Big red chili	-.02900	.01583	.070	-.0605	.0025

\* The mean difference is significant at the 0.05 level.

If the difference in price risk of curly peppers, big red peppers, and cayenne pepper is tested statistically with the LSD test at a confidence level of at least 90 percent, all three types of peppers have a significantly different price risk, both between cayenne pepper, big red chili, and curly chili peppers or between big red chili and curly chili peppers (Tab. 9).

Although the results of the analysis and the statistical tests of production and price risks in Tab. 6 show differences in the level of risk faced, in general, all three show quite high production and price risks, as indicated by the coefficients of variation. However, the big red chili possible loss caused by production risk is faced by the big red chili crop, then the curly chili crop, and the least likely by the cayenne pepper crop. On the other hand, the big red pepper possible loss caused by price risk is faced by the cayenne pepper crop, then the big red and small chili crop by the curly

chili crop.

### 3.3 Differences in Farm Income for Cayenne Pepper, Big Red Chili, and Curly Chili

This study assumes that when choosing and conducting chili cultivation activities, farmers are oriented to obtaining the maximum income or profit. Achieving this objective is highly dependent on the production, price, and costs. The difference in income for the three types of chili cultivation also depends on these three factors.

#### 3.3.1 Production and Prices

If the seasonal production level is above, calculated on average per year, then the cayenne pepper production level in 2021/2022 will be the highest, namely an average of 4.3 tonnes/ha, then big red chili 4.0 tons/ha and curly pepper 3.9 t/ha. Of course, the level of production of the three



types of chili is irrelevant for the comparison, but compared to the production of similar chilies in the previous year in East Lombok Regency, it

seems that the chili production in 2021/2022 has decreased considerably.

**Tab. 10 Average production and prices of cayenne pepper, big red chili, and curly chili (Primary data processed, 2022)**

No.	Season	Cayenne pepper		Big red chili		Curly chili	
		Production (kg)	Price (IDR/kg)	Production (kg)	Price (IDR/kg)	Production (kg)	Price (IDR/kg)
1	Rainy season	3,539	41,061	3,295	24,171	3,093	30,736
2	Dry season	5,054	14,611	4,711	16,984	4,603	13,648
3	Average/Year	4,296	27,836	4,003	20,578	3,848	22,192

The East Lombok Regency BPS data in figures (2022) shows that the productivity of cayenne pepper in East Lombok Regency in 2021 is 7.8 tonnes/ha and big red chili (including curly chili) is 10.8 tons/ha. Relatively the same results were also found in the research by <sup>[3]</sup> that the productivity of cayenne pepper in the areas of the chili production center in East Lombok Regency during the rainy season reaches 7.6 ton/ha and during the dry season reaches 11.2 ton/ha. This difference indicates that chili productivity on

Lombok Island is determined by location, weather conditions, and other external factors.

### 3.3.2 Commercial Costs

Farm costs are calculated from the total expenditure of farmers, both implicitly within the farmer's family and explicitly from outside the farmer. The results of the analysis show that the cost of growing cayenne pepper is higher than the cost of growing big red chili peppers and curly chili peppers, especially during the rainy season.

**Tab. 11 Average costs of cayenne pepper, big chili, and curly chili (IDR000/ha) (Primary data processed, 2022)**

No.	Description	Cayenne pepper		Big red chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
	A. Variable Costs	42,074	30,689	33,159	30,991	31,907	26,508
1	Production facilities	16,396	13,006	13,267	13,471	11,885	11,188
2	Labor	13,212	10,555	9,117	8,298	8,397	7,047
3	Cost of other input production	12,466	7,127	10,775	9,223	11,625	8,273
	B. Fixed Costs	14,240	12,257	11,329	11,427	11,173	11,390
1	Land lease	13,178	11,082	10,597	10,490	9,981	10,236
2	Land tax	247	215	189	208	193	150
3	Water fee	120	410	171	316	460	489
4	Shrinkage	695	551	373	414	539	516
	Totals (A+B)	56,314	42,946	44,488	42,419	43,080	37,899

In the rainy season, the cost of growing cayenne pepper is IDR 56 million/ha, while the average crop of big red chili is IDR 44 million/ha and curly pepper IDR 43 million/ha. During the dry season, the cost of growing cayenne pepper is not much different from other types of chili, namely cayenne pepper of IDR 43 million/ha, big red chili IDR 42 million/ha and curly pepper IDR 37 million/ha (Tab. 11).

