The environmental adaptation to production and price risks of cayenne pepper learning from the lombok island-indonesia

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The environmental adaptation to production and price risks of cayenne pepper: Learning from the Lombok Island - Indonesia

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Abstract. The environment in which the place of cultivation determines the level of production and income of the farm, but how the behavior of farmers in the use of technology to achieve high levels of productivity and prices of cayenne pepper is something that still is not known. This study aims to find environmental adaptation technologies that can increase the production and price of cayenne pepper in a changing environmental situation. The study used exploratory methods in three villages of the chili production centers that have different altitudes. The unit of analysis in this study is the cayenne pepper crop that was planted in 2020/2021. As respondents, 45 farmers who grow cayenne pepper were randomly chosen. The highest productivity of cayenne was found in the lowlands at 11,133 kg/ha, in the midlands at 10,277 kg/ha, and the lowest in the highlands at 9,400 kg/ha. Cayenne pepper production risk is highest in the highlands at 0.46, in middle lands at 0.42, and lowest in the lowlands at 0.34. For it is part, the price risk is classified as high in the highlands at 0.62, the middle lands at 0.61, and the lowlands at 0.60. The behavior of farmers in coping with agricultural risks is considered a *risk-taker*. Cayenne pepper agricultural production still has an opportunity to increase by increasing the area of farmland, labor, urea or ZA fertilizers, SP36 fertilizers, and by increasing the ability of farmers to manage agricultural risks.

1. Introduction

Cayenne pepper cultivation is highly capital intensive, especially to meet the needs of plastic mulch costs, production facilities, and labor wages, while the prices of production facilities and labor wages continue to rise every year [1]. In an effort to increase production and price stability, the support of financial institutions as a provider of financing sources is needed to overcome the need for capital, as well as the support of agricultural extensionists in technology transfer. Therefore, the condition of the internal and external environment of agriculture seems to have an effect on the production and price of cayenne pepper.

Limiting factors in cayenne pepper cultivation are physical environmental conditions and social environmental conditions that are not in accordance with the requirements for plant growth, including rainfall, air temperature, water availability, and humidity. soil fertility. In addition to physical limitations, they also face social obstacles such as knowledge, mastery of technology, and experience of farmers in the cultivation of cayenne pepper [1,2] The condition of the physical environment and the social environment

is believed to have an effect on the achievement of production and the acquisition of prices received by farmers. Therefore, environmental conditions must be controlled for optimal productivity and price.

The results of a study conducted by Nurul Mala et al (2021) in the Sumber Rejo district showed that there was no significant difference between the production risk and the income risk of growing large chilies and cayenne pepper, but the risk The price risk of large chili peppers was higher when compared to the price risk of chili peppers, cayenne pepper [3], while the results of the study by Muhtar Amin and Campina Illa Prihantini (2021) indicate that the production risk of cayenne pepper is low [4]. The low risk of cayenne pepper production was also reported by Alfianor Alfianor, Yudi Ferrianta, Hamdani Hamdani (2018) [5], so cayenne pepper cultivation is one of the profitable and feasible agricultural businesses [6,7]. The low production risk and price risk for cayenne pepper shown in the study results are presumably due to the location of the research in the lowlands, while the study's production risk and price risk in midland and highland areas have not been fully disclosed, but what does appear is less production risk compared to price risk, because the price of cayenne pepper tends to fluctuate between the rainy and summer seasons. dry season.

Cayenne pepper price fluctuations between seasons are caused by market mechanisms, namely fluctuating supply on the one hand and almost stable demand between seasons on the other. In the dry season, production and supply are abundant, causing prices to fall, while in the rainy season, production is low and supply is low, so chili prices rise sharply. This condition means that cayenne pepper farmers face a high production and price risk [8]. Of the results of the above theoretical study, none have shown a relationship between production risk and price risk associated with the height of the farm location, as well as the socio-economic environmental conditions that affect the productivity of the cayenne pepper crop. . Linking production risk and price risk at various altitudes (lowlands, medians, and mountains) as the sole object of study, as well as linking it to the variables of the socioeconomic environment of agricultural actors is an integral part of the novelty of this research.

