E3S Web of Conferences **665**, 01012 (2025) https://doi.org/10.1051/e3sconf/202566501012
IConARD 2025

Risks of Cabbage and Chicorice Farming in Banyuroto Village, Sawangan District, Magelang Regency, Central Java

Sriyadi[1*], *Tasya* Amalia Putri[1], *Zizou* Al Durra[1], *Rojiatun* Alafiah[1], *and Bambang* Heri Isnawan[2]

[1]Department of Agribusiness, Universitas Muhammadiyah Yogyakarta, Indonesia
[2]Department of Agrotechnology, Universitas Muhammadiyah Yogyakarta, Indonesia

Abstract. Cabbage and chicory are vegetable horticultural commodities that often face production and income risks. Farmers who are generally rational risk-averse of farming. Differences in risk aversion between individuals can lead to disparities in decision-making. This study aims to (1) analyze the level of risk of costs, production, and income of cabbage and chicory farming; (2) analyze farmers' behavior towards the cost risk, production, and income of cabbage and chicory farming; and (3) analyze social factors that affect farmers' behavior on the risks of cabbage and chicory farming. The research employed a descriptive analytical approach. Data were collected through observation and structured interviews with 60 cabbage and 60 chicory farmers using questionnaires. The results show that cabbage farming carries a higher level of risk than chicory farming. Most farmers exhibit risk-averse behavior toward both commodities. Risk aversion increases with larger land size, older age, and more frequent crop failure, but decreases with higher education, longer farming experience, larger household size, and greater farm income. Overall, farmers are more risk-averse in cabbage farming than in chicory farming. Extension programs are essential to enhance farmers' understanding of optimal planting times for cabbage and chicory, thereby reducing farming risks and improving income stability.

1 Introduction

The horticultural subsector that is most cultivated by farmers in Indonesia is vegetables. Currently, vegetables and fruits are only considered as dietary supplements. However, many studies have shown that there are nutrients and active chemicals in them, known as phytonutrients and phytochemicals, that have a variety of health benefits, such as preventing disease, treating, and healing. Vegetables and fruits as a source of various minerals, vitamins, and fiber. Various minerals and vitamins contained in fruits and vegetables have a role as antidote to harmful compounds (antioxidants) for the body.

In terms of kind, variety, quality, and quantity of production, vegetable crop yields differ by region. Because vegetables must adapt to the unique climate, soil, and topographic

[*] Corresponding author: sriyadi@umy.ac.id

conditions of each place, they come in a variety of types [1]. Due to its extremely high economic worth, this vegetable product is a superior one, as seen by the quantity of work required, expenses incurred, revenue produced, and profits made.

The most popular and extensively consumed horticultural product among Indonesians, vegetables are grown by farmers all over the country, from lowlands to highlands. Because plants must adjust to the temperature, soil, and topography, vegetables provide a variety of yields in terms of both quality and quantity. In Indonesia, vegetables are a strategic commodity because they can affect inflation if the price changes. In addition, vegetables are a high-value commodity, which encourages many farmers to cultivate them [2].

One of the comparative advantages of vegetable commodities is their potential competitiveness, as vegetable commodities can always achieve high competitiveness as long as the economy is stable without recession [3]. In most developing countries, the agricultural sector, including vegetables, is at the forefront of economic development. This is shown by the large amount that the agricultural sector contributes to the formation of GDP [4].

Vegetable farming faces the risk of unstable and fluctuating prices and production failures. When there is risk, farmers who are fundamentally rational are reluctant to take risks [5, 6]. Differences in how a person views risk will affect the way they make decisions [7, 8]. Farmers' risk-taking behavior is influenced by socioeconomic considerations [9]. These socioeconomic factors include land acreage, farmer age, education, experience, frequency of agricultural failures, and farming income.

Given the context and articulation of the problem, the study seeks to: (1) Examine the degree of risk associated with vegetable farming's expenses, output, and revenue. (2) Examine how farmers behave in relation to the expense, danger, output, and revenue of growing vegetables. (3) Examine how societal influences influence farmers' decisions on the dangers of growing vegetables.

The urgency of this research is that, in Indonesia, many studies on the risks of farming have been conducted, including research on the risks of vegetable farming. However, there is a dearth of study on risk that examines how farmers in Magelang Regency, Central Java, behave when faced with risk, as well as the societal elements that influence such behavior. Additionally, farmers' behavior about the risk of cultivating vegetables was evaluated using the quadratic utility regression function model approach.

