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Risk Analysis For Sustainable Broccoli Cultivation : A Case Study From Ngablak District Magelang Regency

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ABSTRACT

Broccoli farming has a high production risk due to climate change, pest attacks, and fluctuations in production input prices. The purpose of this study is to analyze the income and risks of broccoli farming, factors affecting broccoli production, and farmers' risk preferences. This research is useful in understanding the risks of farmers in broccoli farming. The location of the investigation was deliberately determined (purposive method), namely, in Sumberejo Village, Ngablak District, Magelang Regency, Central Java Province, which is a vegetable center area. The sampling was carried out randomly on 60 broccoli farmers. The analytical tools used to measure risk are the values of the coefficients of variation and resistance. Factors that affect production using the Cobb-Douglas production model, and those that affect risk using Ordinary Least Square (OLS) with the De Janvry model approach. The results showed that the coefficients of variation in production and income were 0.76 and 0.88, and the risk aversion coefficient was quite high with an average of 1.125. It means that broccoli cultivation is in high-risk category where the variation of production and income among farmers were relatively high. Factors that affect production are land, seeds, pesticides, chemical fertilizers, and organic fertilizers. Education, institutions, land area, and income influence farmers' behavior toward risk. Higher education, agricultural area, income and participation in institutions (farmers' groups) lead farmers to take risks.

Keywords*: Broccoli; farming; income; revenue; risk*

BACKGROUND

Broccoli is one of the vegetable commodities that is in high demand every year. Broccoli has gained a great deal of attention due to its health benefits and economic importance. From an economic point of view, this crop is profitable. Several studies showed that the average income of broccoli is more than IDR[1] 30 million per hectare (Kusumawardani et al., 2023; Sarwai et al., 2016; Yusub et al., 2020). In addition, the studies also showed that broccoli farming is financially feasible as an investment through high value of NPV, Net B/C, and R/C ratio (Ajarsari et al., 2019; Malia, 2022). Broccoli farming activities are able to produce about 5,000 kg/ha (Larasati, 2019; Yusub et al., 2020). Although economically profitable, broccoli farming has many risks such as production risks in the form of pest and disease attacks, climatic weather, and seed quality (Apte, 2010; Murtiningsih et al., 2023; Pineda et al., 2024). Meanwhile, market risks can be seen from price fluctuations, collector dependence, and unstable production input costs (Ciancaleoni et al., 2016; Kata & Leszczyńska,

[1] Indonesian currency (IDR)

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2021). These high risks require a separate mitigation strategy to ensure the sustainability of agriculture.

Risk is the possibility of unwanted events that can result in losses for business actors (Wahyuni & Sumarmi, 2018). In the context of broccoli farming, risk identification and assessment are needed to develop farming activities more efficiently in business management, considering that risks are related not only to technical aspects, but also to economic and market aspects (Anjani et al., 2022; Kata & Wosiek, 2024). Risk analysis in broccoli farming considers aspects such as agronomic, technical, economic, and market feasibility that can determine the success of an undertaking (Anjani et al., 2022). Technical risks related to agricultural production activities need to be thoroughly analyzed, including the productivity and profitability of broccoli farming, such as land area, fertilizer use, and labor management, as well as strategic measures to mitigate the risks that occur (J. Wang et al., 2020).

Farmers who are able to streamline production factors consisting of technical and economic factors will increase farming productivity (Pratiwi et al., 2018). To increase productivity, it is necessary to handle or manage resources appropriately to overcome problems such as limited resources. Broccoli farming involves a number of complex variables, including selection of the right varieties, optimal soil management, pest and disease control, efficient use of fertilizers, appropriate irrigation techniques, and effective marketing strategies. Therefore, a thorough analysis of broccoli farming practices is crucial to understanding the various dynamics involved in producing this crop efficiently and sustainably. This study contains an analysis of various aspects of broccoli farming, such as farming income and factors that affect production.

Each farmer has differences in making decisions in agriculture; this is due to the amount of income to be earned (Widjayanti & Rizal, 2016). Farmers consider many factors when making decisions, one of which is risk. In terms of risk, this study also discusses the analysis of production and income risks, the value of risk aversion, and the factors that affect farmers' risk aversion. Analysis of production and income risk shows the variation of production and income among farmers. While the value of risk aversion shows the preferences of farmers facing different uncertainties in their farming activities. In contrast to previous study that analyzed farm risks from only one aspect of production (Kasim et al., 2019; Purnamasari et al., 2024). This study combines it with income risk, farmer risk behavior, and factors that influence farmers risk.

