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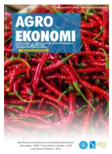

Feasibility and Risks of Chili Farming in Disaster-Prone Areas of Mount Merapi, Indonesia

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ABSTRACT

Mount Merapi, located in Indonesia, is an active volcano that poses a significant threat to the surrounding communities. Vegetables, including chili, are grown in the disaster-prone areas surrounding Mount Merapi, despite the risks associated with the active volcano. Based on the prevailing wind patterns in the region, the disaster-prone areas surrounding Mount Merapi have been classified into four distinct zones, namely Zones I, II, III, and IV, each characterized by distinct agroecosystems, feasibility, and risk levels. Therefore, this study aimed to describe agroecosystems, costs, income, feasibility, and risks of chili farming in in the four zones surrounding Mount Merapi. The samples of this study consist of 163 farmers from the four disaster-prone zones surrounding Mount Merapi, selected through purposive sampling. The RC ratio was employed as part of the feasibility analysis, and the production and income risks were analyzed. The results showed that chili farming in Zone IV (the area farthest from the disaster center) possessed the lowest cost, revenue, and income. On the contrary, Zone III generated the highest cost and revenue, while Zone I (the area with the highest vulnerability to disasters) had the highest income. The range of R/C values ranges from 2.40 in Zone I to 1.16 in Zone IV. Considering the results, chili farming was feasible in disaster-prone areas, where the production risk was lower than the income risk. Therefore, Zone I, the area with extremely high disaster risk, had the lowest production and income risk. This study highlighted that chili farming provides benefits to the vulnerable farmers and new perspective for agricultural sustainability in the area of Mount Merapi.

INTRODUCTION

Volcanoes are widely recognized to be formed through the accumulation of magma deep within the Earth's crust. One such example is Mount Merapi in Indonesia, which is widely acknowledged as one of the most active volcanoes in the world

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(Brata et al., 2014). It is located at the boundary of two provinces, separating the Special Region of Yogyakarta (DIY) from Central Java. Despite its danger, the ash from the eruptions increases crop yields (Fiantis et al., 2019). The major eruption in 2010 affected the changes of people's behavior on the slopes of Mount Merapi during the evacuation (Handayani et al., 2019). Lava, pyroclastic flows, and tephra (volcanic dust) covered the ground, thereby causing damage to the land. These eruptions also have a significant impact on various aspects, including human casualties, infrastructure destruction, socio-economic disruption, and environmental degradation. As a result, the eruption of Mount Merapi potentially caused pyroclastic flows to enter the populated areas along the slopes (Muir et al., 2019).

Despite the potential for significant destruction, communities located around Mount Merapi often exhibit reluctance to leave the area. According to studies conducted by (Muir et al., 2019), residents typically only evacuate to secure areas during eruptions and return once the danger has passed. Other studies discovered that individuals in the area were reluctant to relocate due to their understanding of the disaster and the economic benefits they gained from increased soil richness following the eruption or an influx of visitors (Napisah et al., 2017). The community may take advantage of the soil in the highlands by establishing an agricultural business, as many currently depend on high-land farming as a means of survival. This land use strategy provides a four-cardinal-direction-based description of the Mount Merapi area's agroecosystem, which is a habitat for various plants and animals, such as annual crops, horticultural crops, food crops, medicinal plants, and livestock. Chilies, tomatoes, spring onions, cabbage, cauliflower, mustard greens, *pak choi*, and other horticultural crops are commonly cultivated within 5-10 kilometers of the mountain's peak.