The agricultural costs that are mainly incurred by farmers are variable costs consisting of ordinary production facilities, in the form of seeds, fertilizers, growth stimulants, and drug costs, then labor costs and other support facilities like plastic mulch and stakes. These variable inputs cost about 70% of total farm costs. Although fixed inputs consist of income and land taxes, equipment depreciation, water costs, and interest on loan capital (30%), no farmers used

loan capital in their farm business. The fixed cost incurred by many farmers is land rent. The results showed that the land rent in the research area, calculated per hectare, ranged between IDR 15 million and IDR 25 million per year or around IDR 7.5 million to IDR 12.5 million per chili growing season. But because most farmers cultivate their own land, this implicit cost is not seen as a burden on farmers.

### 3.3.3 Income and Farming Efficiency

Although the chili production in the Lombok Island in 2021/2022 has decreased sharply compared to the previous year because this decrease was offset by a fairly high increase in chili prices during the rainy season, farm income obtained is still quite high and farming is considered efficient.

**Tab. 12 Average production, prices, production value, production costs, and farm income (Primary data analysis, 2022)**

No.	Component	Cayenne pepper		Big red chili		Curly chili	
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season
1	Production (kg)	3,539	5,054	3,295	4,711	3,093	4,603
2	Price (IDR/kg)	41,061	14,611	24,171	16,984	30,736	13,648
3	Production Value (IDR.000)	145,297	73,843	79,655	80008	95,071	62,825
4	Production Cost (IDR.000)	56,314	42,946	44,488	42,419	43,080	37,899
5	Revenue (IDR.000)	88,983	30,897	35,167	37,589	51,991	24,927
6	RC Ratio	2.58	1.72	1.79	1.89	2,21	1.66

The highest income and agricultural efficiency in the rainy season is obtained with the cultivation of cayenne pepper, which reaches IDR 89 million/ha with a CR ratio of 2.58; then the curly chili crop IDR 51 million/ha with RC 2.21; the lowest is the income from the big red chili crop, which amounts to IDR 35 million/ha with a RC ratio of 1.72. In the dry season the opposite occurs, the highest income is obtained by the big red chili cultivation, which is IDR 38 million/ha with a RC ratio of 1.89, then the cayenne pepper crop is IDR 31 million/ha with a RC ratio of 1.72; and the smallest obtained from the cultivation of curly pepper is IDR 25 million/ha with a RC ratio of 1.66 (Tab. 12).

When income from the aforementioned chili pepper crop is compared between the rainy season and the dry season, the biggest difference is in the cayenne pepper crop, which reaches IDR 58 million/ha; then curly pepper IDR 27

million/ha. Meanwhile, for the big red chili crop, the difference is less than IDR 3 million/ha. This means that the big red chili crop has a relatively stable income between the rainy and dry seasons, while the cayenne pepper and curly chili crops are very volatile. This indicates that the cayenne pepper and curly chili crop have a high-income risk, while chili cultivation has low income risk.

### 3.3.4 Commercial Rent

If the above seasonal farm income is calculated as an average per year, then the cayenne pepper farm income is an average of IDR 59.19 million/ha, the average big red chili costs IDR 37.82 million/ha and curly pepper with an average of IDR 37.10 million/ha. To ensure that there is a difference in the income of the three chili growing businesses, a statistical test was carried out with the LSD test.

**Tab. 13 Comparative test results (LSD) on farm income from cayenne pepper, big red chili, and curly chili (Primary data processed, 2022)**

Comparison		Mean Difference (IJ)	Std. Error	Sig.	95% Confidence Intervals	
					Lower Bound	Upper bound
Cayenne pepper	Big red chili	21367.133 *	6618730	002	8211.69	34522.58
	Curly chili	22082.767 *	6618730	001	8927.32	35238.21
Big red chili	Cayenne pepper	-21367.133 *	6618730	002	-34522.58	-8211.69
	Curly chili	715,633	6618730	.914	-12439.81	13871.08
Curly chili	Cayenne pepper	-22082.767 *	6618730	001	-35238.21	-8927.32
	Big red chili	-715,633	6618730	.914	-13871.08	12439.81

\* The mean difference is significant at the 0.05 level.