This research was carried out in Sumberejo Village, Ngablak District, Magelang Regency, where the majority of broccoli farmers exist and most of them are enganged in the vegetable farmer group. From this research, it is hoped that it will understand the risk conditions of broccoli farming so that stakeholders can carry out risk management for the sustainability of farming.

RESEARCH METHODS

The research was conducted in October-December 2023 in Sumberejo village, Ngablak district, Magelang regency, Central Java province. The location of the research was intentionally selected (purposive method). The purposive method is a technique for selecting a research location that is deliberately determined by the researcher, taking into account several criteria and certain reasons. The consideration of choosing the location is because Sumberejo village is one of the villages that has a large number of vegetable farmers in Ngablak district (Statistics Indonesia, 2024); and according to the survey many vegetable farmers group exist in the area and most of the farmers are cultivating broccoli and have contract with modern retail markets and processors.

This study uses primary and secondary data. Primary data was obtained through the results of interviews with broccoli farmers in Sumberejo Village, Ngablak District, Magelang Regency using a

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questionnaire as the main data collection tool. The sampling was done using purposive sampling because there is no information about the number of broccoli farmers. The sample was selected as many as 60 farmers in Sumberejo Village area based on the information from the farmer group leader that the farmers are cultivating broccoli every year. Meanwhile, secondary data was obtained from related agencies and research journals.

Farm income is the difference between revenue and total cost. Revenue is multiplied between the production of broccoli and the price of broccoli. The total cost represents all the costs incurred by farmers to produce broccoli, such as seeds, pesticides, manure, chemical fertilizers and labor. The formula is as follows:

$$\Pi = TR - TC$$

Information:
Π : Brocolli farming income (Rp/MT)
TR : Revenue of broccoli farming (Rp/MT)
TC : Total cost of broccoli farming (Rp/MT)

The risk analysis used in this study includes production and income risks, which are analyzed using the value of the coefficient of variation (KV). The formula for the KV value is as follows:

$$KV = \frac{\sigma}{\bar{\gamma}} , \quad , \alpha = \sqrt{\frac{\sum \gamma^2}{n}} \gamma = Y - \bar{Y}$$

Information:
KV : Coefficient of variation in production or income
σ : Standard deviation (variant) of production or revenue
$\bar{\gamma}$: Average production or income
n : Number of samples

The higher the KV value, the greater the risk of broccoli farming. The high value of KV indicates the magnitude of the variability of the average value in high broccoli growing. This illustrates the high risk of agriculture facing farmers (Saptana et al., 2010; Zakirin et al., 2013). The lower limit (BB) is also calculated to find the value of the lowest production or income that may be received. The formula of the lower limit is as follows:

$$BB = \bar{Y} - 2\sigma$$

Information:
BB. : The lower limit of production or revenue
$\bar{Y}$: Average production or revenue
σ : Standard deviation of production or revenue

To analyze the factors that affect broccoli production using the Cobb-Douglas approach, as follows:

$$\text{Ln Y} = \beta_0 + \beta_1 Ln\, X_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \beta_6 Ln\, X_6 + \varepsilon$$

Where:
Y : Production (kg)
X_1 : Land area (m)
X_2 : Seeds (kg)
X_3 : Pesticides (liters)

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X_4 : Chemical fertilizer (kg)
X_5 : Organic fertilizer (kg)
X_6 : Labour(HOK)
ε : Error term
β_0 : Intercept
β_{1-6} : Regression coefficient
To calculate the level of farmers' reluctance to face risks, an input approach is used according to Moscardi & De Janvry (1977), with the following formula:

$$K(S) = \frac{1}{\theta}\left(1 - \frac{P_i X_i}{P_y f_i \mu_y}\right)$$

Where
K (S) : Measurement of the parameter of aversion to risk, S is a variable that presents the characteristics of the farmer.
θ : Coefficient of variation of production
Pi: The input price for production to -i is the most significant and has the largest contribution to each respondent.
Xi: The number of i-i inputs is the most significant and has the largest contribution to each respondent.
Py : Broccoli price
fi : The production elasticity from input to -i is the most significant and has the greatest contribution.
μ_y : Average production

Based on the results of risk aversion, K(S), according to Moscardi & De Janvry (1977), can be grouped into three farmer criteria:

1. Dare to take risks (risk lover) or low risk, if the value of $0 < K(S) < 0.4$
2. Neutral risk or medium risk, if the value is $0.4 < K(S) < 1.2$, and
3. Reject risk (risk averter) or high risk, if the value of $1.2 < K(S) < 2.0$

To analyze the characteristic factors of farmers that affect their reluctance to take risks, multiple linear regression analysis with the OLS approach is used with the following equations:

$$K(S) : \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + \varepsilon$$

Where:
Z_1 : Age (years)
Z_2 : Formal education (years)
Z_3 : Institutional (dummy, 1 if a member of the group, and 0 if not a member)
Z_4 : Land area (m^2)
Z_5 : Number of families involved in farming (members)
Z_6 : Revenue (Rp/MT)

RESULT AND DISCUSSION

Sumberejo Village is a vegetable production center in Magelang Regency. One of the vegetable productions is broccoli. Table 1 shows the average production, and Table 2 shows cost and farming income per planting season of 60 respondents of broccoli farmers in Sumberejo Village. The average income from broccoli farming is IDR 8,043,375 per planting season. Meanwhile, the total cost of

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production facilities, labor, and depreciation is 4,503,128 per planting season. The average income of broccoli farmers is 3,540,247 per growing season. The R/C ratio is 1.79 which means that with the use of a fee of IDR 1 million, it will get a revenue of IDR 1.79 million. These results show that in general broccoli cultivation in Sumberejo Village is quite profitable to cultivate.

Table 1. Average production and price of broccoli

No	Description	Value
1	Land area (ha)	0.157
2	Price of brocolli (Rp/kg)	10.000
3	Production quantity (Kg/MT)	798

Note: MT: Planting season

Table 2. Average cost and income of broccoli

No	Description	Quantity	Value (IDR)
1	Revenue (Rp/MT)		8.043.375
2	Usage of Production Inputs Per MT		
	Seeds (g)	29	225.156
	UREA (kg)	21.33	540.375
	NPK (kg)	42.67	810.563
	Manure (kg)	137	360.250
	Pesticides (l)	7.43	945.656
	Labor (HOK)	20.87	1.621.128
3	Total cost (Rp/MT)		4.503.128
4	Income (Rp/MT)		4.383.609
5	R/C ratio	1.79	

Production Risk and Revenue Risk Analysis

Although it is quite profitable, farmers face various risks in broccoli farming. The risks studied in this study are production and income risks. The method used to analyze risk is to measure the coefficient of variation (KV). The coefficient of variation calculates the comparison between the standard deviation value and the average value. A small KV value indicates that the average variability of the risk value is low, which indicates that the risk is low. On the contrary, a high KV value indicates that the variability of the average value at the risk is high. Table 3 shows that the average production of broccoli is 798.66 kg per MT, the standard deviation is 607.41, and the KV value is 0.76 or 76%. According to Zakirin et al. (2013), a KV value between 61 and 80 is included in the high-risk category. The BB value of production is -416.16 kg. Negative signs indicate that the broccoli farming carried out by farmers is likely to fail every time they are harvested. In terms of production, brocolli farming is high-risk due to pest infections and climate change.

This high variation in production is due to the high variation in the use of inputs, especially pesticides, and fluctuating production yields. Pest infestations such as aphids and armyworms, as well as diseases such as black rot and leaf spot, are the main problems of damaged and failed broccoli harvests. The high use of pesticides in efforts to control pests and diseases plays a role in efforts to avoid the risk of crop failure. Another cause of this production risk also comes from extreme weather changes in the last growing season, where high temperatures cause failure and suboptimal broccoli growth. The existence of pest attacks and extreme weather changes result in high production risks

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that farmers must face. Climate change has a serious impact on the agricultural sector; therefore, it is necessary to manage cultivation more adaptively, such as the use of superior varieties resistant to climate change, organic fertilizers and adjustments to cultivation techniques (Salampessy et al., 2018; Sudarma & As- syakur, 2018).

Table 3. Risks of Broccoli-Farming Production

No	Description	Production Risk
1	Average Production	798.66
2	Standard deviation	607.41
3	Coefficient of variation	0.760
4	KV(%)	76
5	BB	-416.16

Income is the total revenue minus the costs incurred in broccoli farming. From the results of the calculation of the average income of broccoli farming, which is Rp. 4,383,609.70 per MT, with a standard deviation of 3,875,406.56. In farming activities, income often does not match expectations, due to unpredictable events such as the low price of broccoli in the harvest season.

