

# Analysis of Production Risk in Red Chilli Farming on Coastal Land Using a Shower Irrigation System in Panjatan District, Yogyakarta

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**Abstract.** The agro-climatic challenges of red chili farming on coastal land require farmers to use production factors that are better in quantity and quality. The risks faced by farmers on sandy land include low levels of nutrients in the land, strong winds that cause plants to easily collapse, porous characteristics of the land, so it requires more water than paddy fields. The irrigation system is important to anticipate optimal watering. This research aims to determine the factors that influence the production and risk of red chili production, as well as determine the relationship between the use of these factors on the production and risk of red chili production using a shower irrigation system on coastal land in Panjatan District, Yogyakarta. Respondents were taken using the census method with a total of 50 farmers. The analysis uses a Cobb-Douglass type production function model based on Just and Pope. The results of the research show that the factors that influence red chili production on coastal sand land with a shower irrigation system are land area, seeds, liquid insecticide and solid fungicide. The factors that influence the risk of red chili production are phonska, liquid herbicide, labor and irrigation fuel costs.

## 1 Introduction

Horticultural plants are plants that have higher economic value if they can be developed further [1]. One of the horticultural crops that have quite high economic value if developed further is red chili [2]. Red chilies are one of the leading commodities among farmers because the adaptability of red chilies is quite good. Red chili plants can be cultivated in lowland and highland areas, but in the highlands their growth is slower. Red chili plants can grow in

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various types of soil, but soil drainage and aeration must be good enough, and water must be available during chili cultivation [3].

The irrigation system on sandy land is an important consideration in providing sufficient water for red chili plants because it is a factor that can influence production [4]. The increasing use of modern technological inputs such as fertilizers, pesticides and manure under unstable irrigation conditions can be the cause of difficulties in increasing agricultural productivity [5]. Efficient and cost-effective ways of irrigation have emerged as the need of the hour due to limited water resources [6]. Most water is wasted due to inefficient ways of watering plants [7][8]. Soil management to increase water productivity must be considered. In agricultural water management, reasonable allocation of irrigation water based on soil conditions should be considered [9]. Sand land has low water holding capacity. So, it is necessary to use an appropriate irrigation system, farmers in Panjatan District, Yogyakarta use a shower system [10].

The next consideration in chili farming on coastal sand land is the high production risk. The characteristics of this land, which are low in nutrients, porous, and subject to hot weather, increase the likelihood of crop failure. The inherent traits of coastal sand land present challenges that farmers must navigate, as the use of production factors is often accompanied by significant production risks. To enhance soil nutrients, it is necessary to apply fertilizers at rates higher than those typically used in paddy fields. The integration of manure with chemical fertilizers is essential to boost nutrient levels in the soil, ensuring that red chili plants receive adequate nourishment. However, it is crucial that the addition of fertilizers aligns with standard agronomic requirements to avoid potential negative impacts on crop health and yield. Research indicates that effective risk management strategies are vital for mitigating the production risks associated with farming in such challenging environments. For instance, the implementation of innovative tools for risk management can help farmers address the unique challenges posed by coastal sand land [29]. Additionally, understanding the economic implications of production risks is essential, as these risks can lead to significant financial losses if not properly managed [30]. Furthermore, studies have shown that the use of irrigation systems can facilitate red chili farming on sandy land, helping to overcome some of the limitations associated with nutrient deficiencies and water availability [31]. Moreover, the importance of adjusting fertilizer applications to meet the specific needs of red chili plants cannot be overstated, as improper fertilization can exacerbate production risks [32]. The combination of strategic nutrient management and innovative farming practices is crucial for ensuring the sustainability and productivity of red chili farming in coastal sand land [33]. By adopting these practices, farmers can enhance their resilience against the inherent risks of their agricultural environment.

One of the sub-districts that produces red chilies on coastal land is Panjatan Sub-district. Panjatan District is one of the sub-districts that has the highest planted area compared to the other 12 sub-districts in Kulon Progo, Special Region of Yogyakarta. However, the amount of red chili productivity in Panjatan District fluctuates from year to year About 3-4% from 2020 until 2022. [12]. It can be said that the production factor of planted area is not the only one that influences red chili production in Panjatan District, Yogyakarta.

This year the pests that attack red chili plants in Panjatan District are caterpillars. To overcome these pest attacks, farmers use pesticides. Pesticides cannot be applied just once; pesticides must be given to plants attacked by pests regularly in large quantities. Therefore, of course there will be other risks that farmers will face in the form of economic risks, namely costs incurred and production due to excessive use of pesticides [13] [14]. Managing the risk of pest attacks is very important [15]. Thus, the aim of this research is to determine the factors that influence red chili production and production risk in red chili farming, as well as the relationship between production and production risk on coastal land in Panjatan District using a shower irrigation system.

## 2 Research Method

In this section the researcher will discuss in detail the sampling procedures and data analysis techniques.