2 Research method

Research on risks of cabbage and chicorice farming in Banyuroto Village, Sawangan District, Magelang Regency, Central Java was conducted using descriptive analysis methods [7,10]. The research location was Sawangan District, Magelang Regency, Central Java, and from Sawangan District, one of the vegetable production centers was chosen, namely Banyuroto Village with 6 hamlets, each hamlet was taken by 20 respondents. Data collection was carried out by observation and interviews with questionnaire guides. When processing data, inductive procedures are utilized to draw inferences based on concretely known facts and events as well as actual facts at the research location.

2.1 Risk of shallot farming

A coefficient of variation was used to assess the degree of risk associated with vegetable farming's expenses, output, and revenue. Kimbal's results [11] show that the magnitude of variance and standard deviation can be used to measure cost, production, and revenue risks. The following is a mathematical representation of the coefficient of variation:

$$KV = \frac{\sigma}{\overline{X}} \tag{1}$$

The term KV represents the coefficient of income variation, which measures the relative variability of income. The symbol σ denotes the standard deviation of income, indicating the degree of fluctuation or dispersion in farmers' income. Meanwhile, $\bar{X}$ refers to the average revenue, representing the mean income earned from vegetable farming. The distribution's mean value has little variability, as indicated by the tiny coefficient of variation. This implies that there is little average risk in terms of cost, output, and income.

2.2 Farmers' behavior toward risks

To ascertain how farmers behave in relation to the cost risk, output, and revenue of vegetable farming, a quadratic utility function model is employed:

$$U = b_0 + b_1 M + b_2 M^2 \tag{2}$$

The symbol U represents the value utility, which indicates the level of satisfaction or usefulness derived from a particular outcome. The term M denotes the acceptance obtained at the equilibrium point of the alternative option that is filed, referring to the level of acceptance or benefit achieved under equilibrium conditions. The parameter b_0 is the intercept, while b_1 represents the regression coefficient, showing the relationship between the dependent and independent variables. Lastly, b_2 stands for the risk preference coefficient, which measures the degree of risk tolerance or aversion among farmers.

Bernoulli's principle and the Neumann-Morgenstern technique enhanced with neutral probability (50:50) determine the equilibrium value, which is the state of equilibrium between values under uncertain and definite conditions. This balancing value, known as the certainty equivalent, or CE, is the money made by growing onions. By connecting the scale of the utility, it can be used to obtain utility functions. Since every farmer has a unique CE value, their utility curves will vary as a result of the variations in their income.

2.3 Socioeconomic factors influencing farmer behavior towards risk

Farmers' behavior toward risks was examined using multiple linear regression models, which were influenced by factors such as income, land area, age, education, experience, number of family members, and failure frequency. With land area, age, education, experience, number of family members, frequency of failures during the previous five years, and farmers' income from farming for a year as independent factors, the risk coefficient is a dependent variable.

$$b_2 = \alpha_0 + \sum_{i=1}^{7} \alpha_i X_i + \mu \tag{3}$$

The coefficient b_2 represents the risk preference coefficient, indicating the level of risk tolerance among farmers. The variable X_1 denotes land size (measured in hectares), X_2 represents farmer age (in years), X_3 refers to farmer education (in years), and X_4 stands for farmer experience (in years). Meanwhile, X_5 indicates the number of members in the peasant family (measured in persons), X_6 represents the failure frequency, and X_7 denotes farmer income from farming (in IDR per year). The term α_0 serves as the intercept, while α_1 through α_7 represent the regression coefficients corresponding to each explanatory variable—covering land area, farmer age, education, experience, family size, failure frequency, and farming income, respectively. Finally, μ denotes the confounding variables, which account for other factors that may influence the results but are not explicitly included in the model.

In conducting this research, a statistical approach was applied to ensure the accuracy and reliability of the analytical results. (1) Verifying the classical assumptions and (2) Assessing the model's suitability comprise the two stages of the previously described analysis model test using ordinary least square (OLS). The typical assumption tests employed in this study are multicollinearity and heteroscedasticity tests because the data used are either cross-sectional or single-point data. If the model being studied does not contain a classical assumption disorder, the model used for identification is the result of ordinary least square (OLS) analysis. The model has been modified to remove both heteroscedasticity and multicollinearity disorders if they exist.

Heteroscedasticity test: To determine whether heteroscedasticity disorders were present, the Shazam data analysis program employed a number of tests, such as the Harvey, Glesjer's, Koenker, and Breusch-Pagan tests. If at least one of the four tests indicates a heteroscedasticity disorder, the model is adjusted using the heteroscedasticity model and the Feasilbe Generalize Least Square (FGLS) method is applied for analysis. To enhance the model for heteroscedasticity disorders, four distinct types of heteroscedasticity models were used, these are the first four examples: the models depvar (dependent variable), mult (multiplicative), stdlin (standard deviation functions as a linear function of exogenous variables), and varlin (variance functions as a linear function of exogenous variables"). To identify the factors affecting the risk preference coefficient, one of the four heteroscedasticity improvement models was chosen as the best (appropriate) model.