The cultivation of horticultural crops, such as chilies, plays a crucial role in the agricultural sector of Indonesia (Kaburuan et al., 2019). Farmers diversify the cultivation into various vegetables, fruit, and herbs to optimize land and increase profits (Laishram et al., 2022). Red chili is a popular commodity among farmers due to the high demand and ability to be harvested repeatedly, making it a surpass strategy for managing fluctuating income (Antriyandarti et al., 2013). Chilies are well known to be an essential part of Indonesian food. Furthermore, mountain chilies have unique qualities that differentiate them from other varieties. Despite the risk associated with Merapi (Napisah et al., 2017), the presence of chili farmers illustrates that this crop remains a viable option (Antriyandarti et al., 2013). In the agro-climax on the slopes of Merapi, chilies have become one of the prosperous horticultural plants. As a result of the eruption, volcanic ash, a dominant component of the *regosol* soil around the slopes, enables the crop to thrive and meet high consumer demand (Antriyandarti et al., 2013). However, agriculture in the surroundings of Mount Merapi is particularly vulnerable to volcanic eruptions, as farmers are forced to curtail their work when the condition deteriorates, thereby impacting farming production.

The cultivation of chilies in the Merapi area is challenging due to the price fluctuations and the inherent threats posed by the volcano. During the major harvest, the price usually drops immensely, creating considerable losses for farmers. Furthermore, numerous animals migrating to the settlement and attacking the plant contribute to the potential failure of chili farming. Therefore, this causes an imbalance between revenue and the spent cost and dangers. This disparity between costs and selling prices is a common issue faced by farmers in the area and poses a significant financial risk (Duhan, 2018).

Despite these challenges, chili farming remains prevalent in the Merapi region. The promotion and other relevant crop production rules depend highly on farming feasibility studies (Challender et al., 2019; Indrasti et al., 2021). In fact, many studies about chili or other horticulture products feasibility (Widyastuti et al., 2019), but the study in volcano prone area and moreover is comparing the different vulnerability zone are still limited. Despite agriculture in the prone area is still being practiced by many farmers, it is common in the proximity to the top of Mount Merapi does not have any significant impact on agricultural practices. The risks and costs incurred by farmers may differ among the zones. Therefore, the aims of this study are to (a) describe the cost and income of chili farming in disaster-prone areas of Mount Merapi, (b) examine the feasibility of chili farming in these areas using the RC ratio, as well as (c) assess the production and income risks of chili farming in these disaster-prone areas.

METHODS

This study was conducted within a 5-10 km radius of the peak of Mount Merapi, an area known to be vulnerable to natural disasters. The location was selected based on the unique characteristic of chili cultivation in the community, which is being cultivated in volcano prone area. The study area was further divided into four zones, each with varying levels of potential disaster risk. The four zones are surrounded in three regencies, namely Sleman in the Province of Special Region of Yogyakarata, Magelang and Boyolali in Province of Central Java. Zone I: The most dangerous disaster-prone area affected by lava flows, large or small materials. The location is in the Glagaharjo Village, Cangkringan Sub-district, Sleman and about 9 km south from the peak of mount Merapi. Zone II: A dangerous disaster-prone area characterized by the potential formation of a new lava dome. The location is in the Krijing Village, Dukun Sub-district, Magelang and about 5.3 km west from the peak of mount

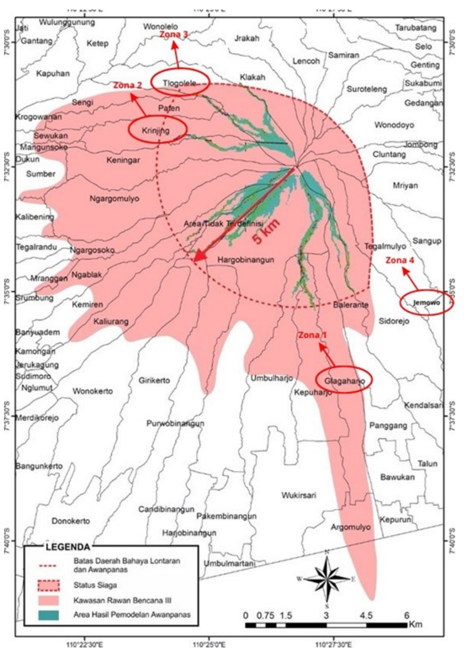

Figure 1. Disaster Prone Areas of Mount Merapi with a Radius of 5-10 km from its Peak (Release, 2020)

Merapi.