Based on the results of the LSD test in Tab. 11, it is conclusive (99%) that the income from the cayenne pepper crop in the Lombok Island is higher and convincingly differs from the income from the big red chili pepper crop and curly chili. Meanwhile, the incomes from the big red chili crop and the curly chili do not show a convincing difference. The results of this trial provide an explanation for the reasons why farmers in the Lombok Island, especially in the East Lombok Regency, prefer to plant bird's eye chilies instead of big red or curly chilies.

### 3.4 Relationship between Production and Price Risks and Farming Income

In the cultivation of cayenne pepper, big red chili, and curly chili, the production risk during the rainy season is on average higher than in the dry season, which is characterized by a decrease in production, but the decrease in production in the cultivation of cayenne pepper and curly pepper during the rainy season is followed by a sharp rise in prices, strong enough that earned farm income is higher than in the dry season, during which production risk is lower. Meanwhile, big red chili pepper production risk is indicated by a decline in production during the

rainy season, which is not followed by an adequate price increase, as is the case with cayenne pepper and curly chili. The price increases that occur cannot cover the decrease in

production or production risks that occur, and the income obtained is lower than in the dry season, where production risks are lower.

**Tab. 14 Risk-to-return test results for cayenne pepper, big red chili, and curly chili (Primary data processed, 2022)**

Type of Chili	Variable Correlation	Coef Value. Correlation	Significance Test (P-Value)	Strength Connection
1. Cayenne pepper	Production-Risk-Income	0.339	0.067*	Less strong
	Price Risk – Income	-0.518	0.003***	Very strong
2. Big red chili	Production-Risk - Income	-0.404	0.027**	Less strong
	Price Risk – Income	-0.021	0.265	Less strong
3. Curly chili	Production-Risk - Income	0.071	0.708	Less strong
	Price Risk - Income	-0.599	0.001**	Very strong

## 4 Discussion

### 4.1 Productions Risk

Tab. 4 shows the results of the analysis that the coefficient of variation of production (CVq) of the three types of chili is quite high, but the highest is the big red chili (0.51), then the curly chili (0.49) and the most-low is cayenne pepper (0.45). This means that the chili crop production on the island of Lombok is quite risky, but the big red chili crop is included in the high-risk category (CVq > 0.50), while the curly chilies, especially the allspice cayenne, are still included in the low production risk category.

The production is the total yield of chili as a whole from the first to the last harvest, converted into units of hectares. The price is the average value of production per kilogram of chili received by farmers from the first to the last harvest. The results show that the production of cayenne pepper, big red chili, and curly chili in 2021/2022 differs quite a bit between the rainy and dry seasons, where the rainy season production is lower than the dry season. The production of cayenne pepper in the rainy season is 3.5 tons/ha and in the dry season - 5.1 tons/ha; big red chili production in the rainy season is 3.3 tons/ha and in the dry season - 4.7 tons/ha; curly pepper production rate in the rainy season is 3.1 ton/ha and in the dry season - 4.6 ton/ha (Tab. 10).

The average cayenne pepper production in Thailand is 13.96 tons, higher than the cayenne pepper production on Lombok Island (3.5 tons/ha). In Thailand, environmentally friendly technology has been implemented with an environmental index of 0.0142<sup>[13]</sup>. The low production of cayenne pepper on Lombok Island is suspected as a result of pest disturbances, the application of conventional technology, poor pest management practices, and the use of toxic. <sup>[14]</sup> state that Indonesia can produce curly chilies, each tree can produce 0.75 - 1 kg/harvest period. Such a low production achievement means a high

level of risk. As explained by <sup>[15]</sup> that production and cost risks are caused by poor pest management and the low quality of pest control management by farmers.