3 Results and discussion

3.1 Risk analysis of cabbage and chicory farming

An examination of the coefficient of variation from the production, cost, and revenue of chicory and cabbage farming was utilized to ascertain the production risk, cost, and income. The amount of the coefficient of variation for farmers' revenue, expenses, and productivity from cultivating cabbage and chicory is determined by the analysis of the coefficient of variation. The analysis of the coefficient of variation in the output, costs, and profits of growing cabbage and chicory is shown in Table 1.

The study's findings indicate that while the cost risk of growing cabbage and chicory is different, the risk of producing and earning money from growing cabbage is higher than that of growing chicory. There is a high-income risk associated with cabbage growing because of the high output risk. The danger of growing cabbage is higher than that of growing chicory because the former is more vulnerable to pests and illnesses than the latter. Variations in production also contribute to the risk of growing cabbage. The study's findings indicate that growing vegetables like chicory and cabbage carries a significant financial risk. The findings of this study are consistent with studies that demonstrate the increased risk associated with vegetable cultivation [12,13].

Farmers do not plant cabbage at the same time, which is the cause of this yield disparity. Since weather and climate have a significant impact on cabbage growth, different planting times lead to varying growth and harvest times, which in turn lead to different yield. For example, it goes without saying that farmers who plant cabbage during the rainy season—when rainfall is noticeably higher—will produce less. This is in contrast to farmers who plant cabbage before the rainy season begins, which would surely increase yields due to lower rainfall at that period.

Table 1. Average, standard deviation and coefficient of variation in cabbage and chicory farming costs per hectare, 2024

Farming	Cabbage in Banyuroto Village, Sawangan Magelang District			White Chicorice in Banyuroto Village, Sawangan Magelang District		
	Cost	Production	Income	Cost	Production	Income
Cost	20,953,636	13,829	20,268,194	17,350,428	16,198	18,339,190
Standard Deviase	7,275,261	9,724	14,815,945	5,823,350	2,301	8,699,287
Coefficient of Variation	0.35	0.70	0.73	0.34	0.14	0.47

Source: Primary Data, processed 2024

3.2 Farmers' behavior toward risks

To find out how farmers reacted to the risks of growing cabbage and chicory, the quadratic utility function was employed. The utility function of each farmer was estimated using the procedure described in the study technique and the Bernoulli-Morgenstern principle, which was improved with a neutral probability (50:50).

The lowest and greatest determination coefficients *(R^2)* for each farmer's utility function in the production of cabbage in Banyuroto Village, Sawangan District, Magelang, are 0.965 and 0.995, respectively. This shows that for farmers with the lowest determination coefficient value *(R^2),* 96.50% of the variation in the utility value of growing cabbage comes from changes in revenue, with the remaining 3.50 percent coming from changes in other factors not included in the model. Variations in cabbage farming revenue account for 96.50% of the variance in the utility value of farming for farmers with a determination coefficient value of *(R^2)*, with the remaining 0.50 percent coming from variations in other parameters not included in the model. While the lowest f-count is 51.431 and the highest is 1,011.250.

Regarding chicory cultivation in Banyuroto Village, Sawangan District, Magelang had the highest determination coefficient *(R^2)* at 0.997 and the lowest at 0.975. For farmers with the lowest determination coefficient value *(R^2)*, this means that a 97.50 percent variation in chicory farming revenue is responsible for the variation in the utility value of chicory farming, while a 2.50 percent variation is caused by other factors not included in the model. In the case of farmers with the lowest determination coefficient value *(R^2),* this means that variations in the revenue from chicory farming account for 99.70 percent of the variation in the utility value of chicory farming, while variations in other factors not included in the model account for 0.30 percent. While the lowest f-count is 65.421 and the highest is 1,275.500.