Zone III: A quite dangerous disaster-prone area affected by ashfall and small material (gravel) flows. The location is in the Tlogolele Village, Selo Sub-district, Boyolali and about 4.8 km north from the peak of mount Merapi.

Zone IV: The least dangerous disaster -prone area, only affected by ashfall. The location is in the Jemowo Village, Tamansari Sub-district, Boyolali and about 9.8 km east from the peak of mount Merapi.

Other studies and public survey by the government discovered that 90% of the population's livelihood in the disaster-prone areas were farming. However, data on their exact number were unavailable, therefore a total of 163 chili cultivators selected from 240 vegetable farmers (this data was obtained from previous study (Rozaki et al., 2021) in the four disaster-prone areas were the respondents of this study.

The primary data for this study was obtained through the use of structured interviews, using a pre-determined questionnaire. Secondary data was collected from the relevant agencies for enrichment. The information from the last harvest season of chili in the Mount Merapi area, between March 2020 and October 2020, was used for the analysis. The following shows details of the analysis conducted, including examining the cost, income, feasibility, and risk analysis of chili farming.

Feasibility Analysis

The feasibility of chili farming was measured by the RC ratio, as presented in equation 1 (Rahayu et al., 2019):

$$\text{RC ratio} = \frac{TR}{TC} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

$$TR = P.Y \quad \ldots\ldots\ldots\ldots (2)$$

Where:
TR = total revenue from sales of Chili
P = price of chili per kilogram in Indonesian rupiah
Y = total volume of chili in kilograms

$$TC = \sum_{j=1}^{8} TCj \quad .... \quad (3)$$

Where:
TCj = total cost of each input variable j
J =1, 2 ...8, which consist of 1-seed cost, 2-solid fertilizer cost, 3-liquid fertilizer cost, 4-solid pesticides cost, 5-liquid pesticides cost, 6-Labor cost, 7-mulching cost, 8-additional cost

Risk Analysis

The expectation of main goal by farmers is reaching the stability of chili production, especially due to extreme climatic conditions in disaster-prone areas. One of the stability indices used is the coefficient of variation (CV), expressed as a percentage (Döring & Reckling, 2018) Coefficient of variation is shown in equation 4.

$$CV = (\sigma/C) \text{x} \quad 100\% .... (4)$$

Where CV was the coefficient of variation; was the standard deviation; and C was the production average (kg)/income average (IDR) (Zul Mazwan et al., 2020).

RESULTS AND DISCUSSION

Characteristics of Mount Merapi Disaster-Prone Areas

The characteristics of disaster-prone areas of Mount Merapi describe the agroecosystems in the four zones. Mount Merapi's disaster-prone areas have four zones, each with distinct agroecosystem characteristics. The most dangerous area was Zone I, which had high temperature p yroclastic flow, incandescent lava, cold lava, and volcanic material composed of rock, ash, and gravel as its eruption materials. Despite this, the local government in Zone 1 had designated this area as an orchard tour due to the region's abundance of horticulture crops and fruit trees.

Zone II was a dangerous disaster-prone area that spread volcanic material such as ash and debris, covering the plants with a circumference of about 10 cm and eventually caused death. Vegetable crops dominated it through the implementation of an intercropping system. Vegetable farming in this area was more diversified. Furthermore, the attractive aspect of this zone compared to others was the existence of rice farming.

Zone III was identified as a vulnerable disaster area, commonly impacted by debris flows such as lava and ash. Perennial agroforestry plants dominated the agroecosystem, and almost all varieties of wood were observed in this zone.

Zone IV was relatively safe from Merapi's threats. This zone was solely affected by volcanic ash, which caused the drying of the plant. The agroecosystem consisted of horticultural, food, and annual crops with less variety than other zones. The area was a dairy cattle producer alongside Zone III. Furthermore, an interesting aspect was that when Mount Merapi was set to erupt, a swarm of monkeys descended from the mountain and damaged plants.