On this basis, it is interesting to carry out this research with the aim of analyzing the level of productivity, production risk, and price risk of cayenne pepper in three elevation levels of the farm above sea level, namely lowlands, middle lands and highlands. The results of this study are expected to produce a valuable lesson on efforts to control production risk and price risk, as well as strategic recommendations for dealing with production risk and price risk. In particular, this study aims to determine the effect of high farm location on productivity and its effect on production risk and price risk.

2. Research methods

The research was carried out in the East Lombok Regency, the center of chili production on the island of Lombok. The research localities were classified according to the altitude of the place above sea level, that is, lowlands below 200 meters above sea level (masl), middle lands between 200 and 500 masl, and highlands above 500 meters above sea level. In each cluster, a village is determined as the research site using a purposive sampling technique [9]. The selected villages were Labuhan Haji Village representing the lowland group, Kerongkong Village representing the middle lands group, and Timbanuh Village representing the highland group. In each village, 15 cultivation units were established as sampling units, so in total there were 45 cayenne pepper cultivation units.

Data was collected by combining several integrated primary data collection techniques, namely structured interviews using 45 questionnaires, in-depth interviews with *key informants,* direct observation or observation of the object of investigation*,* and desk study to enrich the discussion [10] while secondary data is collected through documentation and inventory of information that contributes to the discussion.

The collected data was analyzed using a mixed model, which is a combination of quantitative analysis and qualitative analysis [11]. The quantitative analysis was carried out using descriptive statistics where the data was presented in the form of tables, charts, or graphs, while the qualitative analysis was

carried out using a comparative technique of percentages between conglomerates of low and high middle lands. Especially for risk analysis using the coefficient of variation.

3. Results and discussion

3.1. Productivity

The highest cayenne pepper crop productivity was found in the middle lands during the dry season, while the lowest cayenne pepper crop productivity was found in the highlands during the wet season.

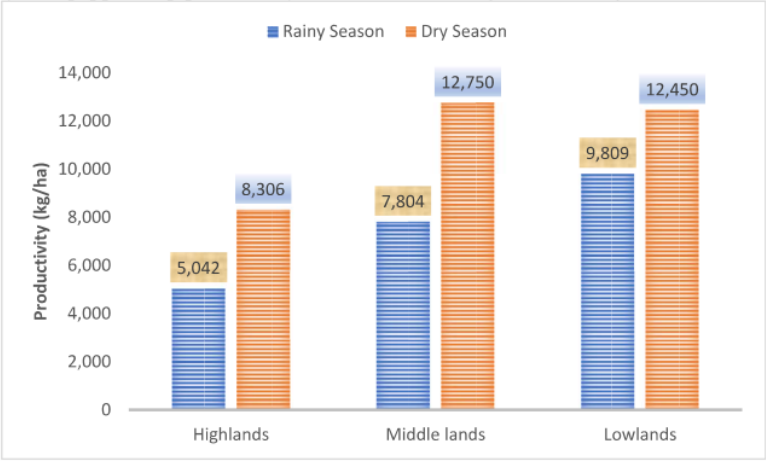

Figure 1. Comparison of cayenne pepper farming productivity between clusters attitude locations

The highest productivity of cayenne pepper farming is obtained in the dry season, while in the rainy season the productivity is lower when compared to productivity in the dry season. The productivity of cayenne pepper farming in the lowlands and in the middle lands is higher than in the highlands. In order to expand the area of cayenne pepper farming, it is recommended that it be developed in lowland locations and in middle lands locations.

3.2. Price

The equilibrium price is formed as an interaction between the quantity demanded by consumers and the quantity supplied by producers. During the dry planting season between May and October, there was an increase in production that exceeded demand so prices fell, while in the rainy planting season production decreased while demand was almost constant, as a result, supply shifted to the left, causing the price of cayenne pepper to rise. In Figure 2 it can be seen that the price of cayenne pepper is more expensive in the rainy season than in the dry season, but the prices between bunches are almost the same, so the bunches do not affect the price of cayenne pepper.

