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ADAPTATION OF MELON FARMERS TO CLIMATE CHANGE: A CASE STUDY IN RASAU JAYA DISTRICT, WEST KALIMANTAN

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ABSTRACT

This study examines the adaptive strategies employed by melon farmers in Rasau Jaya District, Kubu Raya Regency, West Kalimantan, in response to climate change impacts on melon production. Using a mixed-method approach, data were collected from 40 melon farmers through surveys and interviews. Findings reveal diverse adaptation strategies including changes in planting schedules, selection of climate-resilient varieties, crop diversification, organic fertilizer use, application of monitoring technology, participation in technical training, and seeking alternative livelihoods outside agriculture. Significant factors influencing adaptation include farmer age (older farmers tend to adapt better), family dependents (higher number motivates adaptation), land ownership status (owners show greater adaptive behavior), and access to climate information (better access supports adaptation). Education level, farm size, farming experience, and off-farm employment showed no significant effect. The study suggests strengthening locally based training programs, expanding climate information access, securing land tenure, and empowering farming households to enhance adaptive capacity to climate change.

Keywords: Melon farmer adaptation, climate change, agricultural adaptation, influencing factors, ordinal logistic regression

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1. Introduction

Agriculture remains a vital sector in the economy of West Kalimantan, where a majority of the population depends on farming activities for their livelihoods. Despite abundant agricultural resources, this sector faces numerous challenges such as climate change, low commodity competitiveness, unsustainable land use, and unequal access to technology and information (Handika, 2023). Among agricultural commodities, horticulture—including melon cultivation—plays an important role. Kubu Raya Regency is recognized as a key regional center for melon production in West Kalimantan, contributing significantly to the local fresh fruit supply chains (BPS West Kalimantan, 2023).

Climate change poses serious risks to agricultural productivity globally and locally. It is characterized by long-term shifts in temperature and weather patterns, including altered rainfall distribution, rising temperatures, and extreme weather events (Ainurrohmah et al., 2022). These changes threaten crop yields, quality, and food security by increasing crop failure risks, pest outbreaks, and resource scarcity (Sarvina, 2019). Indonesia's tropical climate makes it particularly vulnerable to such changes, with frequent natural disasters escalating due to climate variability (Aziz et al.,, 2021).

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In the specific context of melon cultivation (Cucumis melo L.), the crop is notably sensitive to environmental fluctuations. Melon production is challenged by irregular rainfall, extreme temperatures, and pest infestations that have intensified under climate change (Erniati et al., 2024). Melon is a seasonal fruit enjoyed for its nutritional benefits including vitamins A and C, and it is crucial to increase production to meet consumer demand (Budiana, 2013).

Farmers' ability to adapt to climate change is critical in mitigating adverse effects on melon cultivation. Adaptation strategies include modifying planting schedules, selecting climate-resilient varieties, diversifying crops, optimizing fertilizer use, applying monitoring technologies, participating in technical training, and seeking alternative livelihoods to reduce vulnerability (Adiyoga et al., 2018). Adaptation levels vary among farmers and are influenced by socioeconomic factors such as age, education, farming experience, land ownership, family dependents, and access to information (Gusti et al., 2021). Older farmers may have richer traditional knowledge aiding adaptation, though younger farmers might be more open to technology adoption (Suryadi et al., 2025).

Farmers' ability to adapt to climate change is critical in mitigating adverse effects on melon cultivation. Adaptation strategies include modifying planting schedules, selecting climate-resilient varieties, diversifying crops, optimizing fertilizer use, applying monitoring technologies, participating in technical training, and seeking alternative livelihoods to reduce vulnerability (Apriyani et al., 2025). Adaptation levels vary among farmers and are influenced by socioeconomic factors such as age, education, farming experience, land ownership, family dependents, and access to information (Aryana Putri, 2017). Older farmers may have richer traditional knowledge aiding adaptation, though younger farmers might be more open to technology adoption (Syukur, 2020).