Table 2. Distribution of cabbage and chicory farmers' behavior towards risk, 2024

Behaviour	Cabbage in Banyuroto Village, Sawangan Magelang District		White Chicorice in Banyuroto Village, Sawangan Magelang District	
	Sum	Presented %	Sum	Presented %
Averter	52	86.67	45	75
Netral	8	13.33	15	25
Lover	0	0	0	0
(R^2) Lowest		0.965		0.975
(R^2) Highest		0.995		0.997
Lowest F-count		51.431		65.421
Highest F-count		1,011.250		1,275.500

Source: Primary Data, processed 2024

According to Table 2, 52, or 86.67 percent, of the 60 farmers who cultivate cabbage have a negative and significant risk coefficient *(b_2)*, suggesting that they take the risk of cultivating cabbage with hesitancy. Three, or 5% of farmers, have a risk coefficient *(b_2)* that is positive but not significant, and five, or 8.33% of farmers, have a negative risk coefficient *(b_2)*. These findings suggest that farmers behave in a neutral manner toward the risks associated with growing cabbage and that no farmer is willing to take any chances. The results of the study indicate that most cabbage farmers behave tentatively when confronted with the risks associated with growing cabbage. 45 farmers, or 75% of the 60 farmers who grow chicory, have a risk coefficient *(b_2)* that is negative and significant, meaning they act hesitantly toward the risks of chicory farming; 10 farmers, or 16.67% of the farmers, have a risk coefficient *(b_2)* ; and 5 farmers, or 8.33% of the farmers, have a risk coefficient *(b_2)* that is positive but not significant, meaning they act neutrally toward the risks of chicory farming and that no farmers are willing to take a chance. The results of the study indicate that most chicory farmers behave tentatively when confronted with the risks associated with farming chicory. The results of the study indicate that when confronted with farming hazards, farmers who cultivate cabbage and chicory vegetables behave reluctantly. The results of this study are in line with research showing farmers' unwillingness to embrace the risks involved with growing vegetables [6].

Given that most farming households deal with a major financial conundrum, it makes sense that most farmers act hesitantly when taking risks. Farmers in the countryside are unable to use the calculation of maximum earnings in farming because they live very close to the limit of subsistence and are frequently impacted by weather uncertainty. Farmers will attempt to prevent failing and avoid taking significant risks in order to achieve large profits. This type of behavior, which is typical of most farmers, is referred to as safety first.

Because chicory and cabbage produce quickly and are somewhat expensive, farmers who grow them are motivated to make more money. Most farmers, with little or no capital, have not dared to grow chicory and cabbage on a large commercial scale because of the considerable risks involved, including attacks by pests and diseases or unstable price swings. Because they no longer have a budget to cover their living expenses, small farmers or farmers with limited capital must unavoidably sell their produce when harvest time arrives, regardless of the price. The majority of farmers use a monoculture overlap method while growing chicory and cabbage. September through November is the planting season for chicory and cabbage.

3.3 Socioeconomic factors that affect farmers' behavior towards risk

Socioeconomic characteristics that are believed to affect farmers' risk-taking behavior include land area, age, education, experience, number of family members, frequency of failures over the past five years, and annual agricultural earnings. Because the quadratic utility function was analyzed, the risk coefficient *(b_2)* was utilized as the dependent variable in this instance. As a result, it is thought that seven elements affect how farmers conduct in dangerous situations. The results of a multiple linear equation model that looks at the factors influencing farmers' risk-taking behavior are shown in Table 3.

Table 3 demonstrates that, out of the seven independent factors, three—farmers' age, income, and education—have a considerable impact on the non-free variable, which is the risk coefficient, which gauges how risk-averse farmers are.

The next stage in identifying any deviations from the conventional assumptions of the multiple linear regression model is to find multicollinearity and heteroscedasticity. Multicollinearity is the presence of a perfect or obvious linear relationship between some or all of the variables that characterize the regression model. To ascertain whether there is a multicollinearity problem with the estimator model, an indicator of correlation coefficients between independent variables is employed. Because the correlation coefficient between the free variables is relatively low, the analysis's conclusions show that the multiple linear regression model used does not have a multicollinearity problem.

Table 3. Regression coefficient and t-calculate the function of farmer behavior on the risk of cabbage and chicory farming, 2024

Independent Variables	Regression Coefficient	T-Count
Intersep	0.935E-05***	12.100
Land (X_1)	-0.786E-10NS	-0.965
Farmer Age (X_2)	-0.453E-07*	-2.551
Farmer Education (X_3)	0.857E-08**	2.764
Farmer Experience (X_4)	0.295E-07NS	1.573
Number of Family Members (X_5)	0.695E-08NS	1.121
Failure Frequency (X_6)	-0.324E-06NS	-0.553
Farmer Income (X_7)	0.275E-05**	2.867
Dummy (D)	0.755E-06***	3.879
Coefficient of Determination (R^2)	0.915	
$F - hitung$	8.523***	
DW	1.801	

Source: Primary Data Analysis.