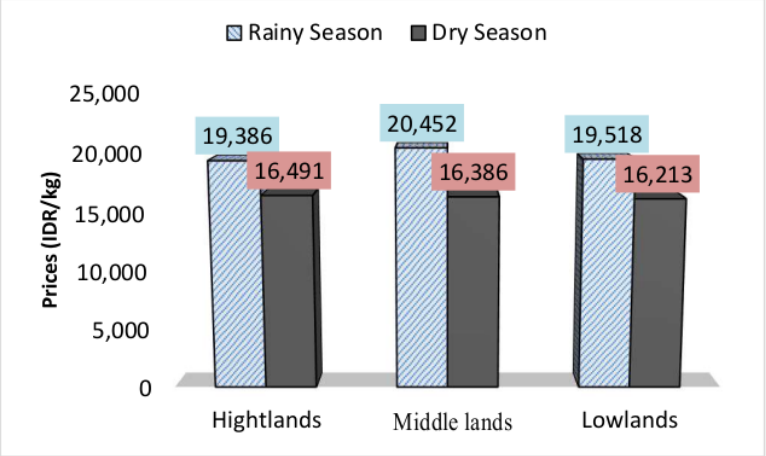

Figure 2. Comparison of cayenne pepper prices between clusters attitude of farm locations

3.3. Cayenne pepper production risk

The production risk analyzed by the production variance is measured by adding the difference in the square of the production with the production expectations multiplied by the probability of each event (high, normal, and low production) according to the observations in the cultivation activities. of cayenne pepper [12]. 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.

Based on the results of the analysis, it is known that highland farmers face the highest production risk with a coefficient of variation of 0.46, then middle land farmers are 0.42 and lowland farmers face the lowest 0.34. But in general, the production risk faced by cayenne pepper growers on the island of Lombok is low, the value of the coefficient of variation is still less than 0.5. The results of this study are in line with the research results of Nurul Mala et al (2021) [3] and Muhtar Amin and Campina Illa Prihantini (2021) [4] who state that the risk of cayenne pepper production is low. Examples of production risk are pest and diseases attack, water scarcity, high rainfall, and technology application not as recommended.

Table 1. Cayenne pepper production risk in cluster locations in 2021.

Nu.	Description	Highlands	Middle lands	Lowlands
1	Production variance (kg/ha)	8,256,362	16,356,598	12,259,434
2	Production Standard Deviation	2,873	4,044	3,501
3	Production Variation Coefficient	0.46	0.42	0.34
4	Upper Yield Lower Limit (kg/ha)	474	1,569	3,368

Source: Analysis of primary data (2021).

The value of the lower bound of the highest return is used as an indicator of the possibility of success in risk treatment [. The cayenne pepper crop on the island of Lombok also has a positive Lower Maximum Yield value (Lq > 0), which means that the cayenne pepper crop from the point of view of production will not suffer losses if it is grown in lowlands, middle lands or highlands, so that in profitable aggregate. The

results of this study are supported by the results of cost-effectiveness and feasibility analysis conducted by Annisa PuspitawaTI (2020) [6] and Arifah Astining Cahya, Rita Herawaty Br Bangun (2020) [7] who stated that chili cultivation is profitable and feasible to cultivate. Of the three groups of cayenne pepper growing locations, it appears that the most suitable locations are in the lowlands, while the highlands and middle lands are limited to development locations.

3.4. Cayenne pepper price risk

The coefficient of variation is often used to compare diversity in working groups [13], one of which is to measure price risk. The coefficient of variation of prices is the chance that price variations will occur during a period of one year in the rainy planting season with the dry planting season. The results of the analysis show that the coefficient of variation in the price of cayenne pepper between groups of places is relatively the same, namely in the highlands 0.62; in the middle lands 0.63, and in the highlands 0.61. Because the value of the coefficient of price variation is greater than 0.5, the price fluctuations of cayenne pepper are classified as high risk based on the results of the analysis in Table 2.

Table 2. Cayenne pepper price risk based on location character in 2021.