The results of the LSD test on the differences in the risk of cayenne pepper, big red chili, and curly chili also show that the risk of cayenne pepper production is lower and significantly different from the risk of big red chili production, including curly pepper, with a confidence level of more than 95% ( $\alpha = 5\%$ ). Meanwhile, there is no convincing difference between the production risks of big red and curly peppers at this level of confidence (Tab. 7).

The lower value of the coefficient of variation of cayenne pepper production indicates that the cayenne pepper farm is better able to control the risk (variation) of production, compared to curly pepper farm, more than big red chili farm.

### 4.2 Price Risk

The results of this study are different from the results of <sup>[16]</sup> in the Sumberrejo district, showing no significant difference between the production risk and the income risk of the cultivation of big red chili and cayenne pepper, but the price risk of big red chili is higher than the cayenne pepper price risk. This condition shows that each region has a different potential in the cultivation of basic chili products. However, the low risk of cayenne pepper production is supported by the research results of <sup>[17]</sup> and <sup>[18]</sup> who found that the risk of cayenne pepper production was low, which is why the cultivation of cayenne pepper is considered a profitable and viable agricultural business<sup>[17]</sup>.

Farmers are affected by transaction and price risks caused by oversupply. Price risk can be avoided by selecting the right marketing channels<sup>[19]</sup>. In accordance with the results of this study, the decline in chili production compared to last year's production impacted increasing chili prices. Although the production of chili in 2021/2022 has decreased drastically, the sale

price has increased considerably, especially during the rainy season. As it happened in the cultivation of cayenne pepper; the price of cayenne pepper received by farmers in 2020/2021 during the rainy and dry seasons is an average of IDR 20 thousand/kg and IDR 16 thousand/kg<sup>[20]</sup> the average price received by farmers during the rainy season is IDR 41 thousand/kg and in the dry season an average of IDR 15 thousand/ha. Price risk follows the volatility of retail chili prices. The traders hope that building up somewhat higher margins will offset the price risk for stockholders<sup>[21]</sup>.

Therefore, although during the rainy season, the level of production of farmers falls drastically, farmers do not feel a loss because it is covered by a sharp increase in sales prices. In contrast to the dry season, production did not increase much, but prices fell sharply to around IDR 15 thousand/kg less than in 2021, IDR 16 thousand/kg. Differences or fluctuations in chili prices during the rainy and dry seasons occur for all types of chili, but the most marked difference is cayenne pepper that reaches around IDR 26 thousand/kg, and curly chili reaches around IDR 17 thousand/kg. For big red chilies, the price difference is relatively small, around IDR 7,000/kg. This difference indicates that the annual price risk for the three types of chili is different, the highest price risk is faced by the cayenne pepper crop, then the curly chili, and the lowest is faced by big red chili<sup>[18]</sup>.

#### **4.3 Correlation between Production Risk and Farming Income**

The farmers who are willing to business on chili farming that is indicate they have the courage to face risks. The attitude toward risk is related to income because farmers who dare to face risks have the opportunity to earn income. Therefore, it should be suspected that there is a relationship between the level of risk and income. Production risk is related to climate risk and loss of income borne by farmers due to crop failure, heavy rain, and wind<sup>[22]</sup>.

Correlation analysis shows that the risk of cayenne pepper production is positively related to farm income. This means that the higher the production risk, the higher the income from the chili crop. On the other hand, cayenne pepper price risk is negatively related to farm income. The higher the price risk, the lower the income from the cayenne pepper crop. The same happened with the curly pepper crop, where production risk had a positive relationship with farm income, while price risk and farm income had a negative relationship. Unlike big red

peppers, both production risk and price risk are negatively related to farm income (Tab. 14).

#### **4.4 Correlation between Price Risk and Farming Income**

A decrease in income occurs due to either a decrease in prices or a decrease in the level of production. This shows that farmers can reduce income risk by reducing the relative importance of fixed cost allocation to the farm<sup>[23]</sup>.

The complexity of revenue risk is closely related to production risk and price risk because revenue risk can be part of production risk, on the one hand, because it depends on farmers' decisions, and on the other hand, can be linked to markets or prices<sup>[24]</sup>.