*Information: ***: significant in α: 1 %; **: significant in α: 5 %; *: significant in α: 10 %.*
NS: insignificant on α: 10 %
- *T-Table (With df = ∞) at α: 1% = 2.576; α: 5% = 1.960; and α: 10% = 1.645*
- *F-table, on α: 1% = 2.510; α: 5% = 1.940; and α: 10% = 1.670*

When the variation of each disturbance ui element is not constant, heteroscedasticity arises. Heteroscedasticity is an issue with cross-sectional data. This study employed the Harvey Test, Glesjer's Test, Koenker Test, and Breusch-Pagan Test methodologies to identify the heteroscedasticity issue. The results of the research show that there is a heteroscedasticity problem with the estimator model. The improved models that were used to eliminate the influence of heteroscedasticity were the depvar model (heteroscedasticity improvement with dependent variables), the mult model (heteroscedasticity improvement with multiplicative), the stdlin model (heteroscedasticity improvement with standard deviation is a linear function of exogenous variable), and the varlin model (heteroscedasticity improvement with variance is a linear function of exogenous variable). The results are shown in table 4.

Based on the analysis results in Table 4, it is known that the heteroscedasticity model has a determination coefficient value *(R^2)* of 0.915. This shows that up to 91.50 percent of the variation in the risk coefficient value or farmer behavior toward risk can be explained by differences in land area, age, education, experience, number of family members, frequency of failures over the previous five years, and farming income. The remaining 8.50 percent can be explained by other factors that influence but are not included in the model.

With a likelihood ratio (LR) value of 22.446 higher than the chi-square value of 20.090, the computation's result demonstrated that the independent factors taken together significantly affect the dependent variables. In other words, the ways in which farmers respond to risk are influenced by their overall socioeconomic characteristics, including land area, age, education, experience, number of family members, frequency of failures during the past five years, and agricultural revenue.

Table 4. Regression analysis between risk coefficients with seven independent variables that have eliminated the influence of heteroscedasticity, 2024

Independent Variables	**Regression Coefficient**	**Heteroscedasticity Free Regression Coefficient**			
	OLS	**DEPVAR**	**MULT**	**STDLIN**	**VARLIN**
Intersep	0.935E-05*** (12.100)	0.856E-05*** (15.31)	0.765E-05^{NS} (0.944)	0.721E-05^{NS} (0.554)	0.176E-06*** (3.779)
Land (X_1)	-0.786E-10^{NS} -0.965)	-0.776E-10*** (-12.22)	-0.757E-10* (-1.877)	-0.565E-10^{NS} (-1.2449)	-0.434E-11^{NS} (-0.211)
Farmer Age (X_2)	-0.453E-07* (-2.551)	-0.277E-07*** (-11.27)	-0.123E-07^{NS} (-1.075)	-0.723E-07^{NS} (-0.677)	-0.443E-08* (-1.891)
Farmer Education (X_3)	0.857E-08** (2.764)	0.565E-08*** (11.91)	0.232E-08*** (2.833)	0.364E-08^{NS} (1.556)	0.773E-08*** (2.777)
Farmer Experience (X_4)	0.295E-07^{NS} (1.573)	0.378E-07*** (8.55)	0.249E-07^{NS} (0.743)	0.346E-07^{NS} (1.335)	0.455E-08^{NS} (0.584)
Number of Family Members (X_5)	0.695E-08^{NS} (1.121)	0.678E-08*** (10.44)	0.575E-08^{NS} (0.777)	0.352E-08^{NS} (0.432)	0.845E-08^{NS} (1.446)
Failure Frequency (X_6)	-0.324E-06^{NS} –(0.553)	-0.433E-06*** (-9.71)	-0.825E-06^{NS} (-0.983)	-0.787E-06^{NS} (-0.654)	-0.344E-07* (-1.899)
Farmer Income (X_7)	0.275E-05** (2.867)	0.433E-05*** (11.33)	0.824E-05*** (3.220)	0.775E-06^{NS} (1.555)	0.777E-06* (1.966)
Dummy (D)	0.755E-06*** (3.879)	0.886E-06*** (7.669)	0.787E-06*** (3.329)	0.566E-06*** (2.955)	0.886E-06*** (2.889)
R^2	0.915	0.915	0.915	0.915	0.915
F-Count/LR	8.523***	22.446***	22.446***	22.446***	22.446***