### 2.1 Sampling technique

The location chosen for this research was Panjatan District, Yogyakarta using the method purposive or on purpose because this sub-district produces the highest red chilies in Kulon Progo Regency in 2020-2022. The villages used as research sites were Garongan and Pleret. Sampling in this study used census techniques with a total of 50 respondents, farmers who grow red chili plants in monoculture on coastal land.

### 2.2 Data analysis technique

Data analysis using type production functions *Cobb-Dougllass* with approach *Just and Pope* with the following production function:

$$\ln Y = \ln a + \beta_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + b_9 \ln X_9 + b_{10} \ln X_{10} + b_{11} \ln X_{11} + b_{12} \ln X_{12} + b_{13} \ln X_{13i} + is \quad (1)$$

Function *productivity variance* red chili pepper are as follows:

$$\ln p^2 AND_i = \ln \theta_0 + i_1 \ln X_{1i} + i_2 \ln X_{2i} + i_3 \ln X_{3i} + i_4 \ln X_{4i} + i_5 \ln X_{5i} + i_6 \ln X_{6i} + i_7 \ln X_{7i} + i_8 \ln X_{8i} + i_9 \ln X_{9i} + i_{10} \ln X_{10i} + i_{11} \ln X_{11i} + i_{12} \ln X_{12i} + i_{13} \ln X_{13i} + is \quad (2)$$

In this regression model, statistical tests are carried out to test how big the influence of production factors is in calculating production risk, the F test is for testing factors together, and the t-test is for testing individual variables [16].

## 3 Results and Discussion

### 3.1 Production Function Analysis

The production function is an equation used to describe a possibility that will occur in a production activity [17].

#### 3.1.1 Analysis of Production Factors

Based on Table 1, the results of the analysis of factors that can influence production, it can be seen that the regression equation obtained is:

$$Y: 21,801 X1^{0,373} X2^{0,345} X3^{-0,021} X4^{-0,013} X5^{-0,003} X6^{-0,002} X7^{-0,045} X8^{0,017} X9^{0,011} X10^{0,053} X11^{-0,059} X12^{0,014} X13^{0,041}$$

The first factor that has a positive and significant influence on red chili production is land area. These results are in line with research conducted in Trimulyo Village, Tegineneng District, Pesawaran Regency, where land area is one of the factors that influences production [18][19][20][21]. The second factor that has a positive and significant effect on red chili production is liquid insecticide. However, this does not happen in the Tasimalaya area because solid insecticides affect red chili production [22]. Liquid insecticides are used by farmers in Panjatan District when plants are attacked by plant pests (OPT), as has been explained, the problem occurred when planting red chilies in Panjatan District in 2023 was pest attacks in

the form of whiteflies, thrips, armyworms, and also fruit flies. So, by administering this liquid insecticide, it can help farmers overcome pests that attack red chili plants. Another significant factor is solid fungicides. Additional use of fungicides will increase red chili production. This also happens in the Musanze region of Northern Rwanda the use of pesticides affects food crop production [23].

**Table 1.** Regression Results of Factors Affecting Red Chili Production in Panjatan District, Yogyakarta

Variable	Coefficient	Std Error	Sig.
Constant	3.082**	1.286	0.022
Land Area ( $X_1$ )	0.373*	0.210	0.084
Seed ( $X_2$ )	0.345	0.235	0.151
Urea ( $X_3$ )	-0.021	0.020	0.305
Phonska ( $X_4$ )	-0.013	0.023	0.578
NPK( $X_5$ )	-0.003	0.025	0.904
ZA ( $X_6$ )	-0.002	0.021	0.928
Manure ( $X_7$ )	-0.045	0.096	0.643
Liquid Herbicide ( $X_8$ )	0.017	0.014	0.204
Solid Insecticide ( $X_9$ )	0.011	0.013	0.413
Liquid Insecticide ( $X_{10}$ )	0.053**	0.025	0.043
Solid Fungicide ( $X_{11}$ )	-0.059**	0.022	0.012
Labor ( $X_{12}$ )	0.014	0.179	0.936
Irrigation Fuel Costs ( $X_{13}$ )	0.041	0.079	0.602
R Squared			0.734
Adjusted R			0.638
F-statistic			7.642
Sig (F-statistic)			0.000***
N			50

Description: \*\*\*significant 1%; \*\* significant 5%; \* significant 10%

### 3.1.2 Production Risk Analysis

Production risk is a possibility that can occur, but farmers already know that it is caused by certain things and can occur when production activities are in progress [24]. Production risk in agriculture refers to the potential for adverse outcomes arising from various factors during the production process. Farmers are generally aware that such risks can stem from a multitude of sources, including environmental conditions, market fluctuations, and operational uncertainties. These risks manifest during production activities, significantly impacting agricultural productivity and economic viability. Effective risk management is essential for maintaining competitiveness in agricultural enterprises, as production risks can lead to substantial economic losses [25].