On the other hand, in the dry season, the average price risk faced by farmers of bird's eye chili peppers, big red chili peppers, and curly chili peppers increases and is greater than that in the rainy season, marked by a sharp fall in prices<sup>[9]</sup>. This drastic price reduction was not followed by a sharp increase in production, so income earned was low, even for cayenne pepper and chili peppers, much lower than the income earned during the rainy season.

The existence of a positive and negative relationship between production risk and price risk with farm income indicates that high risk is not always followed by the possibility of low income. Also, low risk is not always followed by high farm income. What is more decisive and logical is the courage of farmers despite the risks of agriculture. The more courageous farmers are in facing the risks that are marked by the more intensive use of production inputs, the more likely farmers are to earn higher incomes or profits<sup>[9]</sup>.

### **5 Conclusions and Implications**

#### **5.1 Conclusions**

The comparative model of production and price risk could be used to analyze the comparison of the risk level of various types of chili farming in the tropical areas. The risk of cayenne pepper production is the lowest compared to the production risk of curly chili farming and big red chili farming, conversely, the price risk of cayenne pepper is in the high-risk category compared to the price risk of big red and curly chilies. The higher the production risk of cayenne pepper and curly chili farming, the greater the farming income<sup>[8]</sup>; the higher the production risk, the lower the big chili farming income; the higher the price risk, the lower the farming income.

## 5.2 Implications

Cayenne pepper farming and curly chili farming are risky but profitable businesses in an effort to increase farmers' income and for the government to ensure price stability and control inflation, while big chili farming has relatively stable prices. However, it is not profitable for farmers. Therefore, the planting area is limited according to market demand.

## Acknowledgment

Thank you very much to the Rector of the University of Mataram and the Head of the Research and Community Service Institute for facilitating research funding through the state non-tax revenue allocation in 2022, so that we can publish our manuscript on the research results.

## References

### 参考文献

- [1] MARIYONO J, SUMARNO S. Chilli production and adoption of chilli-based agribusiness in Indonesia. *Journal of Agribusiness in Developing and Emerging Economies*, 2015, 5(1), 57–75.
- [2] FRANKEL J A. How can commodity exporters make fiscal and monetary policy less procyclical? John F. Kennedy School of Government, Harvard University, 2011. <https://dash.harvard.edu/handle/1/4735392>
- [3] SUSANAWATI, AKHMADI H., FAUZAN, et al. Supply chain efficiency of red chili based on the performance measurement system in Yogyakarta, Indonesia. *Open Agriculture*, 2021, 6(1), 202–211.
- [4] SIDDK M, ZAINI A, BUDA STRA I K, et al. Analysis of the impact of the claim of chili price stabilization in West Nusa Tenggara. Faculty of Agriculture, Mataram University, 2018.
- [5] MARIYONO J. Moving to commercial production: a case of intensive chili farming in Indonesia. *Development in Practice*, 2017, 27(8), 1103–1113.
- [6] NUGROHO L H. Red pepper (*Capsicum* spp.) fruit: a model for the study of secondary metabolite product distribution and its management. *AIP Conference Proceedings*, 2016, 1744(1), 020034.
- [7] BPS. West Nusa Tenggara in figures. Mataram: Central Bureau of Statistics of West Nusa Tenggara Province, 2021.
- [8] GEORGE T, MARKUS J. Explanatory research: definition, guide, & examples. Scribbr Publisher, 2022. <https://www.scribbr.com/methodology/explanatory-research/>
- [9] NOVICKYTE L. Income risk management in agriculture using financial support. *European Journal of Sustainable Development*, 2018, 7(4), 191–202.
- [10] NEWCOMER K E, HATRY H P, WHOLEY J S. Handbook of practical program evaluation. 4th ed. John Wiley & Sons, 2015.
- [11] HAYES A. *Co-efficient of variation meaning and how to use it*, 2022. <https://www.investopedia.com/terms/c/coefficientofvariation.asp#>
- [12] GUJARATI D N. Basic econometrics. New York: McGraw-Hill, 2015.
- [13] SITTICHINAWING A, PANITARN N D, PEERAPTTANA P. Green productivity index of cayenne pepper production (case study in Nongkhai province). In: Proceedings of the 1st Mae Fah Luang University International Conference, 2012.
- [14] WIJAYA C H, HARDA M, RANA B. Diversity and potency of *Capsicum* spp. grown in Indonesia. In: DEKEBO A. (ed.) *Capsikum*. London: IntechOpen, 2020: 3–24.
- [15] KARYANI T, SUSANTO A, DJUWEDAH E, et al. Red chili agribusiness and the risks faced by the farmers. *IOP Conference Series: Earth and Environmental Science*, 2020, 466, 012002.
- [16] MALA N, PRASMATIWI F E, SAYEKTI W D. Income and risks of chilli cultivation in Sumber Rejo District, Tanggamus Regency. *Journal of Agribusiness Science*, 2021, 9(1), 91–98.
- [17] AMIN M, PRIHANTINI C I. Analisis Produksi dan Risiko Produksi Usahatani Cabai Rawit di Kecamatan Watunohu, Kabupaten Kolaka Utara. *Agrimor: Jurnal Agribisnis Lahan Kering*, 2021, 6(1), 15–21.
- [18] ALFIANOR, FERRIANTA Y, HAMDANI. Analisis Risiko Produksi Tanaman Cabai Rawit Di Desa Malilingin Kecamatan Padang Batung Kabupaten Hulu Sungai Selatan. *Frontier Agribisnis*, 2018, 2(4).
- [19] PUSPASARI A. Cost-income analysis of cayenne pepper cultivation in Cigalontang Sub-District, Tasikmalaya District. *Mimbar Agribisnis: Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 2020, 6(2), 1130–1142.