Income risk is analyzed using the coefficient of variation (KV) that shows the value of the average variability of income. Table 4 shows a KV value of 0.884 or 88.4%. This value shows that the risk of income from broccoli farming is very high. According to the Zakirin et al. (2013), the KV value above 80% is included in the very high-risk category. The BB value is -3,367,203.33. This negative sign indicates that broccoli farming carried out by farmers is likely to suffer a loss of IDR 3,367,203.33 per planting season. This figure shows that broccoli farmers must be ready or willing to bear the risk of income loss of up to IDR 3,367,203.33 each time they harvest.

Table 4. Risks of broccoli farming income

No.	Description	Revenue Risk
1	Average income	4,383,609.79
2	Standard deviation	3,875,406.56
3	Coefficient of variation	0.884
4	KV(%)	88.4
5	BB	-3.367.203,33

This high-income risk is not only caused by low production and crop failure due to pest attacks, diseases, and weather changes, but also fluctuations in the selling price of broccoli. where the price of broccoli at the farmer level averages Rp. 12,000-13,500 per kg, during the big harvest, it drops to an average of Rp. 10,000 and some are even priced at Rp. 5,000 per kg. This happens because of the law of market equilibrium, where when production (harvest) is abundant, prices will decrease. Fluctuations in crop prices are one of the financial risks that farmers must be prepared to face when farming. During the peak season, excess supply causes market prices to fall, while during the famine season, prices are likely to increase due to product shortages (Kata & Leszczyńska, 2021). This market price volatility often results in fluctuations in the income received by farmers more than other professions, making farmers very vulnerable to financial instability.

Based on the results of the production and income risk analysis, it shows that the risk of broccoli farming is very high. Therefore, farmers must pay attention to broccoli farming activities by running

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broccoli farming more efficiently using production inputs and managing farming management to reduce risks. The main source of risk of production is the attack of the pest, extreme wheat and low fertility. Therefore, to overcome production risks for pest attack are through use of superiode seeds to increase productivity and resist form pests and diseases. In addition, farmers can adopt integrated pest management (IPM) for pest control with minimal use of chemical pesticide. The IPM use an ecological approach by combining biological, cultural, physical and chemical to achieve sustainable pest control (Barzman et al., 2015). The extreme weather still affects the production of broccoli, where the cultivation is still dependent on the weather. Farmers can use the bamboo greenhouse to plant broccoli to avoid the heat of the weather in this last growing season. Farmers also routinely use manure and chemicals to maintain soil nutrients and overcome soil infertility due to long-term use. Some farmers also use bambo greenhouses.

The main source of income risks is the price of broccoli is relatively fluctuating and the prices of input of farming such as pesticide, labor, and fertilizer are high.To reduce income riks, farmers can join the farmer group to sell collectively and build a contract with high value markets (processors and modern retail markets); hence, the volatility of prices can be reduced.The farmer group has an important role in linking with high value markets through their marketing functions in helping the members of farmers sell the broccoli to the suppliers. In addition, the farmer groups also have a function of providing input of farming for their members. By joining the farmer group, farmers also get the lower price of input farming than buying in the market.Due to the important role of the farmer group, the government and other stakeholders can strengthen the position of the farmer group and expand their role on marketing.Many studies have revealed that the farmer group or cooperative plays an important role in reducing risk and increasing farmer income (Duguma, 2016; Liu et al., 2019).

Factors affecting Broccoli-Farming Production

Analysis of factors that affect broccoli farming production was used to assess the risk aversion parameter (K(s)), where K(S) is a productivity function. The functions of broccoli production in this study were analyzed using the Cobb-Douglas approach. These factors include land, seeds, pesticides, chemical fertilizers, organic fertilizers, and labor. Based on the results of the analysis, it was shown that the factors that significantly affected broccoli production included land, seeds, pesticides, chemical fertilizers and organic fertilizers. Meanwhile, the use of labor does not have a significant influence on broccoli production.