Based on Table 2, the results of the analysis of factors that can influence production risk can be seen as the equation obtained is:

$$\sigma^2 Y_i: 55,257 X_1^{0,062} X_2^{0,353} X_3^{-0,194} X_4^{0,337} X_5^{0,114} X_6^{0,106} X_7^{-0,695} X_8^{0,150} X_9^{-0,004} X_{10}^{0,130} X_{11}^{-0,085} X_{12}^{-2,542} X_{13}^{1,008}$$

Factors that significantly influence the risk of red chili production are phonska, liquid herbicide, labor and irrigation fuel costs. Handling risks from farmers depends on the farmer's response to the risks that occur [14]. Phonska fertilizer is useful for increasing plant resistance to drought, disease attacks and can stimulate the growth of flowers and fruit. Based on the analysis results, adding phonska fertilizer will increase the risk to production, however adding phonska fertilizer does not increase red chili production. This does not correspond to

what happened in Ireland [26]. Labor also influences production risk, but additional labor does not affect production increases. This is not in accordance with what happens in Africa, where labor influences production [27].

**Table 2.** Regression Results for Factors that Influence the Risk of Red Chili Production in Panjatan District, Yogyakarta

Variable	Coefficient	Std Error	Sig
constant	- 4.012	7.633	0.602
Land Area ( $X_1$ )	0.062	1.249	0.961
Seed ( $X_2$ )	0.353	1.398	0.802
Urea ( $X_3$ )	-0.194	0.118	0.110
Phonska ( $X_4$ )	0.337**	0.139	0.020
NPK( $X_5$ )	0.114	0.148	0.447
ZA ( $X_6$ )	0.106	0.127	0.409
Manure ( $X_7$ )	-0.695	0.569	0.230
Liquid Herbicide ( $X_8$ )	0.150*	0.080	0.069
Solid Insecticide ( $X_9$ )	-0.004	0.078	0.956
Liquid Insecticide ( $X_{10}$ )	0.130	0.150	0.392
Solid Fungicide ( $X_{11}$ )	-0.085	0.132	0.524
Labor ( $X_{12}$ )	-2.542**	1.063	0.022
Irrigation Fuel Costs ( $X_{13}$ )	1.008**	0.468	0.038
R Squared			0.397
Adjusted R			0.179
F-statistic			1.824
Sig (F-statistic)			0.077
N			50

Description: \*\*\*significant 1%; \*\* significant 5%; \* significant 10%

### 3.1.3 Relationship of Factors to Production and Production Risk

**Table 3.** Relationship between the use of production inputs on production output and the risk of red chili production in Panjatan District, Yogyakarta

Production Input	Production Factor Coefficients	Production Risk Factor Coefficient
Constant	+**	-
Land Area ( $X_1$ )	+*	+
Seed ( $X_2$ )	+	+
Urea ( $X_3$ )	-	-
Phonska ( $X_4$ )	-	+**
NPK( $X_5$ )	-	+
ZA ( $X_6$ )	-	+
Manure ( $X_7$ )	-	-
Liquid Herbicide ( $X_8$ )	+	+*
Solid Insecticide ( $X_9$ )	+	-
Liquid Insecticide ( $X_{10}$ )	+**	+
Solid Fungicide ( $X_{11}$ )	-**	-
Labor ( $X_{12}$ )	+	-**
Irrigation Fuel Costs ( $X_{13}$ )	+	+**

Description: \*\*\*significant 1%; \*\* significant 5%; \* significant 10%

Based on the analysis from Table 3, the relationship that farmers really hope for or the best opportunity between production factors and the risk of red chili production in Panjatan District, namely, the addition of production factors in the form of solid insecticides and labor

can increase red chili production and can reduce the risk of red chili production in Panjatan District. However, these results are different from research conducted in Watunohu District, North Kolaka Regency, which stated that the production factor that can increase red chili production and reduce the risk of red chili production is land area [28].

## 4 Conclusions and Recommendations

### 4.1 Conclusion

Red chili production is influenced by land area production factors, liquid insecticides and solid fungicides. The risk of red chili production is influenced by phonska, liquid herbicides, and irrigation fuel costs. In summary, production risk is a well-recognized phenomenon in agriculture, influenced by various factors that farmers must contend with during their production activities. Effective risk management strategies are vital for mitigating these risks and ensuring the sustainability of agricultural enterprises.

### 4.2 Recommendation

Red chili farmers in Panjatan District, Yogyakarta can pay more attention to the use of factors that can increase production yields and reduce production risks, namely solid insecticides and also labor. So that production results can be maximized. Production risk in agriculture refers to the likelihood of encountering adverse outcomes during the production process. Farmers are generally aware that such risks can arise from various factors, including environmental conditions, market fluctuations, and operational uncertainties. These risks can occur while production activities are ongoing, significantly affecting agricultural productivity and economic stability. Understanding and managing these risks is crucial for farmers as they navigate the complexities of agricultural production, enabling them to make informed decisions that balance potential rewards with associated uncertainties. Effective risk management strategies are essential for mitigating these risks and ensuring the sustainability of agricultural enterprises 5.

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