Source: Primary Data Analysis.
*Information: ***: significant in α: 1 %; **: significant in α: 5 %; *: significant in α: 10 %.*
NS: insignificant on α: 10 %
-T-Table (With df = ∞) at α: 1% = 2.576; α: 5% = 1.960; and α: 10% = 1.645
-F-table, on α: 1% = 2.510; α: 5% = 1.940; and α: 10% = 1.670
-Chi-Square, at α: 1% = 20.090; α: 5% = 15.510; and α: 10% = 13.360
-OLS : Ordinary least square
-Depvar : Improved heteroscedasticity with dependent variables
-Mult : Improvement of heteroscedasticity with multiplicative
-Stdlin : Improvement of heteroscedasticity with standard deviation is a linear function of exogenous variable
-Varlin : Correction of heteroscedasticity with variance is linear function of exogenous variable

Table 4 shows that the Depvar model (improvement of heteroscedasticity with dependent variables) is the most effective of the four models used to eliminate the influence of heteroscedasticity because, in comparison to the other three models, it has the most independent variables with the greatest real effect, meaning that all of the independent variables have a real effect. The depvar model, which enhances heteroscedasticity with dependent variables, was chosen to identify the factors impacting farmers' risk-taking behavior. The depvar model (improvement of heteroscedasticity with dependent variables) states that all independent variables have a real partial effect on dependent variables.

The following may be said about the findings of the socioeconomic elements that influence farmers' behavior toward the dangers associated with growing chicory and cabbage (table 4).

3.3.1 Land

With an average area of 3,106 m^2 for chicory farming and 3,419 m^2 for cabbage farming, farmers have a comparatively little land area. Ceteris paribus, an increase in land area will lead to a considerable decrease in the risk coefficient, as shown by Table 4, which shows that the land area has a significant and negative regression coefficient. To put it another way, farmers are more hesitant to risk failure the larger the farmland. These results are consistent with studies that indicate farmers are less willing to take on the risk of failing the larger their acreage. [8], but in contrast to the study's findings [6].

Because of the unpredictability involved, farmers find planting chicory and cabbage to be a dangerous choice. The chance of failure is increased if a narrow piece of land is already dangerous, particularly when combined with a large piece of land. The danger of failure is caused by insect illnesses and degraded soil conditions in addition to the uncertainty element. Some farmer-owned lands suffer from saturation, which is defined by a state of the soil that makes it difficult for water to be absorbed. If the soil is still planted, chicory and cabbage may flourish at first, but they will soon wilt and die. Many scientists think that overuse of inorganic fertilizers and pesticides, which contaminate the soil with chemicals, is the cause of this. Farmers are therefore less likely to cultivate cabbage and chicory on large swaths of land.

3.3.2 Farmer age

The average age of farmers is forty-three, while the youngest is twenty-two and the oldest is sixty-four. Ceteris paribus, growing older will result in a significant drop in the risk coefficient because aging has a negative and significant regression coefficient. In other words, older farmers are more reluctant to assume the risk of failure, while younger farmers are less inclined to do so.

This makes sense because older farmers tend to be more conservative and easily tired, but they might also be more experienced and talented. Despite having less experience and knowledge, younger farmers are more physically fit and show more openness to new ideas. Younger farmers who are more willing to take chances tend to behave in ways that reflect this progressive tendency. This is demonstrated by a few young farmers who are beginning to have the courage to alter how they use production factors. For instance, they have begun to use organic fertilizers instead of chemical ones and have also begun to use fewer chemical pesticides, though they will still use them if necessary to combat diseases and pests because this is the usual practice among farmers. Every week, bugs and diseases show up. These findings are consistent with other research showing farmers' aversion to failure rises with age. [8], Age has the similar tendency in research [6], i.e., it is negatively associated to the risk coefficient, but this relationship is not statistically significant. These results contradict research showing younger farmers are less risk-taking than their more seasoned peers [13].

3.3.3 Education

With a range of 6 to 16 years, farmers have attended formal education for an average of 10 years. As a result, the average farmer holds a junior high diploma (SMP). The farmer education variable's regression coefficient is positive and significant when other factors are consistently taken into consideration. This suggests that a higher level of education will lead to a considerable increase in risk coefficient. To put it another way, farmers who have greater education are more willing to take chances. This is possible because the typical farmer, who has completed junior high school and is generally well-educated, is risk-taking. These findings are in line with studies demonstrating that farmers with greater levels of education exhibit stronger risk aversion [8], although in research [6] the trend is the same even when education is not important.

3.3.4 Experience

The experience of farmers growing chicory and cabbage differs widely. With an average of 17 years, farmers' experience in growing chicory and cabbage ranges from 5 to 41 years. The regression coefficient for the experience of farmers growing chicory and cabbage is positive and substantial, indicating that, ceteris paribus, the risk coefficient will rise dramatically as farmers gain more experience growing these crops. In other words, farmers will be less hesitant to take risks if they have more expertise growing chicory and cabbage. These findings are in line with past study that indicated farmers who have more agricultural experience are less risk averse [8], even while research [6] demonstrated that farming experience is not significant, the tendency is still the same.

