

Risk Mitigation of Red Chili Production in the Village Besakih, Bali Province

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Abstract
Red chili is one of the strategic vegetables This study aims to identify the source, types, and risk mitigation; analyze the level of risks production; and optimal production area. Measuring the level of risk production using the coefficient of variation; source identification and risk mitigation were qualitatively and descriptively analyzed; and the optimal area is determined using the formula ABC of the production function. The study used secondary data and primary data cross section. Respondents and informants deliberately determined. Respondents are farmers who do farming red chili three cropping seasons since February 2015 till July 2016.The results showed the source of risk is the physical environment, the operational environment, and competitors. Mitigating risk is diversified; set the pattern and timing of planting; farming in a land area of optimal; making beds; improve farming techniques; destroy diseased plants were not yet in production; spraying with pesticides to crops pain already in production; discuss commodity and cultivation techniques are good at farmer group meetings. The risk level is relatively high production shown by the variation coefficient of 4.03 with a standard deviation of 672,821.71 kg. The productivity of the average maximum at 14.17 acre area, while the area of arable optimally between 12.98 to 15.36 acres.Suggested (1) farming in a land area of optimal; (2) the relevant agencies need to assist farmers in: (a) adjust the cropping pattern in the broader region; (b) to help find market red chili.
Keywords: risk, mitigation, production function, red chilli

1. Introduction

One of the potential for development of vegetables in Bali is the red chili. Demand red chili in Bali is relatively high, because in addition to local consumption as well as to meet the needs of hotels and restaurants. In 2013, the demand amounted to 58,545 tonnes of red chilli. This figure is much higher than the production of red chilli in Bali, namely 15,431 tonnes (26.36% of demand). This is the potential development of red chilli in Bali (BPS Bali, 2014). Red chili farming in Bali conducted almost in all districts and cities.

Karangasem regency is one of red chilli production centers in Bali. Red chili farming in Karangasem regency especially in the village of Besakih is the highland a red chili farmings. In 2004, there was over production of red chilli in the market, so the price of red chilli in the village Besakih plummeted to Rp 600.00/kg. That situation resulted chili farmers in this village suffer from losses and most farmers being left red chili farming. On the other hand, in January 2016 the price of red chilli in Bali were in the range of Rp 20,000.00 until Rp 30,300.00 per kg or an average of Rp 24,737.50 (BPS Bali, 2016).

It shows that the red chilli has high economic value but the price was very volatile. In addition, red chili heavily influenced by climate. Red chili farmers are often faced with the uncertain climate as well as pests and diseases that indicate there is uncertainty in the farming of red chilli. This uncertainty raises the risk of production indicated by fluctuations in harvest area and the number of plants that can be harvested. This is partly happening in the District Rendang where the village Besakih as one of the centers of production of red chilli, which has decreased the number of plants in 2014 till 2015 amounted to 52.55% and 39.95% reduction in planting area.

Therefore, in order to help farmers to minimize losses in the farming red chili, it is necessary to do research that can identify the source, type, and mitigating the risk of production; suggests the risk level of red chili farm production; as well as the optimal extensive farming red chili. Through an understanding of the sources, types, and mitigation of risk and the level of risk it is expected that the production of red chili farmers can anticipate and minimize the risk. If the control on the risk of production can be done by farmers with better then expected farmers to minimize losses and improve productivity and farm income.

2. Methodology

This study is exploratory research with survey method and RRA. The study was conducted in the village of Besakih, District Rendang, Karangasem, Bali Province determined intentionally (purposive). The data used was quantitative data and qualitative data derived from primary data and secondary data cross section.

Sampling was done on purpose as much as 30% of the population. The population in this study was a red chili farmer in the village Besakih doing red chili farming during three cropping seasons in a row (February till July 2015; August till January 2016; February till July 2016).