- [20] SIDDIK M, TAJIDAN T, DIPOKUSUMO B, et al. The environmental adaptation to production and price risks of cayenne pepper: learning from the Lombok Island – Indonesia. IOP Conference Series: Earth and Environmental Science, 2022, 1107, 012007.
- [21] HUNG P Q, KHAI H V. Transaction cost, price risk perspective and marketing channel decision of small-scale chili farmers in Tra Vinh Province, Vietnam. Asian Journal of Agriculture and Rural Development, 2020, 10(1), 68–80.
- [22] WEBB A J, KARTIKASARI F, KOSASIH I. *Do chili traders make price volatility worse? A qualitative analysis of East Java trading practices*, 2012. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2176153](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2176153)
- [23] AKBAR S, GU-CHENG L I, NAZIR A, et al. Maize production under risk: the simultaneous adoption of off-farm income diversification and agricultural credit to manage risk. Journal of Integrative Agriculture, 2019, 18(2), 460–470.
- [24] SEVERINI S, TANTARI A, TOMMASO G. Effect of agricultural policy on income and revenue risks in Italian farms: implications for the use of risk management policies. Agricultural Finance Review, 2017, 77(2), 295–311.
- [25] MARDIANTO M F F, SEDIONO, SYAHZAQI I, et al. Prediction of Indonesia strategic commodity prices during the COVID-19 pandemic based on a simultaneous comparison of Kernel and Fourier series estimator. Journal of Southwest Jiaotong University, 2020, 55(6). <https://doi.org/10.35741/issn.0258-2724.55.6.43>