Despite increasing awareness of climate change among farmers, knowledge gaps remain regarding effective adaptive responses and coping mechanisms (Amirat et al., 2021). Strengthening farmers' capacity through education, extension services, and access to timely climate information is thus paramount (Maru et al., 2023). Employing advanced methodologies such as ordinal logistic regression allows for rigorous analysis of factors affecting adaptation behaviors and helps tailor policy interventions to boost resilience (Agresti, 2010).

This study aims to empirically investigate the adaptive strategies of melon farmers in Rasau Jaya District, Kubu Raya, West Kalimantan, and identify key socioeconomic and institutional factors influencing their adaptation to climate change. The findings intend to contribute to the development of effective climate-resilient agricultural practices and support local governments in designing policies that enhance farmer adaptive capacity for sustainable horticultural production.

2. Theoretical Underpinning

Adaptation to climate change in agriculture is a critical area of study as global warming and environmental variability increasingly threaten crop production and rural livelihoods. Adaptation refers to adjustments in practices, processes, or structures to moderate, cope with, or exploit changes in the environment (Adiyoga et al., 2018). In the context of melon farming in Rasau Jaya, adaptive capacity includes farmers' ability to adjust planting patterns, select resilient varieties, diversify crops, optimize inputs, and seek alternative income sources to sustain productivity under changing climatic conditions.

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Climate change manifests through increased temperatures, erratic rainfall, droughts, floods, and pest outbreaks, all directly impacting agricultural systems (Ainurrohmah et al., 2022). In West Kalimantan, observed shifts in rainfall patterns and rise in frequency of peatland fires demonstrate local climatic stressors confronting farmers (Nazarudin, 2010). Melon plants (Cucumis melo L.) are particularly vulnerable to these climatic shifts due to their sensitivity to temperature extremes, moisture variability, and pest pressures (Wilujeng et al., 2024). These vulnerabilities underscore the importance of effective adaptive strategies to safeguard productivity and farm incomes.

According to the IPCC (2001), adaptive capacity is defined as the ability of systems, individuals, or communities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. In melon farming, adaptive capacity is shaped by socioeconomic factors such as age, education, land tenure, family dependents, farming experience, and information access, which condition farmers' decisions and options for adopting adaptive measures (Wulansari, 2022).Older farmers often bring experiential knowledge while younger farmers may have greater openness to innovation (Suryadi et al., 2025). Land ownership provides security that encourages long-term investments in adaptation (Aryana Putri, 2017). Meanwhile, access to timely and relevant climate information empowers farmers to anticipate and respond effectively to environmental changes (Maru et al., 2023).

3. Research Method

3.1. Research Location and Time

This research was conducted in Rasau Jaya District, Kubu Raya Regency, West Kalimantan. This location was chosen because it is a central melon-producing area in the region, directly affected by climate variability. Data collection occurred in 2025, focusing on the active farming season to capture the most relevant adaptive practices (BPS West Kalimantan, 2023).

3.2. Research Approach and Design

The study employed a mixed methods approach combining qualitative and quantitative research. This approach allowed a comprehensive understanding of both the adaptation strategies used by farmers and the statistical analysis of factors influencing adaptation behavior (Suryadi et al., 2025).

3.3. Population and Sampling

The population consisted of all melon farmers in Rasau Jaya District. A sample of 40 respondents was selected using purposive sampling to focus on active melon farmers who have experienced climate impacts, supplemented by snowball sampling to enrich data reliability (Cahyani, 2024; Suryadi et al., 2025).

3.4. Data Collection Methods

Primary data were gathered through structured questionnaires, in-depth interviews, and direct observation of farming practices. The structured questionnaire collected data on demographic characteristics, farming experience, land ownership, adaptive practices, and access to information. Interviews provided qualitative insight into the reasons behind specific adaptation choices (Handayani et al., 2017; Apriyani et al., 2025).