Characteristics of Farmers

Farmers in disaster-prone areas were characterized by age, education level, and experience. Table 1 illustrates that 70% of them in disaster-prone areas were in their productive age range of 19-60, with most being from Zone IV and the remaining being from Zone II. Despite the presence of unproductive farmers in each zone, the performance of chili cultivars in these four areas showed enthusiasm towards running a farm business.

The education awareness of farmers in the Mount Merapi area was insufficient, with an exemption of the western zone, where several farmers completed their higher education. It was indicated that 43% - 61% only completed elementary education, while others did not attend school. The lack of farmers' educational awareness was attributed to the perception that obtaining higher education would be costly. The farmers believed raising a new generation would be the best way to ensure financial stability for their families.

Approximately 60% of the farmers in the disaster-prone areas of Mount Merapi had an average of 20 years of experience in their occupation, while the remaining had 28 to 69 years of experience. According to the findings of Eliyatiningsih & Mayasari (2019) a typical farmer is considered to be experienced when they have been farming for more than 20 years. This suggests that these farmers have

Table 1. Profile of Chili Farmers in Disaster Prone Areas of Mount Merapi

Category	Zone I		Zone II		Zone III		Zone IV	
	∑	%	∑	%	∑	%	∑	%
Age (year)								
19-32	2	15.38	5	23.81	30	30.93	8	25.00
33-46	7	53.85	8	38.10	34	35.05	12	37.50
47-60	1	7.69	2	9.52	19	19.59	5	15.63
61-74	3	23.08	5	23.81	9	9.28	6	18.75
75-88	0	0.00	1	4.76	5	5.15	1	3.13
Total	13	100	21	100	97	100	32	100
Education								
No school	3	23.08	1	4.76	10	10.31	2	6.25
Elementary School	8	61.54	12	57.14	59	60.82	14	43.75
Junior High School	0	0.00	6	28.57	15	15.46	9	28.13
Senior High School	1	7.69	2	9.52	9	9.28	6	18.75
Higher Education	1	7.69	0	0.00	4	4.12	1	3.13
Total	13	100	21	100	97	100	32	100
Experience (year)								
1-13	4	30.77	7	33.33	30	30.93	10	31.25
14-27	5	38.46	6	28.57	31	31.96	10	31.25
28-41	3	23.08	5	23.81	25	25.77	9	28.13
42-55	1	7.69	2	9.52	8	8.25	2	6.25
56-69	0	0.00	1	4.76	3	3.09	1	3.13
Total	13	100	21	100	97	100	32	100

Source: Primary Data (2021)

leveraged their capabilities to perform and manage the efficient use of inputs in their farming practices.

Cost and Income Analyses

The cultivation of chili in the disaster-prone areas of Mount Merapi was found to involve a cost and income analysis. The majority of the chili farming in this region took place in both rice fields and dry fields, and the majority of the farmland used was acquired through usufructuary rights from the village treasury. Table 2 presents the data on the land dedicated to chili farming in the disaster-prone areas of Mount Merapi.

The highest land area owned by farmers was in Merapi disaster-prone area of Zone III, while the lowest was in Zone I. The reduced farming in Zone I was attributed to the ongoing recovering efforts following the 2010 eruption. The soil in this area was highly compacted with ash deposits, making cultivation more challenging due to the high energy and time requirements.

Chili farming in mountainous areas usually employs an intercropping system, hence, it was assumed that the applied production factors were divided by the number of intercropped plants. The analysis comprised explicit cost, revenue, and incomecomprised explicit cost, revenue, and income.

Table 2. Land Use Area for Chili Farming in Merapi Disaster Prone Areas in 2020

Village	Land Area (m^2)
South Zone I	1,092
West Zone II	2,342
North Zone III	2,366
East Zone IV	1,193

Source: Primary Data (2021)

In chili farming, seeds are typically planted in a polybag or box 25 days after sowing. The farmers in zone 4 used minimal seeds due to the less nutrient soil and attacks on the plant by swarms of monkeys migrating from the mountain. The variation in chili variety caused the difference in cost in every zone as farmers faced difficulties accessing superior seeds. According to Gobie (2017), the differences between price and cost are caused by the obstacle in accessing superior seeds.