Table 5. Factors affecting broccoli farming production

Variable	Coefficient	Standard Error	t-count	Signifikan
Constant	0.428ns	0.950	0.450	0.655
Land	0.418***	0.126	3.301	0.002
Seed	0.528***	0.135	3.915	0.000
Pesticides	-0.194***	0.094	-2.058	0.045
Chemical Fertilizers	0.105***	0.029	3.590	0.001
Manure	-0.069***	0.032	-2.174	0.035
Labour	-0.376ns	0.240	-1.589	0.123
R-square	0.807			
Adjusted R-square	0.651			
F-statistics	15.240***			0.000

Note: Significant α=0.001

Land area has a positive and significant influence on broccoli production. This means that an increase in the land area will increase broccoli production. The coefficient value shows 0.418 which means that the more the land area increases by 1 unit, the more it will increase the production of

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broccoli by 0.418 units. These results are in line with the research by Budiman et al. (2019), who found that land area has a great influence on increasing agricultural production. Likewise, the use of seeds is positive and significant with a coefficient value of 0.528. This shows that by increasing the use of broccoli seeds by 1 unit, it will increase broccoli production by 0.528 units. This is in line with research by Khakim et al. (2013) that seeds influence increasing agricultural production. Meanwhile, the use of pesticides and organic fertilizers has a negative and significant influence on broccoli production. This is different from previous research in which fertilizers and pesticides have a significant effect on agricultural production (Andayani, 2018; Setyadi et al., 2020). This means that the increasing use of pesticides and manure can reduce broccoli production. This is likely due to the high use of pesticides and manure by broccoli farmers, so it no longer has an impact on increasing broccoli production. In farming activities, fertilizers cannot be used alone in production but are also related to other inputs. If there is an imbalance in the use of input of production, it will have an impact on the nonoptimal growth of plants (Wijaya et al., 2023).

Coefficient of Reluctance to Take Risks

The risk aversion coefficient (K(S)) reflects the behavior of farmers towards the risk of broccoli farming. which is classified into three, namely, risk lover if the value is $0.0 < KS < 0.4$, risk neutral if the value is $0.4 \leq KS \leq 1.2$, and risk averter if the value is $1.2 < KS < 2.0$ (Moscardi & De Janvry, 1977). The average value of the risk aversion coefficient was 1.125, where the majority of the 71% were farmers who behaved in a risk neutral manner, and 28% of farmers were reluctant or refused to take risks (Table 6). Meanwhile, no farmer is in the category of daring to take risks. With the hail that shows that farmers are neutral to risks, it shows that farmers dare to take risks, but do not dare to take big risks.

Table 6. Distribution of Risk Aversion Coefficient

Category KS	n1	%
Low ($0.0 < KS < 0.4$)	0	0
Sedang ($0,4 \leq KS \leq 1,2$)	43	0.713
High ($1.2 < KS < 2.0$)	17	0.283
Installation-Installment 1.125		
Minimum 0.613		
Maximum 1.283		

Factors that affect farmer behavior towards risk or risk aversion are education, institutions, land area, and net income (Table 7). The value of the determination coefficient (R^2) is 0.569 which means that 56.9 percent of the independent variation of the variable in this study is able to explain farmers' behavior towards risk or risk aversion. The value of the F count (11.70) is greater than that of the F table (3.854). This means that together the independent variables have a significant effect on the dependent variables. Farmers' reluctance to take risks is influenced by the characteristics of education, institutions, land area, and net income. Meanwhile, the age and number of families did not have a significant effect on farmers' risk aversion.

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Table 7. Factors that affect farmers' behavior towards broccoli farming risks

Variable	Coefficient	Standard error	t-count	Signifikan
Constant	1.484***	0.095	15.60	0.000
Age	-0.002ns	0.001	-1.37	0.177
Education	-0.016***	0.006	-2.65	0.011
Institutional	-0.078***	0.303	-2.58	0.013
Land	-0.006***	0.000	-3.66	0.001
Number of families	0.016ns	0.014	1.13	0.264
Income	-0.013***	0.004	-3.05	0.004
R-square	0.569			
Adjusted R-square	0.521			
F-statistics	11.70***			

Note: Significant α=0.01; ns = insignificant

The average age of the broccoli farmers surveyed was 42 years, the youngest being 19 years and the oldest being 70 years. Based on the results of the t test, it was shown that age did not have a significant effect on the risk aversion parameter. This means that the younger or older the farmer's age, it does not affect the farmer's behavior or aversion to risk.

The average formal education of broccoli farmers is 8.43 years, with the lowest education being 6 years and the highest being 16 years. Based on the t-test, it was shown that the level of education of farmers had a significant effect with a negative sign on the parameter of the risk aversion coefficient. This means that the higher the level of education of farmers, the lower the risk aversion. Or in other words, the higher the level of education of farmers, the bolder they are in taking risks. This is in line with research by Lawalata et al. (2017) that a farmer's education will increase the courage to take risks in every decision. With a high level of farmer education, farmers are more open to new knowledge, and it is easy for them to adopt innovations in new technologies to overcome risks in broccoli farming.