Nu	Description	Highlands	Middle lands	Lowlands
1	Price variation	103,073,876	113,086,843	101,177,097
2	Price Standard Deviation	10,153	10,634	10,059
3	Price Variation Coefficient	0.62	0.61	0.60
4	Higher performance lower bound	(3,811)	(3,932)	(3,462)

Source: Analysis of primary data (2021).

The results of this study show that the price risk condition contrasts with the production risk. Price risk is high, while production risk is low, because the coefficient of variation is less than 0.5 in the highlands, middle, and lowlands, while price risk is high because the coefficient of variation is greater than 0.5 [13]. The fluctuating price of cayenne pepper encourages wide price variations between seasons, thus opening the opportunity for the lower bound of the highest price return with a negative sign ($Lq < 0$). Price risk analysis results above 0.5 and Lq values below 0.5 are indicators for farmers to be more careful because their cayenne pepper crop is always overshadowed by potential losses as a result. of the risk of fluctuations in the price of cayenne pepper, especially for farmers who grow cayenne pepper plants in the dry season.

3.5. The behavior of farmers facing the risks of cayenne pepper cultivation

The results of the multiple linear regression analysis indicate that production risk, price risk along with other independent variables affect the behavior of farmers when using various production inputs. The results of the partial analysis show that production risk and price risk affect the use of production inputs, although not all of them have a significant effect. This further proves that cayenne pepper growers behave boldly (*risk takers*) in the face of production risk and price risk, or at least behave neutrally (*risk-neutral*) in the face of crop risks. of cayenne pepper. This means that farmers' awareness of these risks encourages them to overcome them by applying balanced technology so that their crop does not fail. The higher the risk faced, the more intensive is the use of production inputs [8].

What is meant by balanced agricultural technology is the use of organic fertilizers together with the proportional use of inorganic fertilizers [14].

3.6. Environmental adaptation in facing production risk and price risk

The attitude of farmers who dare to face risks is manifested in their ability to adapt to the changing or varied physical and socioeconomic environment that is expected through the application of technology adapted to environmental conditions. The risk of rain is overcome with the plastic mulch technology and the gutter depth setting as well as the bed height setting. Extreme rainfall conditions in the rainy season are adapted using technology that can prevent flooding because cayenne pepper plants are not conducive to a flooded water environment. Meanwhile, socioeconomic conditions are anticipated by controlling the cultivated area planted with cayenne, as well as diversifying the business to avoid greater losses. The results of the research carried out by Maytti Potolau et al (2013) [15] showed that the risk of growing cayenne pepper in the dry season was lower than in the rainy season as indicated by the coefficients of variation 0.51 and 0.41, which means that growing cayenne pepper in the rainy season is riskier than the dry season**.** The environment of the planting season gives different effects of agricultural risks and causes different consequences. The high production risk in growing chili plants in the rainy season generates a positive risk for chili prices. The price of cayenne pepper in the rainy season is more expensive than the price of cayenne pepper in the dry season (Figure 2).

Adequacy of the physical and socio-economic environment as part of efforts to control production risk and price risk that will impact revenue risk. The results of the analysis conducted by Siddik et al (2021) [8] using multiple regression analysis showed that production factors, production risk, and price risk together affect the production and income of the cayenne pepper crop at a 99% confidence level. These factors also have a contribution of 94.70% and 85.10% to the variations in the production and income of the cayenne pepper crop [8]. The attitude of farmers who dare to face the risks is shown in the high use of labor, and the use of urea and ZA fertilizers, so to make efficient use of these fertilizers it is necessary to reduce them, because it has not yet exceeded the optimal input use.

Production risk and price risk have different effects on-farm production and income. Production risk has a significant negative effect on cayenne pepper production but does not have a significant negative effect on farm income. This means that the more varied the farmers' production (production risk), especially between the rainy season and the dry season, the average production tends to be lower [15]. Environmental factors in the rainy season and the dry planting season did not show a significant positive effect. Although the results of the analysis are not convincing, the positive influence of this factor on the production and income of the farms indicates that the variation or risk of prices that farmers face each year has taught them to continue fighting to overcome the challenges following their beliefs; and the results show that there is a tendency, to higher price risk, higher production and agricultural income obtained [14].