Farmers' observations and experience, which include both firsthand environmental knowledge and knowledge passed down from generation to generation, provide them with the knowledge and expertise necessary to raise chicory and cabbage. Mature farmers who are willing to learn from their mistakes are very skilled and conscious of the possible consequences of their choices, including those related to pricing and production. This is demonstrated by certain farmers who belong to farmer groups, which always take past events and experiences into account before choosing to grow cabbage and chicory. They also survey other regions that grow similar commodities because if other regions grow the same commodity, it can be determined that the price at harvest will drop, necessitating the use of alternative crops. Farmers will try to anticipate in order to prevent similar mistakes, as the experience of failure in the past will teach invaluable lessons.

3.3.5 Number of family members

Family size ranges from one to four, with the typical farmer having a family of three. Adding additional family members will significantly increase the risk coefficient, assuming all other variables stay constant, because the variable number of family members has a positive and significant elasticity. This implies that farmers will be less willing to take risks if they have a larger family.

This is due to the fact that labor availability is directly correlated with the number of family members. Please be aware that growing chicory and cabbage takes a lot of work. From seed preparation to soil cultivation, planting, weeding, fertilizing, watering, harvesting, and post-harvest, the majority of farmers employ family labor for all tasks. The results of the study also show that a large family size requires more work from the family head in order to assist the family and achieve good results. Farmers are encouraged to act braver and take more chances as a result. These results are in line with studies showing that the more family members farmers have, the less risk averse they would be. [8], even though the number of family members is small in research [6], the pattern is the same regardless of the study's conclusions [14].

3.3.6 Failure frequency

Seasonal unpredictability causes pests and illnesses to appear, which is the main reason why most farmers fail to grow chicory and cabbage. In addition to the high expense of growing chicory and cabbage, fluctuating price variables are another reason why these crops fail. Failures have occurred 0.7 times on average during the last five years, with a range of 0 to 2 times. The elasticity of the frequency of failure in chicory and cabbage farming has a considerable and significant value, meaning that a significant decrease in the risk coefficient will occur with an increase in the frequency of failure, provided all other factors stay the same. In other words, farmers are less willing to take risks when failures occur more frequently. This result is in line with research showing a negative correlation between the risk coefficient and failure frequency, meaning that farmers are less risk averse the more failures they experience [6,8].

3.3.7 Income

Farmers earn between IDR 25,000,000 and IDR 137,000,000 annually, with an average of IDR 35,500,000. The cultivation of tobacco, chile, chicory, and cabbage accounts for the majority of this income. Ceteris paribus, an increase in agricultural income will lead to a notable increase in the risk coefficient because of the positive and considerable elasticity of a year's worth of farmers' revenue. In other words, if farmers make more money from farming, they will be less scared to take chances. The study's results are in line with previous research showing that farmers' risk aversion will decline as income increases [8], even though research [6] found a clear correlation between income and the risk coefficient, but it was not statistically significant.

Making a lot of money is the main reason why farmers grow chicory and cabbage, so this makes sense. A high income is necessary because growing these crops comes with a lot of costs. Even wealthy farmers have the audacity to cultivate cabbage and chicory on a larger scale. They don't mind accepting the possibility of failing because they still have a budget for their living expenditures.

3.3.8 Dummy

To differentiate between the crop commodities being grown—chickory and cabbage—dummy variables are utilized; for example, D = 0 for chicory and D = 1 for cabbage. The dummy variable's regression coefficient is positive and significant, suggesting that farmers' willingness to assume the risks associated with cultivating cabbage and chicory differs. The average coefficient values for chicory farming and cabbage farming are -0.632E-07 and -0.243E-06, respectively. This indicates that farmers are more reluctant to take on the risk of chicory farming than they are to take on the risk of cabbage farming. This is because the former is more vulnerable to pests and diseases.

4 Conclusion and recommendation

The following conclusions can be drawn based on the research findings and discussion. First, growing cabbage is riskier than growing chicory. Second, farmers who cultivate both chicory and cabbage tend to act cautiously or hesitantly when facing risks. Third, several socioeconomic factors significantly influence farmers' behavior toward the risks of growing these crops. These factors include land area, farmer age, education level, experience in cultivating chicory and cabbage, number of family members, frequency of crop failures over the past five years, and farming income. Specifically, land area, farmer age, and failure frequency have a negative effect on risk-taking behavior, while education, farming experience, number of family members, and farming income have a positive effect. This means that the larger the land area, the older the farmer, and the more frequent the failures, the less willing the farmer is to take risks. Conversely, higher education, greater experience in growing chicory and cabbage, larger family size, and higher farming income encourage farmers to be more open to taking risks. Finally, farmers are generally more reluctant to face the risks associated with cabbage cultivation than those linked to chicory. To achieve optimal results, chicory and cabbage should be planted on time, as delays lead to suboptimal outcomes. Therefore, government intervention is needed to regulate planting schedules and provide guidance to farmers to help them determine the appropriate planting time for chicory and cabbage.