The use of fertilizer was essential in chili farming. Farmers employed both basic and advanced fertilizers. The basic included manure, while the advanced was applied manure, NPK, Urea, ZA, Gandasil, Phonska, HNO_3, KCl, Mutiara, and Hydro. Furthermore, farmers also applied POC and ZPT liquid fertilizers.

Table 3 shows that Zones I and II farmers utilized a minimal amount of solid and liquid fertilizers. In contrast, a higher amount was spent in Zones III and IV due to the dependability on inorganic fertilizer. The low fertilizer cost in Zones I and II, which are more vulnerable to disasters, was likely due to the assumption that the land was more productive. However, the fertilizer's need varies in each area due to inherent differences in soil conditions, nutrient availability, and crop performance. Additionally, the amount of fertilizer did not affect the

Table 3. Analysis of Chili Farming in Mount Merapi Area per 1,000 m^2

Type	Zone I ∑	Zone I IDR	Zone II ∑	Zone II IDR	Zone III ∑	Zone III IDR	Zone IV ∑	Zone IV IDR
Cost								
Seed (kg)	2.01	440,981	2.2	232,496	2.57	476,101	1.99	221,338
Solid fertilizer		62,667		73,041		355,278		246,795
Liquid fertilizer		14,423		1,686		24,212		1,563
Solid pesticides		8,462		56,892		76,872		
Liquid pesticide		88,934		177,937		196,595		32,769
Labor (Man/day)			10.22	572,000	7.69	428,717	7.59	401,529
Mulching		189,334		115,659		224,843		
Additional cost		288,619		205,080		254,806		47,194
Total cost		1,093.420		1,434,791		2,154,928		951,188
Production (kg)	374.2		465.43		570.51		276.25	
Price (IDR/kg)		7,035		5,011		6,054		4,025
Revenue		2,632,497		2,332,270		3,453,867		1,111,906
Income		1,539,077		897,479		1,298,939		160,718

Source: Primary Data (2021)

quantity of chili produced (Eliyatiningsih & Mayasari, 2019).

The inorganic pesticide was used on chili to prevent pests and diseases since the crop was susceptible to attack. A study in Sri Lanka showed that pests and diseases such as aphids, thrips, broad mites, armyworms, bacterial wilt, leaf spot, mosaic virus, and bacterial speck had plagued chili plants for a long time (Burleigh et al., 1998). Therefore, pesticides should be applied in the appropriate formula to combat the pests and diseases.

Farmers in the disaster-prone area applied solid and liquid fertilizers, such as herbicides, fungicides, and pesticides. The type and dosage of the applied pesticide differ in each area. Due to the diversity of pests and diseases in Zones II and III, farmers use a lot of solid and liquid pesticide variants to protect plants, resulting in higher costs. Meanwhile, Zone IV's chili farmers spent less since only liquid pesticides are used, but they face the challenge of monkey attacks. Eliyatiningsih and Mayasari (2019) discovered that applying pesticides might maximize production in quantity and quality by reducing the number and severity of pest infestations. However, when these chemicals are not applied efficiently, they can cause damage to chili crops.

Chili farming in the Mount Merapi area mostly utilizes family labor than external labor. This is particularly true for Zone I farmers who recovered their land after the eruption in 2010 and could not afford to hire external labor.

Mulch was utilized by chili farmers to protect the soil from extreme temperatures, reduce the damage and erosion of soil (Kapoor et al., 2022), and (Adekaldu et al., 2021).

It decrease the effects of water pressure on the plants could significantly impact agricultural yields, but its cost might differ in every disaster-prone area due to the quality differences (Bharati et al., 2020). Furthermore, mulch was used in all zones except Zone IV to help conserve water, prevent soil erosion, and lessen the impact of pests on crop yields. The process of its application could affect production and boost plant growth (Ardhona et al., 2013). This is the reason it is not being used by chili farmers in Jemowo. Also, cultivars do not apply mulch in Zone IV since it was considered to drive up the operational cost and minimize the profit. The other detriment of chili plants in this area was susceptibility to destruction by monkeys due to the proximity of Mount Merapi.