Data analysis method used was
1. Qualitative descriptive analysis was used to identify the source and risk mitigation red chili production.
2. The level of production risk was analyzed using the coefficient of variation, which was a measure of relative risk was obtained by dividing the standard deviation of the expected value (Pappas and Hirschey, 1995) using Microsof Office Excel. Steps measurement of the level of risk was:
   a. Measuring the opportunity or possibility of occurrence (P)
   $$P = \frac{W}{n}$$
   Where:
   P = Opportunities
   W = The frequency of occurrence of events which are calculated odds
   n = Many events
   b. Expected return
   $$E(R_{i)} = \sum_{i=1}^{n} P_i R_i$$
   Where:
   $E(R_i)$ = Expected return;
   Pi = Odds of an event;
   Ri = Return
   c. Variants
   $$\sigma_t^2 = \sum_{i=1}^{n} Pi\{Ri - E(Ri)\}^2$$
   Where:
   σ_t^2 = Variance of return;
   Pij = Odds of an event;
   $E(R_i)$ = Expected return
   d. Standard deviation
   $$\sigma_t = \sqrt{\sigma_t^2}$$
   Where:
   σt = Standard deviation;
   σt2 = Variant
   e. The coefficient of variation
   $$KV = \frac{\sigma_t}{E(R_i)}$$
   Where:
   KV = Coefficient variation;
   Σt = Standard deviation;
   $E(R_i)$ = Expected return;
   Return was red chilli productivity in each growing season in three cropping seasons in a row. Productivity unit was kg/ha.
3. The optimal cultivation were analyzed using the ABC formula production function model:
   $$Q/L= a + a_1L + a_2 L^2 + a_3 L^3$$
   Where:
   Q = the productivity (kg/ha)
   L = the acreage (ha) (Salvator, 2003).

3. Results and Discussion

3.1 Characteristics of Respondents

Characteristics of respondents in the study were (1) Age of respondents ranged from 27-65 years with an average age of 43.40 years, of which 93.33% are in the productive age; (2) Experience of respondents in a red chili farming is relatively long, ranging from 8-13 years, or an average of over 11.33 years; (3) All respondents (100.00%) have the principal livelihood as farmers and 13.33% of them have a livelihood on the side as merchant crops; (4) All respondents have a status as the owner of tenants; (5) The level of formal education ranged from high school to graduate school. A total of 60.00% finished primary school, the rest of the school, junior high school graduation, and graduated from high school in the same proportion. It shows that the respondents' education was still relatively low. Therefore, to improve the knowledge of the respondent can be done through formal education. The opposite was stated by Saptana, et al (2010) in his study, the level of formal education family head even though no real positive effect on the technical inefficiency red chili farming. Causes include (a) common for farmers to share experiences, (b) red chili crop cultivation techniques to farmers in the main production areas of red chili relatively controlled en masse.

3.2 Description of Research Area

The study was conducted in the village of Besakih, District Rendang, Karangasem, Bali Province. Besakih village located approximately 40 km from the district capital and 58 km from the provincial capital. North Side Village is Mount Agung Besakih; the south is the village of Menanga; East is Sebudi Village, Selat District; and the West is the District Tembuku. Size Besakih village was 2,123 ha, of which agricultural land in the form of upland area of 1,238.06 ha. Besakih village topography was undulating, hilly with slopes of 15-30% and was situated at an altitude of 600 up to 1,100 m above sea level. Temperatures range from 30° to 35° C with rainfall ranging from 2000 up to 3000 mm/year, and has two seasons: the rainy season and the dry season. Soil conditions at the site of the study were (i) soil structure: crumbly, (ii) the structure of the soil layer: rough, (iii) soil conditions: stable, (iv) the rate of erosion: height, (v) the depth of though: 30 cm, (vi) solum soil: medium (5 to 75), and (vii) earth colors: gray. The soil conditions including critical and forus. Soil pH from 6 to 7 even reached PH 8 (alkalis). In the village of Besakih there were nine farmer groups (Sriwati, 2014).

Land conditions and altitude at the study site in the manner intended for the cultivation of red chilli, namely altitude 0-1400 m above sea level and soil pH from 6 to 7 (Harpenas and benefactor, 2010).

3.3 Red Chilli Farming in the Village of Besakih

Productivity red chilli in the village Besakih varied and fluctuated in the three cropping seasons (February 2015 till July 2016). Productivity grouped into three strata, namely high, medium, and low. The average productivity of red peppers and chances in every strata can be seen in Table 1.