The institution of farmers in this study was measured using a variable dummy, where 1 was for farmers who were members of farmer groups and 0 for farmers who were not members of farmer groups. There were 26 farmers or 43% of the respondents who were members of farmer groups, while the remaining 34 farmers or 57% of the respondents were not members of farmer groups. The results of the t-test showed that institutional farmers or the participation of farmers in farmer groups had a significant negative effect on the risk aversion parameter. This means that farmers who are members of farmer groups will have a lower level of risk aversion. Or, in other words, farmers who are members of farmer groups have the courage to take risks compared to farmers who are not members of farmer groups. With the incorporation of farmers in farmer groups, farmers can get information related to prices, markets, technology, and production facilities more quickly so as to minimize the risk of farming. According to Zou & Wang (2022) farmers who join the farmer group can reduce production costs, manage risks, and adopt innovative agricultural system technology.

The average land area of the broccoli farmers' respondents was 0.157 hectares with the highest area of 0.45 hectares and the lowest area of 0.05 hectares. Based on the results of the t-test, it was shown that the land area had a significant negative effect on the risk aversion parameter. This means that the size of the land area affects the reluctance of farmers to take risks. The larger the farmland,

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the lower the aversion to risk. Or in other words, the larger the farmer's land, the more daring to take risks. This is suspected because with the large area of broccoli farmers, farmers are better prepared to face the risks that will arise. This finding is in line with the previous study showed that larger farms are associated with lower risk aversion (Bergfjord, 2013). Farmers with larger land areas often engage in diversification to mitigate risks, while smaller landholders prioritize intensive use and external inputs to sustain productivity(Falco & Perrings, 2005).

The average number of family members who are active or involved in farming is 2.05 people, with the lowest being 1 person and the most 4 household members. Based on the results of the t-test, it was shown that the high and low number of household members involved in farming did not have a significant effect on farmers' behavior toward risk. It is suspected that the more members involved in farming, the more complex farming decisions are affected.

The average income from broccoli farming is IDR 4,383,609, per MT (planting season), with the highest value of IDR 20,585,400 per MT, and the lowest is IDR 669,240, per MT. Based on the results of the t-test, it was shown that the amount of broccoli income per planting season had a significant negative effect on the risk aversion parameter. The high- and low-income level of broccoli affects farmers' behavior toward risk. The higher the income level, the less reluctant or daring to take risks. This is suspected to be the case for high income farmers who dare take risks in their farming decisions. This finding is in line with the previous study that the lower income farmers correlated with the high-risk aversion (Visser et al., 2020; T. Wang et al., 2024).

In summary, factors that influence farmer risk aversion are education, farmer group (institution), land area, and income. The relationship between risk aversion and the independent variables is reverse. It means that the higher level of education, participation of farmers in the farmer group, the larger the farmland, and the higher the income of farmers led farmers to be more daring to take risks.

CONCLUSION AND SUGGESTION

Broccoli farming is at high risk for both production risk, income, and fluctuating prices. Farmers must be able to overcome these risks to continue farming activities during the current uncertainty. The results show that the risk of broccoli farming, both the production risk and the income, is very high, shown from the KV value of 76% for the production risk and 88% for the income risk. The high value of KV means a high fluctuation in production and income among farmers. The main sources of production risk are pest attacks, climate change, and low soil fertility. While the main source of income risk is fluctuation of broccoli price and inputs of farming. Meanwhile, farmers' behavior toward risk is shown by the level of farmers' aversion to risk under moderate conditions, with a KS value of 1,125. This means that farmers' behavior toward risk is neutral.

To manage high-risk production, broccoli farmers need to use superior seeds, adopt integrated pest management, and use green house. While to reduce income risks, farmers need to join a farmer group to collectively sell broccoli and build a contract with high-value markets. In addition, the high-risk of broccoli farming in the field; the farmer need to increase their courage in facing these risks. The study shows that education, land farming, farmer group (institution) and income influence risk aversion of farmers. Therefore, it needs to increase farmer education, land farming, participation in

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the farmer group, and income. The courage to face these risks is very important to have to mitigate risks, optimize profits, and protect the sustainability of agriculture. The government must improve education and awareness about the agricultural resources available to farmers, fortify the structure of farmer groups, and optimize broccoli cultivation areas to strengthen farmers' confidence in confronting the high risks associated with broccoli farming.