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3.5. Research Variables

This study measures melon farmers' adaptation to climate change through various indicators, such as changes in cropping patterns, crop varieties, crop types, fertilizer types, intercropping, use of monitoring technology, technical training, and seeking alternative employment. Each indicator is measured on a 3-point Likert scale (1 = disagree to 3 = agree).

The independent variables analyzed include age, education, farming experience, land area, number of dependents, land ownership status, access to climate change information, and off-farm employment. These variables play a role in determining farmers' adaptability to changing climate conditions, which will inform the design of interventions to improve agricultural resilience and productivity.

3.6. Data Analysis

This study used ordinal logistic regression to examine the relationship between melon farmers' adaptation levels to climate change (an ordinal dependent variable with categories of low, medium, and high) and various independent variables (continuous and categorical). This method is appropriate because the dependent variable has ordinal levels without equal spacing between categories.

Data Preparation

Farmers' adaptation was measured using 16 indicators using a 3-point Likert scale (1 = disagree, 2 = moderate, 3 = agree). The total adaptation score was calculated by summing the indicator scores and then categorized as follows:

Low (16–26): Farmers have not yet adapted

Moderate (27–37): Farmers are quite able to adapt

High (38–48): Farmers have adapted well

Ordinal Logistic Regression Modeling

An ordinal logistic regression model was used to estimate the effect of predictor variables (age, education, experience, land area, family dependents, land ownership status, access to climate information, and off-farm employment) on the probability of farmer adaptation across three categories. Logit function model:

$$Y=\ln(PjPi)=\beta 0+\beta 1X1+\beta 2X2+\cdots+\beta 10D1+\beta 11D2+\beta 12D3$$

Model Evaluation

Goodness of Fit: Used to measure the model's fit to the data using Pseudo R^2 (Cox & Snell, Nagelkerke).

Model Suitability Test: Tests the overall significance of the model to ensure it is representative and suitable for use.

Parameter Significance Test (Wald Test): Tests the significant influence of each independent variable on the dependent variable using the Chi-Square distribution. A variable is considered influential if its probability value is <α.

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4. Special Guideline for Manuscript Writing Content

4.1 Overview of the Research Area

Rasau Jaya District is located in Kubu Raya Regency, West Kalimantan, Indonesia, encompassing six villages: Rasau Jaya Umum, Bintang Mas, Rasau Jaya III, I, II, and Pematang Tujuh. The area covers approximately 111.07 km^2 with a population of approximately 27,790, making it one of the smallest districts in the regency. It borders Sungai Raya and Sungai Kakap Districts to the north and west, Kubu and Teluk Pakedai Districts to the south, and Sungai Raya to the east. Its proximity to Pontianak City, the provincial capital, makes Rasau Jaya a strategic and developing area.

The climate in Rasau Jaya District is humid tropical, with average temperatures of 24–34°C and high humidity. Rainfall is quite high, with a rainy season significantly impacting agricultural activities. Unpredictable weather conditions due to climate change are a major challenge for farmers, especially melon farmers, who rely heavily on stable weather patterns to maintain the quality and yield of their crops.

Melons have significant economic potential in this region, but face the risk of seedling and harvest failure due to extreme, unpredictable climates. Melon farmers are adopting various adaptation strategies, including adjusting planting times and changing cultivation techniques, to address these risks and maintain agricultural productivity amidst climate change (Dwi Cahyani et al., 2024).

4.2 Respondent Characteristics

The study involved 40 melon farmers who were interviewed using a questionnaire in May–June 2025. Respondent characteristics provide a snapshot of the farmers' backgrounds and help analyze the factors influencing their adaptation strategies to climate change.