References

1. Pranata, A. T. Umam, Pengaruh Harga Bawang Merah Terhadap Produksi Bawang Merah di Jawa Tengah, JEJAK 8(1) (2015). https://doi.org/10.15294/jejak.v8i1.3852
2. L. Rahmadona, A. Fariyanti, B. (2017). Dayasaing Komoditas Bawang Merah di Kabupaten Majalengka, Jawa Barat, Jurnal Hortikultura Indonesia 8(2), 128–135 (2017). https://doi.org/10.29244/jhi.8.2.128-135
3. Y. W. Harinta, J. S. Basuki, S. Sukaryani, Pemetaan dan Pengembangan Agribisnis Komoditas Unggulan Sayuran di Kabupaten Karanganyar, Jurnal Agriekonomika 7(1), 37–45 (2018). http://dx.doi.org/10.21107/agriekonomika.v6i1.1895
4. Septiadi, U. Joka, Analisis Respon dan Faktor-Faktor yang Mempengaruhi Permintaan Beras Indonesia, Agrimor: Jurnal Agribisnis Lahan Kering 4(3), 42–44 (2019). https://doi.org/10.32938/ag.v4i3.843
5. S. Saifan, R. Shibli, M. S. A. Yajid, J. Abd Hamid, S. M. F. Azam, A Time Series Analysis to Enhancing Net Revenue of Farming in Malaysia through Agriculture Extension and Risk Aversion, AgBioForum 23(2), 113–122 (2021). https://hdl.handle.net/10355/89451
6. Pujiharto, S. Wahyuni, Analisis Perilaku Petani Terhadap Risiko Usahatani Sayuran Dataran Tinggi: Penerapan Moscardi and de Janvry Model, Universitas Nusantara PGRI Kediri 1(1), 65–73 (2017). https://doi.org/10.30595/agritech.v19i1.2099
7. Erny, D. H. Darwanto, Masyhuri, L. R. Waluyati, Farmer's Behavior Towards Lembah Palu Shallot Farm Risks in Central Sulawesi, Indonesia, EurAsian Journal of BioSciences 13(2), 931–936 (2019). https://www.proquest.com/openview/cb60064817f30384f6b5eabd88d02bcf/1
8. Sriyadi, A. Yekti, Farmers' Behavior Towards Risks of Shallot Farming: A Case Study in Kalisoro Village, Tawangmangu District, Karanganyar Regency, Central Java, E3S Web of Conferences 316, 02043 (2021). https://doi.org/10.1051/e3sconf/202131602043
9. Choiril, S. Soetriono, E. S. Hani, Analisis Faktor-Faktor Sosial Ekonomi yang Mempengaruhi Perilaku Petani dalam Menghadapi Risiko Usahatani Kentang, SOROT 13(1), 15–27 (2018). https://doi.org/10.31258/sorot.13.1.4810
10. Martínez-Rodríguez et al., Mediterranean Diet Adherence, Body Composition and Performance in Beach Handball Players: A Cross Sectional Study, International Journal of Environmental Research and Public Health 18(6), 2837 (2021). https://doi.org/10.3390/ijerph18062837
11. Z. Chen, K. D. Meilke, C. Turvey, Income Risk and Farm Consumption Behavior, Agricultural Economics 20(2), 173–183 (1999). https://doi.org/10.1016/S0169-5150(98)00079-6
12. Triyono, M. Fauzan, J. Mu'awanah, M. Sedek, Production Factor Efficiency of Shallot Farming in Pati, Central Java, Indonesia, E3S Web of Conferences 316, 02036 (2021). https://doi.org/10.1051/e3sconf/202131602036
13. Fauzan, Pendapatan, Risiko dan Efisiensi Ekonomi Usahatani Bawang Merah di Kabupaten Bantul, AGRARIS 2(2), 107–117 (2016). https://doi.org/10.18196/agr.2231

14. Rahmawati, T. Triyono, Keberanian dalam Mengambil Keputusan dan Risiko sebagai Karakter Wirausaha Petani Padi Organik di Kabupaten Bantul, AGRARIS 3(2) (2017). https://doi.org/10.18196/agr.3253