REFERENCES

Ajarsari, K. M., Siswadi, B., & Hindarti, S. (2019). Economic Efficiency Analysis Using a Profit Function Model in Broccoli Farming in Sumber Brantas Village, Bumiaji District, Batu City. *Jurnal Sosial Ekonomi Pertanian Dan Agribisnis*, *7*(2).

Andayani, S. A. (2018). Factors that affect the production of red chili. *Agribusiness Pulpit: Journal of Scientific Community Thought with an Agribusiness Perspective*, *1*(3), 261–268.

Anjani, I. G., Saputri, A. B., Armeira, A. N. P., & Januarita, D. (2022). Analysis of palm oil consumption and production in Indonesia by applying the moving average method. *JURIKOM (Jurnal Riset Komputer)*, *9*(4), 1014–1019.

Apte, A. (2010). Supply chain networks for perishable and essential commodities: design and vulnerabilities. *Journal of Operations and Supply Chain Management*, *3*(2), 26–43.

Bergfjord, O. (2013). Farming and risk attitude. *Emirates Journal of Food and Agriculture*, *25*, 555–561. https://doi.org/10.9755/EJFA.V25I7.13584

Budiman, K., Kartono, K., & Timisela, N. R. (2019). Risks of Cocoa Farming in Kolaka Regency. *Journal of Agricultural Cultivation*, *15*(2), 119–126.

Ciancaleoni, S., Onofri, A., Torricelli, R., & Negri, V. (2016). Broccoli yield response to environmental factors in sustainable agriculture. *European Journal of Agronomy*, *72*, 1–9.

Falco, S., & Perrings, C. (2005). Crop biodiversity, risk management and the implications of agricultural assistance. *Ecological Economics*, *55*, 459–466. https://doi.org/10.1016/J.ECOLECON.2004.12.005

Kasim, N. A., Megawati, M., Arifah, A., & Hidayati, W. (2019). Production risk of seaweed cultivation in south sulawesi: Comparison between cobb-douglas and just-pope production function. *International Journal of Agriculture System*, *7*(2), 127–137.

Kata, R., & Leszczyńska, M. (2021). Stability and social sustainability of farm household income in Poland in 2003–2020. *Agriculture*, *11*(12), 1296.

Kata, R., & Wosiek, M. (2024). Income Variability of Agricultural Households in Poland: A Descriptive Study. *Agriculture*, *14*(3), 357.

Khakim, L., Hastuti, D., & Widiyani, A. (2013). The Influence of Land Area, Labor, Seed Use, and Fertilizer Use on Rice Production in Central Java. *Mediagro*, *9*(1).

Kusumawardani, N., Tarore, D., & Sofwani, A. (2023). Cost and Income Structure of Broccoli Farming. *GREEN HOUSE JOURNAL*, *2*(1), 6–13.

Larasati, F. D. (2019). Analysis of Broccoli Farming Income in Farmer and Non-Farmer Groups in Kenteng Hamlet, Sumberejo Village, Ngablak District, Magelang Regency. *Jurnal Sungkai*, *7*(2), 25–41.

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 498-510, June 2025

Lawalata, M., Darwanto, D. H., & Hartono, S. (2017). Risks of shallot farming in Bantul Regency. *Jurnal Agrica*, *10*(2), 56.

Malia, R. (2022). Analysis of the Financial Feasibility of Broccoli Farming in the Main Farmer Group of Ciherang Village, Pacet District, Cianjur Regency. *Jurnal Administrasi Bisnis (JUBIS)*, *2*(2), 69–85.

Moscardi, E., & De Janvry, A. (1977). Attitudes toward risk among peasants: an econometric approach. *American Journal of Agricultural Economics*, *59*(4), 710–716.

Murtiningsih, R., Moekasan, T. K., Prabaningrum, L., Sembiring, A., Setiawati, W., Hasyim, A., Udiarto, B. K., Sulastrini, I., Gunaeni, N., & Korlina, E. (2023). *Determining the technical and economic feasibility of combining pest control techniques in open field and netting house chili cultivation systems.*

Pineda, M., Barón, M., & Pérez-Bueno, M. L. (2024). Diverse projected climate change scenarios affect the physiology of broccoli plants to different extents. *Physiologia Plantarum*, *176*(2), e14269.

Pratiwi, P. R., Santoso, S. I., & Roessali, W. (2018). Adoption rate of true shallot seed technology in Klambu District, Grobogan Regency. *AGRARIS: Journal of Agribusiness and Rural Development Research*, *4*(1), 9–18.