Table 1. Average Productivity Red Chilli and Opportunities in Each Stratum in the Village Besakih

No	Level	Average Productivity (kg/ha)	Probability
1	High	12,583.33	0.20
2	Moderate	9,109.72	0.53
3	Low	4,785.71	0.27
	Average	8,651.38	

In Table 1 can be seen that farmers have the highest odds (0.53) the productivity of red chili strata being, ie 9109.72 kg/ha, whereas to obtain the highest average productivity (12,583.33 kg/ha) had the lowest odds (0.20). Strata productivity is determined based on the productivity data of red pepper from the lowest to the highest during three cropping seasons. The highest average productivity achieved lower than average productivity ever achieved by red chili farmer in the village Besakih commercialize in the first time in 2004 (13,313.49 kg/ha). This shows a decline in productivity is relatively high. If the views of the average productivity at the start of planting the red chilli productivity in the study site (13313.49 kg / ha) was higher than the average productivity of red chilli in Baturiti District, Tabanan, Bali Province, which is 13181.62 kg / ha research by Widyantara, 2016.

3.4 Sources and Production Risk Type Red Chili

Red chili productivity fluctuations in the village Besakih indicates production risks in the farming of red chili. Based on the survey and observations results that the risk of red chili production sourced from competitors, physical environment, and operational environment. The types of risks in the farming of red chili, among others:
The price risk. Price risk was one risk type of risk source competitors. Risks stemming from the competitors occurred in 2004, the price reached Rp 600.00 per kg. This resulted in farmers losing money. The impact of this situation was many farmers being left red chili farming.

The risk of changes in weather and climate. In the next planting season farmers face the risk of production sourced from the risk of physical environment, such as changes in weather and climate extremes relative. Results of research Ghani (2013) states that the rainfall including factors that increase the risk of production. These sources of risk potential occurrence of pests, diseases, and weeds. Pests include aphids and fruit flies; among other diseases anthracnose and root rot; weeds. Disease occurs in various stages of production, ie from nursery to harvest. The risk types can lead to the production fell sharply ranges from 10% to 80%. This situation resulted in some farmers decided not to continue farming red chili and then switch to another farm, among others: interest gumitir, glutinous corn, and other commodities.

The risks of sources of operational risk were farmers choose commodities and cultivation techniques based solely on experience and follow other farmers. The result was that farmers can not achieve the expected production.

3.5 Production Risk Mitigation Red Chili

Based on interviews and observations, the risk mitigation production of red chilli farmers do to reduce the risk of, among other things:

The price risk. Risk sourced from competitors prices, farmers mitigate risk by diversifying crops, set the pattern and timing of planting, as well as reducing the planting area. Farmers diversify cropping and rotation patterns with flowers gumitir red chili, tomato and glutinous corn. Farmers choose the commodities are based on experience and following other farmers. In addition, farmers are also the timing of planting. Farmers grow chili at the same time with other farmers or time lapses between farmers in a farmer group. This effort is intended to harvest time are not simultaneous, so that the product on the market is not abundant and prices can be controlled. However, the efforts are carried out in a relatively narrow area that each farmer groups, so that it remains difficult to control prices in the market. Therefore, these efforts need to be done in the wider region are the provinces of Bali. It is caused by red chili production centers in Bali Province are in some districts, among others, Tabanan, Bangli, Gianyar. To realize these efforts would require assistance from relevant agencies, among others, (1) draw up a map of the production in the wider region; (2) helping farmers to find new companies whose the raw materal products use red chilli so that farmers find new markets by becoming business partners. This situation coincides with findings Saptana, et al (2010) in Central Java, the farmers reducing the acreage and cultivate plants that have little risk.

The risk of changes in weather and climate. The risk of changes in weather and climate was a kind of risk of physical environmental risk sources. Risk mitigation in the face of changes in the weather and climate of farmers, among others, (1) make ditches so as to allow better irrigation, so as to reduce root rot, the struggle for nutrients between plants red chili with weeds; (2) set the time of planting, so the weather conditions in accordance with the needs of chili plants.

Pests and diseases. Pests and plant disease is a type of risk of physical environmental risk sources. To reduce the risk of pests and diseases, mitigation of risks by the farmers, among others:

(1) The farmer tried to stage red pepper cultivation stages well from seedling to harvest. Farmers prepare media seeding, planting media healthy and sufficient nutrients; make the nursery and choosing good seeds for planting, and then perform routine maintenance using organic materials or inorganic in accordance with the provisions, harvesting in accordance with the level of ripeness so that the product has a good quality.