- Age: The majority of farmers (47.5%) are in the productive age group of 31–50 years, who have greater energy and motivation to adopt adaptation innovations (Suryadi et al., 2025)
- Education: Most farmers have a junior high or high school education. Education is considered important in understanding and implementing adaptation technologies, although field experience also plays a significant role (Tiara Yanti et al., 2022)
- Farming Experience: Farming experience varies, with 65% of farmers having more than 5 years of farming experience, which strengthens their ability to adapt to climate change through local knowledge and adaptive cultivation techniques (Anisah, 2019)
- Land Size: Land sizes range from 0 to more than 3 hectares, with larger land areas allowing for diversification and the implementation of better agricultural technologies (Kurniastuti, 2025)
- Family Dependents: The majority of farmers have 0-2 dependents, but families with more dependents indicate a need for more creative adaptation strategies to maintain the sustainability of the agricultural economy (Oktaviani & Saptutyningsih, 2018)
- Land Ownership Status: 60% of farmers own private land, which provides flexibility in management and adaptation investment, while farmers with leased land tend to have limited management decisions (Yunika, 2024)
- Access to Information: Some farmers have access to climate change information, which is essential for timely and effective adaptation decision-making (Dwi Cahyani et al., 2024)
- Off-farm Employment: Most farmers engage in additional off-farm employment as an economic strategy to strengthen resilience to climate change risks (Tania & Amar, 2022).

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This characteristic reflects the combination of experience, resources, and access to information that shape the extent and manner in which melon farmers in Rasau Jaya adapt to climate change based on local socioeconomic conditions.

4.3 Melon Farmers' Adaptation to Climate Change

This study used quantitative descriptive analysis with 16 adaptation indicators measured on a Likert scale (1 = disagree, 2 = moderate, 3 = agree). The total adaptation score was calculated by summing the indicator scores and divided into three categories: low (16–26), moderate (27–37), and high (38–48).

Farmers in the low category have not been able to adapt effectively, still relying on traditional cropping patterns and lacking access to information and adaptive agricultural technology, making them highly vulnerable to the risks of extreme climate change.

The moderate category indicates that farmers are beginning to adapt and are aware of climate impacts, making some adjustments such as changing planting times and using simple techniques, but still have limited capital and knowledge.

The high category consists of farmers who actively implement adaptation strategies such as the use of efficient irrigation technology, extreme climate-resistant crop varieties, farm diversification, and regular access to information and training.

The distribution of results shows that 45% of farmers fall into the moderate category, 32.5% fall into the low category, and 22.5% fall into the high category. The majority of farmers choose adaptation strategies such as changing crop types, fertilizers, and intercropping, indicating a focus on crop cultivation. However, most farmers still lack the ability to implement effective adaptation, necessitating increased training, outreach, and access to technology to strengthen farmer resilience (Suryadi et al., 2025).

4.4 Results of Data Analysis

1. Uji Goodness of Fit

Tabel 1. Goodness of Fit Test Results

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	206.296	63	.000
Deviance	53.945	63	.785

Source: Processed Data, 2025

Based on Table 9, the Pearson Chi-Square value is 206.296 with 63 degrees of freedom (df) shows a significance value of 0,000. Because this significance value is smaller than the 0.05 significance level, then it can be concluded that there is a significant difference between observation data and expected distribution. Thus, hypothesis zero (H_0) which states that the data follows the expected distribution rejected. This indicates that the model is not completely appropriate with data based on this test.

However, different results are shown by the Deviance test, which produces a value of 53.945 with 63 degrees of freedom, as well as value significance of 0.785. Because this p-value is much greater than 0.05, then 44 there is not enough evidence to reject the null hypothesis. That is, the model is still considered fit or in accordance with the data based on the deviance test.

Difference in results between Pearson Chi-Square and Deviance tests shows that interpretation of model fit needs to be done carefully be careful. These two statistics do

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measure different aspects model evaluation: Pearson is more sensitive to cells with small frequencies, while deviance provides a general overview of the whole models.