Purnamasari, F., Rosadi, S. H., Muliani, M., & Ridwan, W. (2024). Risk Production Analysis Rice Farming with Just and Pope Approach. *Agribusiness Journal*, *7*(1), 38–45.

Salampessy, Y. L. A., Lubis, D. P., Amien, L. I., & Suhardjito, D. (2018). Measuring the climate change adaptation capacity of paddy rice farmers (the case of Pasuruan Regency, East Java). *Journal of Environmental Science*, *16*(1), 25–34.

Saptana, S., Daryanto, A., Daryanto, H. K., & Kuntjoro, K. (2010). Risk Management Strategy for Red Chili Farmers in Lowland Rice Fields in Java, Central Java. *Jurnal Manajemen & Agribisnis*, *7*(2), 115–131.

Sarwai, B. A., Sriyoto, S., & Yuliarti, E. (2016). Analysis of USAhatanian Broccoli (Brassica oleracea L) and its Marketing in Sumber Urip Village, Selupu Rejang District, Rejang Lebong Regency. *Jurnal AGRISEP: Study of Socio-Economic Problems of Agriculture and Agribusiness*, 237–254.

Setyadi, A., Setiadi, A., & Ekowati, T. (2020). Analysis of production factors that affect the production of curly red chili pepper (Capsicum annum L) in Sumowono sub-district, Semarang regency. *Jurnal Ekonomi Pertanian Dan Agribisnis JEPA*, *4*(4), 1–27.

Statistics Indonesia. (2024). *Ngablak District in Figures*. BPS-Statistics Magelang Regency . https://magelangkab.bps.go.id/id/publication/2024/09/26/dfde52878102790046735218/kecamatan-ngablak-dalam-angka-2024.html

Sudarma, I. M., & As-syakur, A. R. (2018). The impact of climate change on the agricultural sector in Bali Province. *SOCA J. Sos. Ekon. Pertan*, *12*(1), 87.

Visser, M., Jumare, H., & Brick, K. (2020). Risk preferences and poverty traps in the uptake of credit and insurance amongst small-scale farmers in South Africa. *Journal of Economic Behavior and Organization*, *180*, 826–836. https://doi.org/10.1016/J.JEBO.2019.05.007

Wahyuni, H. C., & Sumarmi, W. (2018). Food Safety Risk Measurement in Fresh Fish Supply Chain Systems. *J@ Ti Undip: Jurnal Teknik Industri*, *13*(1), 37–44.

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 498-510, June 2025

Wang, J., Etienne, X., & Ma, Y. (2020). Deregulation, technical efficiency and production risk in rice farming: evidence from Zhejiang Province, China. *China Agricultural Economic Review*, *12*(4), 605–622.

Wang, T., Liu, J., Zhu, H., & Jiang, Y. (2024). The Impact of Risk Aversion and Migrant Work Experience on Farmers' Entrepreneurship: Evidence from China. *Agriculture*. https://doi.org/10.3390/agriculture14020209

Widjayanti, F. N., & Rizal, M. (2016). Partnership system in broiler chicken farming in Jember Regency. *Surya Agritama: Jurnal Ilmu Pertanian Dan Peternakan*, *5*(1).

Wijaya, W., Dwirayani, D., Savitri, M. I., Wahana, S., & Astuti, L. C. (2023). Efficiency and Risk of Shallot Farming in Gebang District, Cirebon Regency, West Java. *Jurnal Agribisnis Indonesia (Journal of Indonesian Agribusiness)*, *11*(2), 408–421.

Yusub, A., Pramono, R., & Sitepu, H. (2020). Agricultural Analysis of Organic Broccoli (Brassica oleracea L. var. botrytis L.) In the Bangkit Merbabu Farmers Group, Batur Village, Getasan District, Semarang Regency. *AGROMEDIA: Berkala Ilmiah Ilmu-Ilmu Pertanian*, *38*(1), 50–61.

Zakirin, M., Yurisinthae, E., & Kusrini, N. (2013). Risk analysis of rice farming on tidal land in Pontianak Regency. *Jurnal Social Economic of Agriculture*, *2*(1).

Zou, Y., & Wang, Q. (2022). Impacts of farmer cooperative membership on household income and inequality: Evidence from a household survey in China. *Agricultural and Food Economics*, *10*(1), 17. https://doi.org/10.1186/s40100-022-00222-x