Table 3 shows that Zone III had the greatest total cost for red chili farming due to the high cost of pesticides. On the contrary, only an insignificant percentage of Zone IV applied pesticides.

As a result of the Covid-19 pandemic, the price of chilies in the Merapi disaster-prone areas decreased significantly, causing farmers to suffer considerable losses. Before the pandemic, the selling price ranged between IDR 15,000 to 20,000 per kilogram. However, during the pandemic, the lowest and highest prices were IDR 4,000 per kilogram and IDR 10,000 per kilogram, respectively.

Zone I and IV farmers generated the highest and lowest average chili prices. Furthermore, those in Zones III and IV had the greatest and least chili yields per hectare. Farmers in Zone I and IV earned the highest and least income. Therefore, Zone I, the most disaster-prone area, generated the lowest chili yields but the highest potential income. This suggests that the chili cultivated there was of exceptionally high quality. The low fertilizer and pesticide use rates in Zone I confirmed that this area was particularly productive due to its geological history as a lava flow.

Chili yield in Zone III was high, but it was caused by intensive attempts to raise productivity by applying sufficient fertilizers and pesticides, as evidenced by the high cost in this area. Despite the high production, the chili price from Zone III was lower than Zone I.

The risk of natural disaster in Zone IV was discovered to be low, resulting in decreased chili production and prices due to the monkey attacks that already described above. This was caused by suboptimal cultivation due to a lack of fertilizer, pesticide, labor, and mulch, caused by the financial inability of farmers stemming from an eruption several years ago. The poor quality of the chili led to low prices. Additionally, damage from monkeys from the nearby Merapi forest further impacted the cultivation of this plant. Due to the extreme damage, many farmers produced low-quality chilies, and others failed to harvest. Nugroho et al. (2018) reported a productivity of 3,102.93 kilograms per hectare or 310.29 kg per 1,000 m^2 of rice fields on the slopes of Merapi in Pakem Sub-district, Sleman. However, the yield in the disaster-prone areas of Zones I, II, and III was still higher than the results of this study.

In disaster-prone areas, the revenue received by chili farmers was affected by production and prices. The least revenue was earned by farmers in Zone IV due to low crop yield and selling prices for chili. Meanwhile, the highest revenue was received by the farmers in Zone III due to the highest production, despite having a lower price than in Zone I. It was observed that high prices and production did not necessarily result in high revenue. Furthermore, the Covid-19 pandemic has significantly impacted society, including chili farmers in the Merapi disaster-prone areas. This led to lower prices and a decrease in revenue.

The amount of income depended on the revenue and the explicit cost incurred. The results showed that Zone 1, the most vulnerable disaster-prone area, generates the highest income, while Zone 4, the lowest vulnerable, generates the lowest income. Compared to Zone 3, the income level in Zone 4 was lower due to the location being quite far from the top of Merapi. Other reasons are low level of fertility and often a place of escape for animals from the forest when Merapi releases hot pyroclastic flows. The risk of damage caused by animals' results in low production and affect their income. In spite of this, the chili farmers were able to secure a sufficient crop to sustain their farming. They believed that the income earned was an indicator of their farming success and was considered a profit.

Farming Feasibility Analysis

Feasibility analysis of chili farming in disaster-prone areas of Merapi is examined from R/C (Table 4). The RC ratio is a comparison between revenue and total cost. The value indicates that for every IDR 1 in cost, IDR 1 in income was gained. Among disaster-prone areas, Zones I and IV had the highest and lowest RC values for chili farming. Despite the feasibility value in Zone IV being small or close to the break-even point, the cultivation of chili in the disaster-prone area was feasible. The lowest RC value in Zone IV was caused by crop failure due to monkey damage, leading to low yields and quality. Despite the low cost, the farming failure caused the feasibility of approaching the break-even point. To optimize production, the utilization of labor needs to be examined. Feasibility is also affected by the very few potential external family workers used, despite many having low ability or skills in chili farming (Emran & Shilpi, 2018).