2. Model Feasibility Test

Tabel 2. Model Feasibility Test Results

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	83.432			
Final	55.332	28.100	13	.009

Source: Processed Data, 2025

The -2 Log Likelihood value in the Intercept Only model is 83.432, while in the Final model it is 55.332. This decrease in value indicates that the final model has a better fit to the data. The Chi-Square value is 28.100 with 13 degrees of freedom and a significance value of 0.009 (< 0.05) indicating that the difference between the basic model and the final model is statistically significant. In other words, the addition of predictor variables in the final model makes a significant contribution to improving the quality of the model. These results indicate that the final model is significantly better than the model using only the intercept. Therefore, the final model is considered feasible and can be used in the analysis process to explain the relationship between the predictor variables and the dependent variable.

3. Pseudo R-Square Test

Tabel 3. Pseudo R-Square Test Results

Pseudo R-Square	
Cox and Snell	.505
Nagelkerke	.573
McFadden	.331

Source: Processed Data, 2025

The Cox and Snell R^2 value of 0.505 indicates that around 50.5% of the variation in the dependent variable can be explained by the model. However, because the maximum value of Cox and Snell R^2 cannot reach 1, the Nagelkerke R^2 measure is used which is a corrected version of Cox and Snell. The Nagelkerke R^2 value of 0.573 indicates that the model is able to explain around 57.3% of the variability in the dependent variable which is quite good in the context of logistic regression.

Meanwhile, the McFadden R^2 of 0.331 also shows that the model has adequate fit, considering that McFadden values above 0.2 are generally considered to indicate a good model. So the Pseudo R-Square value shows that the logistic regression model used has quite good abilities in explaining the relationship between the independent variable and the dependent variable. With a Nagelkerke value approaching 0.6 and a McFadden value above 0.3, the model can be said to have predictive quality that is worthy of further analysis.

4. Ordinal Logistic Regression Test and Significant Parameters (Wald Test)

Data analysis was carried out using ordinal logistic regression, namely statistical methods designed to analyze relationships between variables dependent ordinal scale and one or more independent variables. This approach is suitable for use when there are categories in the dependent variable has a certain order, but the distance between categories is not uniform. 46 With ordinal logistic regression, researchers can estimate probabilities

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cumulative that a response falls into a particular category or more low, based on the value of the predictor variables used (Agresti, 2010).

To find out whether each variable is independent has a significant influence on the dependent variable, is carried out parameter testing using the Wald test. This test aims to test the null hypothesis is that the regression coefficient is equal to zero, which means no influence. If a significance value (p-value) is produced less than 0.05, then the variable is considered to make a significant contribution significant in the model and has an important role in explaining variation in results (Hosmer et al., 2013).

Ordinal logistic regression testing is accompanied by the Wald test thoroughly provides clear information regarding the variables that significantly influence category shifts the dependent variable is on an ordinal scale. Therefore, the results of this analysis plays an important role in identifying the determinants and can used as a basis for decision making or policy formulation which is supported by strong statistical evidence (Long & Freese, 2006).

This study uses ordinal logistic regression for analyze the influence of various factors on the level of farmer adaptation to climate change. The adaptation level categories are divided into three: low, medium, and high. Independent variables used namely age (X1), education (X2), farming experience (X3), land area (X4), number of dependents (X5), land ownership status (D1), and access to information climate change (D2), off-farm employment (D3).

Tabel 4. Parameter Significance Test Results (Wald Test)

Parameter Estimates

	Estimate	Std. Error	Wald	df	Sig.	Exp (Beta)
[Adaptation= 1]	-23.067	1.794	165.366	1	.000**	
[Adaptation= 2]	-19.692	1.716	131.695	1	.000**	
[Age=1]	3.049	1.278	5.692	1	.017*	1.017
[Age=2]	.597	.885	.454	1	.500	1.649
[Age=3]	0[a]	.	.	0	.	.
[Education=1]	-1.763	1.414	1.556	1	.212	1.236
[Education=2]	-.876	1.151	.580	1	.446	1.562
[Education=3]	0[a]	.	.	0	.	.
[Experience=1]	1.657	.965	2.949	1	.086	1.090
[Experience=2]	.207	.981	.045	1	.833	2.300
[Experience=3]	0[a]	.	.	0	.	.
[Wide=1]	-.613	1.156	.281	1	.596	1.815
[Wide=2]	-.875	.949	.851	1	.356	1.428
[Wide=3]	0[a]	.	.	0	.	.