- [1] MARIYONO J, SUMARNO S. 印度尼西亚的辣椒生产和以辣椒为基础的农业综合企业的采用。发展和新兴经济体中的农业综合企业杂志, 2015年, 5(1), 57–75。
- [2] FRANKEL J A. 大宗商品出口商如何降低财政和货币政策的顺周期性? 哈佛大学约翰·肯尼迪政府学院, 2011年。 <https://dash.harvard.edu/handle/1/4735392>
- [3] SUSANAWATI, AKHMADI H, FAUZAN 等。基于印度尼西亚日惹绩效测量系统的红辣椒供应链效率。开放农业, 2021, 6(1), 202–211。
- [4] SIDDIK M, ZAINI A, BUDA STRA I K 等。西努沙登加拉辣椒价格稳定主张的影响分析。马塔兰大学农学院, 2018年。
- [5] MARIYONO J. 转向商业化生产: 印度尼西亚集约化辣椒种植案例。实践发展, 2017, 27(8), 1103–1113。
- [6] NUGROHO L H. 红辣椒(辣椒属)果实: 次级代谢产物分布及其管理研究的模型。AIP 会议论文集, 2016, 1744(1), 020034。
- [7] BPS. 西努沙登加拉的数字。马塔兰: 西努沙登加拉省中央统计局, 2021年。
- [8] GEORGE T, MARKUS J. 解释性研究: 定义、指南和示例。抄写员出版社, 2022年。 <https://www.scribbr.com/methodology/explanatory-research/>
- [9] NOVICKYTE L. 使用财政支持的农业收入风险管理。欧洲可持续发展杂志, 2018年, 7(4), 191–202。
- [10] NEWCOMER K E, HATRY H P, WHOLEY J S. 实用程序评估手册。第4版。约翰·威利父子公司, 2015年。
- [11] HAYES A. 变异系数意义及其使用方法, 2022年。 <https://www.investopedia.com/terms/c/coefficientofvariation.asp#>
- [12] GUJARATI D N. 计量经济学基础。纽约: 麦格劳-希尔出版社, 2015年。
- [13] SITTICHINAWING A, PANITARN ND, PEERAPTTANA P. 辣椒生产的绿色生产力指数(廊开省案例研究)。在: 第一届皇太后大学国际会议论文集, 2012年。
- [14] WIJAYA C H, HARDA M, RANA B. 辣椒属的多样性和效力。生长于印度尼西亚。在:

- DEKEBO A. (编辑) 辣椒。伦敦：IntechOpen，2020年：3–24。
- [15] KARYANI T, SUSANTO A, DJUWEDAH E 等。红辣椒农业综合企业和农民面临的风险。眼压会议系列：地球与环境科学，2020, 466, 012002。
- [16] MALA N, PRASMATIWI FE, SAYEKTI W D. 唐加木斯摄政区桑伯雷乔区辣椒种植的收入和风险。农业科学杂志, 2021, 9(1), 91–98。
- [17] AMIN M, PRIHANTINI C I. 北科拉卡摄政区瓦图诺胡区辣椒种植生产风险分析。阿格里莫：旱地农业综合企业杂志, 2021, 6(1), 15–21。
- [18] 阿尔菲亚诺、费里安塔 Y、哈姆达尼。南上河巴东巴东摄政酒店区马林金村辣椒生产风险分析。农业前沿, 2018, 2(4)。
- [19] PUSPASARI A. 打横县雪茄街道辣椒种植的成本收入分析。农业企业平台：面向农业企业的科学共同体思想杂志，2020，6(2)，1130–1142。
- [20] SIDDIK M, TAJIDAN T, DIPOKUSUMO B 等。辣椒生产和价格风险的环境适应性：向印度尼西亚龙目岛学习。眼压会议系列：地球与环境科学，2022, 1107, 012007。
- [21] HUNG P Q, KHAI H V. 越南茶荣省小规模辣椒农户的交易成本、价格风险视角和营销渠道决策。亚洲农业与农村发展杂志, 2020, 10(1), 68–80。
- [22] WEBB A J, KARTIKASARI F, KOSASIH I. 辣椒贸易商是否使价格波动加剧？东爪哇交易实践的定性分析，2012年。[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2176153](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2176153)
- [23] AKBAR S, GU-CHENG LI, NAZIR A, 等。面临风险的玉米生产：同时采用非农收入多元化和农业信贷来管理风险。综合农业杂志, 2019, 18(2), 460–470。
- [24] SEVERINI S, TANTARI A, TOMMASO G. 农业政策对意大利农场收入和收入风险的影响：对风险管理政策使用的影响。农业金融评论，2017年，77(2)，295–311。
- [25] MARDIANTO M F F, SEDIONO, SYAHZAQI I 等。基于内核和傅立叶级数估计量的同时比较，预测新冠肺炎大流行期间印度尼西亚的战略商品价格。西南交通大学学报, 2020, 55(6). <https://doi.org/10.35741/issn.0258-2724.55.6.43>