Tampubolon et al. (2018)

Table 4. Feasibility of Chili Farming in Merapi Disaster Prone Areas

Description	Zone I	Zone II	Zone III	Zone IV
Revenue (IDR)	2,632,497	2,332,270	3,453,867	1,111,906
Total cost (IDR)	1,093,420	1,434,791	2,154,928	951,188
R/C	2.40	1.62	1.60	1.16

Source: Primary Data (2021)

discovered that a volcanic eruption affected economic losses and agricultural productivity in the short term. However, the long-term effects of this eruption would result in more fertile soil in dangerous areas. This also proved by previous study that upper slope (Zone I) has abundant nutrient resources, while middle slope (Zone IV) has the lowest nutrient resources (Aini et al., 2019). This is the reason why Chili farming in Zone I had the highest feasibility (Table 4).

Risk Analysis of Red Chili Farming

The risks of farming in Merapi disaster-prone areas were viewed from red chili prices, production, and income received by farmers. The level of risk faced by farmers varied. It was expected that the lowest risk would result in higher production and income.

Table 5 shows that Zone I had the smallest score of production and income risks. This indicates that it had a smaller risk than other zones, despite being more prone to natural disasters. Conversely, Zone IV was harmless but had the greatest risk. The results confirmed that crops could be damaged or even destroyed by volcanic ash trapped resulting from eruptions (Thompson et al., 2017).

Farmers in the Merapi disaster-prone areas face varying risks and productivity levels. Those in high-risk areas often adopt unique practices for farming chilies. To improve production and quality, these farming procedures should

Table 5. Coefficient of Variation (%) of Red Chili Farming in Merapi Disaster Prone Areas

Description	Zone I	Zone II	Zone III	Zone IV
Production	0.86	1.18	1.6	1.18
Income	1.68	2.16	2.09	13.80

Source: Primary Data (2021)

align with current standard operating procedures (SOPs). However, due to the soil condition impacted by volcanic ash, it is essential to evaluate the SOPs for chili farming in these areas.

Chili farmers in Zone IV had a high-income risk, as some earned high profits while others experienced crop destruction or quality losses due to animals migrating down from Mount Merapi as a result of scorching pyroclastic flow. Study on local wisdom in the Mount Kelud region has highlighted the need to understand environmental knowledge to discover a solution. This knowledge entails the shared responsibility of the community to safeguard and manage its natural resources (Sukmana, 2018).

CONCLUSION AND RECOMMENDATION

Chili farming had the lowest cost, revenue, and income in Zone IV, the farthest area from the disaster epicenter, while the highest was in Zone III. Farmers received the highest income in Zone I, where the disaster risk was the greatest. The RC ratio shows that chili farming in the disaster -prone area is feasible. Its highest and lowest value was discovered in Zone I and IV. Furthermore, the cultivation of chilies in these areas had a greater risk of production loss than income loss. Zone I was the most at risk from natural disasters but had the least to lose in income and production.

The least dangerous part of Mount Merapi was also the least profitable for farming chilies due to high production risk and poor agricultural feasibility. The disaster-prone areas generate the highest income, feasibility, and the smallest production and income risks.

It is essential to carry out farming procedures in line with current SOPs to reduce the production and income risk associated with chili farming in disaster-prone areas, particularly Zone IV, it is crucial to implement farming procedures following current Standard Operating Procedures (SOPs). However, given the impact of volcanic ash on the soil, evaluating the SOPs for chili farming in Merapi disaster-prone areas is essential. Farmers with a firm grasp of environmental knowledge can reduce their exposure to financial loss due to crop failure caused by wild animal attacks by adhering to SOPs. This study still has limitation in the presenting chili feasibility in volcano prone area, but this study shows that agriculture practice will bring benefits for farmers as long as they do it in correct way.

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