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[Amount=1]	-20.803	.881	558.164	1	.000**	.
[Amount=2]	-20.172	.000	.	1	.	.
[Amount=3]	0[a]	.	.	0	.	.
[Status=0]	-1.603	.842	3.620	1	.057	1.059
[Status=1]	0[a]	.	.	0	.	.
[Information=0]	-2.396	1.125	4.537	1	.033*	1.034
[Information=1]	0[a]	.	.	0	.	.
[Work=0]	-.176	.899	.038	1	.845	2.328
[Work=1]	0[a]	.	.	0	.	.

Source: Processed Data, 2025
Information: * < 0.05 and ** < 0.01

The results of the ordinal logistic regression analysis produce two cumulative logit functions as following:

$$\text{Logit } (Y \leq 1) = -23.067 + 3.049X1_1 + 0.597X1_2 - 1{,}763X2_1 - 0{,}876X2_2 + 1{,}657X3_1 + 0{,}207X3_2 - 0.613X4_1 - 0.875X4_2 - 20.803X5_0 - 20{,}172X6_0 - 1.603D_1 - 2.396D_2 - 0.176D_3$$

$$\text{Logit } (Y \leq 2) = -19.692 + + 3.049X1_1 + 0.597X1_2 - 1{,}763X2_1 - 0{,}876X2_2 + 1{,}657X3_1 + 0{,}207X3_2 - 0.613X4_1 - 0.875X4_2 - 20.803X5_0 - 20{,}172X6_0 - 1.603D_1 - 2.396D_2 - 0.176D_3$$

The Wald test results show that several variables have a significant influence on the adaptation opportunities of melon farmers, with a significance value of Sig. < 0.05 and the Exp(Beta) value indicates a tendency to adapt. The adaptation strategy variable has a very strong and significant influence at low and medium adaptation levels, supporting the view that appropriate adaptation strategies increase farmers' adaptive capacity.

Age, especially the 17-30 year age group, also significantly influences adaptation, where productive age increases the opportunity for adaptation due to better work energy and learning abilities, while shorter farming experience tends to reduce the opportunity for higher adaptation. The number of family dependents has a very significant effect; farmers with more dependents tend to have greater economic motivation to adapt.

Access to climate information also plays an important role in increasing farmers' adaptive capacity, with access to information increasing opportunities for appropriate adaptation according to the findings of. Land ownership status approaches significance, with farmers without their own land being more cautious in making adaptation decisions due to limited long-term investment. Farming experience and land ownership play an important role in farmers' adaptation readiness.

Meanwhile, the variables education, land area, and off-farm employment did not show a significant influence on the level of adaptation, indicating that these factors are less dominant than age, experience, access to information, and number of dependents in the context of melon farmers' adaptation to climate change.

The explanation of the Wald test in ordinal logistic regression is to test the significance of the influence of each predictor variable on the response variable partially, with a Sig value. <0.05 indicates that the variable has a significant effect, and the Exp(Beta) value indicates the probability of the variable's tendency towards the farmer's level of adaptation.

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5. Conclusion

Adaptations made by melon farmers to climate change are partial large is in the medium category (45%), with the main strategy being crop diversification, use of different fertilizers, and intercropping systems. This shows that farmers have begun to adapt, but implementation optimal strategy still needs to be improved through knowledge, information, technology, and institutional support.

Factors proven to have a significant influence on the level of adaptation are farmer's age, number of family dependents, access to climate information, status land ownership, and farming experience. Meanwhile, formal education, land area, as well as work outside agriculture do not have a significant effect on adaptation level.

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