(2) For the affected plants before disease severe enough to produce the plants are destroyed so that the disease does not spread to healthy plants. If the plants are attacked by the disease was now bearing fruit, the plant is maintained, but the fruit is damaged are annihilated, then spraying with pesticides. Other risk mitigation are the farmers doing crop rotation to break the cycle of pests and diseases. Mitigation also performed at several red chilli production centers in Indonesia in accordance with the research Anwarudin, et al (2015) and Saptana, et al (2010).

Farmers not yet know for certain commodities and good cultivation techniques for risk mitigation. Risk mitigation by the farmers is the result of discussions during group meetings and personal experiences. Therefore, it needs the support of relevant agencies so that farmers can mitigate that should be done in order to effectively and efficiently.

3.6 Production Risk Level Red Chili

Based on the results of data analysis can be seen that the expected value, variance, standard deviation, and coefficient of variation of the production of red chilli in Table 2.

Table 2 Value expectations, variance, standard deviation, and coefficient of variation of the production of red chilli in the village of Besakih

No	Size	Value
1	Expected return	166,911.58
2	Varian	452,689,051,202.98
3	Standar deviasi	672,821.71
4	Koefisien variasi	4.03

In Table 2 it can be seen that the level of risk based on the production of red chilli variation coefficient of 4.03, meaning that for every one unit of the expected results obtained from the red chili farming risks faced by 4.03 units. Alternatively, it can mean for every one kilogram of red chili expected result would run the risk of 4.03 kg at the time of the production risk with a standard deviation of 672,821.71 kg. This risk is higher than the risk of red chilli in Baturiti District, Tabanan, Bali Province, which is between 0.23 to 3.59 research results Widyantara (2016).

Based on the results of risk analysis indicates that the production of red chili farmer in the village Besakih face a huge risk. These risks may lead to loss of farming due to reduced production. Therefore, farmers should do proper mitigation of the risk. By knowing the risk and value expectations of the farmers have a reference in the plan and continue farming red chili.

Decision zoomed farmers planting area is one form of risk mitigation to reduce losses because most farmers use farm loan funds as capital. It can be seen from the average - average land area of 98.67 acres belonging to the respondents, while the average land size of 17.56 acres of red pepper or ranging from 10 to 30 acres per growing season. Red chili land size is relatively narrow, ie 17.80% of the area belongs. To determine the optimal land size regression analysis between the productivity of the land size that results are listed in Table 3.

Table 3. Regression Productivity With a Land Size

No	Commentary	Coefficient	T statistics	Significant
1	Intercept	- 500.834	- 1,565	0,125
2	L	194.031	5.032	1,013
3	L^2	- 7.067	- 5.923	5,566
4	L^3	0,002	10.890	1,133

Description: R square = 0.917 with significance = 3.116E-22 and Se = 254.216

Table 3 shows that the production function of red chilli in the village Besakih is $Q/L = -500.834 + 194.031 L - 7.067 L^2 + 0{,}002 L^3$. Productivity maximum average obtained in 14.17 acre area, while the area of arable optimally between 12.98 till 15.36 acres. A total of 22.22% of respondents are in optimal land size. Therefore, farmers who have not yet optimal land size needs to adjust his cultivated area in order to minimize the risk of farming in particular the risk of production.

4. Conclusion

1. Risk of red chili production sourced from competitors, physical environment, and operational environment. Types of risks inherent in the village of Besakih, among other price; the weather and climate; pests and disease; weeds; selection of commodities and farming techniques based solely on experience and information other farmers.
2. Mitigation of risk that farmers are diversifying; set the pattern and timing of planting; reducing the planting area; making beds; destroy diseased plants were not yet in production; spraying with pesticides to crops pain already in production; discuss the selection of commodities and good farming techniques during a meeting of farmer groups.
3. The level of risk is relatively high production of red chilli indicated by the coefficient of variation of 4.03 with a standard deviation of 672,821.71 kg. The area cultivated red chili optimal adalah14.17 acre (12.98 till 15.36 acre). A total of 22.22% of respondents are in optimal land size.

Based on the conclusion of the suggestions in this study is (1) Farmers should perform red chili farming in land size is optimal, and (2) Relevant agencies should assist the farmers in terms of: (a) planning of production and cropping patterns red chilli in the wider region; (b) to help find market red chili, among others, be a liaison between farmers and raw materials user companies to partner with the red chili red chili farmers.

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