The cluster of altitude above sea level as a place for cayenne pepper cultivation was analyzed as a dummy variable indicating that cayenne pepper production in the lowlands showed a positive and significant difference from other plains, but in the aspect of agrarian income, it does not show a significant difference. Unlike the middle lands, it actually shows a significant negative difference in the aspect of agricultural income, but in production, it does not show a significant difference. From the results of this analysis, it is known that the best cluster location for growing cayenne pepper is in the lowlands because the production risk is lower and there is not much difference in price risk. Therefore, it is identified that the location for the cultivation of cayenne pepper is in the lowlands and medium lands, while in the highlands the production risk is relatively more complex.

In this study it is known that the sowing time factor presents a significant difference with respect to the production aspect, this finding is based on the results of a study carried out by Maytti Potolau (2013) [15] that the cultivation of chili plants in the Rainy season has a higher production risk compared to the cultivation of chili plants in the dry season with a coefficient of variation of 0.51 and 0.41. One of the biggest threats to cayenne pepper cultivation in the rainy season is the appearance of root rot disease and the

presence of pests that attack the fruit. Pest attacks on cayenne peppers result in fruit loss when the fruits are still young.

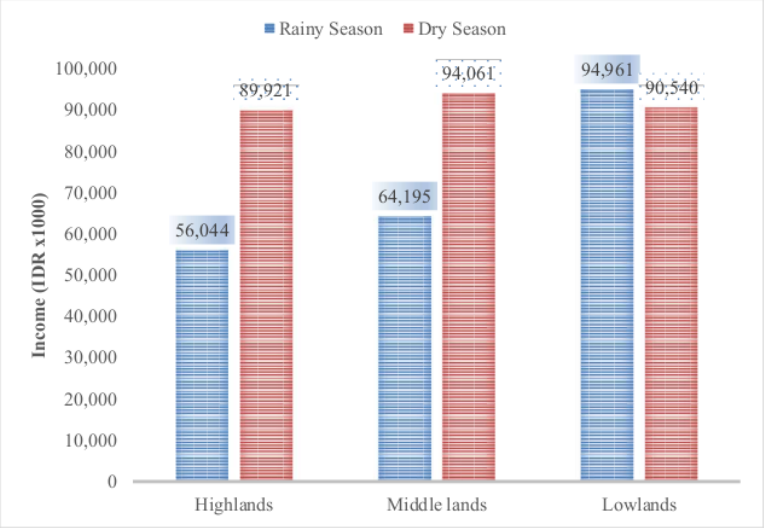

Figure 3. Cayenne pepper farming income (IDR x 1000/ha) according to altitude and planting season

Regarding income, it seems that there was an insignificant difference because the low production in the rainy season (Figure 1) was compensated by the increase in prices (Figure 2). From the results of the analysis, it appears that the location of the height group from sea level and the season have more influence on production than farm income (Figure 3). This indicates an interaction between physical environmental factors and social environmental factors in the formation of income variables because income is the result of the interaction between production costs, production, and prices [16] where there is a negative relationship between production and price, that is to say, that when production increases in season, dry planting is followed by a decrease in prices, on the other hand, when production decreases or decreases due to climatic changes, pests and diseases, the price of cayenne pepper tends to increase [8].

4. Conclusions

Cayenne pepper production risk is low with a coefficient of variation less than 0.5, while price risk is high with a coefficient of variation greater than 0.5. Cayenne pepper production risk is highest in the highlands at 0.46, in middle lands at 0.42, and lowest in the lowlands at 0.34; while price risk is high at 0.62 highlands, 0.61 midlands, and 0.60 lowlands. Production risk and price risk have a positive effect on adaptation to the physical environment and socioeconomic environment, which is reflected in the attitudes and behavior of farmers who dare to face risks. Faced with production risk and price risk, farmers seem to be more determined to implement technology, which is reflected in the increasing use of agricultural production facilities. The right location cluster for farming has an effect on production but has no effect on the price of cayenne pepper, but growing cayenne pepper in the rainy season is riskier than planting cayenne pepper in

the season dry and has a positive impact on increasing the price of cayenne pepper in the rainy season, which is higher price risk, higher is the income of the farm.

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