Determinants of Farmers' Perception on Causes, Impacts, and Uncertainty to Climate Variability in Food Storage Areas in Bengkulu Province, Indonesia

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Abstract

Agricultural development is currently faced with various biophysical constraints and problems, including climate variability, which threatens economic resilience and vulnerability through cropping season chaos and decreased agricultural land productivity. This research aims to study farmers' perceptions of climate variability's causes, uncertainties, and impacts on rice farming. The survey research was conducted on rainfed rice farming in the food barn area of Seluma Regency, Bengkulu Province, with 100 rice farmers selected purposively. Data was collected through the interview method using a structured questionnaire. The results of the study found that most farmers perceive that climate variability is due to deforestation. In the vicinity of the research location, there have been a lot of area expansions carried out by felling trees to open oil palm plantations. However, not even a few rice farmers have converted their paddy fields into oil palm plantations. Climate variability also causes pest attacks to increase during prolonged droughts so that many rice plants are damaged and grain production decreases. Lack of access to climate information and low levels of education cause farmers to have limited ability and knowledge to respond to climate variability. Moreover, farmers understand climate variability is only limited to changes in the rainy season and dry season.

Keywords: Perception; farmer; climate variability.

Introduction

Farmers' perception of climate variability is a complex process that includes a range of psychological constructs such as knowledge, beliefs, attitudes, and practices related to how the local climate has varied (Whitmarsh and Capstick, 2018). Climate change has caused severe impacts in all parts of the world, including Bengkulu Province, which resulted in increased vulnerability of the community is one of the reasons low awareness of the community to adapt to its impacts. Studies on climate variability and perception has been widely carried out (Whitmarsh and Capstick, 2018; Somboonsuke et al., 2018; Singh, 2020; Mairura et al., 2021). However, most research on perceptions of climate change relates to climate variables such as a change in average temperature (Asrat and Simane, 2017; Jha and Gupta, 2021), change in average rainfall (Khanal, 2014; Tripathi and Mishra, 2017; Jha and Gupta, 2021). As discussed in this study, there is still limited research on perceptions of climate variability involving farmers' perceptions of causes, impacts, and uncertainty to climate variability.

Some experts predict that in the tropics, there will be a decline in agricultural productivity and an increase in poverty levels because the livelihoods of the majority of the population who work in the agricultural sector are also becoming increasingly vulnerable as a result of climate variability stress (Aydinalp & Cresser, 2008; Lama & Devkota, 2009). Climate variability in the agricultural sector will influence resources, agricultural infrastructure, and agricultural production systems to aspects of food security and independence and the welfare of farmers and society in general. Areas that are poor and highly vulnerable to climate variations tend to be more at risk of experiencing food shortages. The prolonged drought followed by crop failure that hit Indonesia is one example of the impact of climate change that has consequences for acute malnutrition for the community. Studies conducted by SEAMEO-Biotrop show that an average temperature change of 2°C can threaten food production shortages. Rice production will reach a record deficit of 89 million tonnes, or 36% of the total production needed to feed Indonesia's population by 2050 (Rosenzweig & Parry, 1994; Naylor *et al*., 2002; Partnership, 2008).

The research in Bengkulu Province is interesting because it is the third poorest province in Indonesia and has a long coastline of 512 km, making Bengkulu Province vulnerable to natural disasters, earthquakes, and tsunamis (BPS, 2017). However, farmers' knowledge about climate change is still minimal. Research on farmers' perceptions of climate variability, especially rainfed farmers, is still very limited in Bengkulu Province, carried out in the plantation sector (Irawan and Syakir, 2019) and capture fisheries (Mulyasari et al., 2018). Farmers are synonymous with poverty because of the great uncertainty about the impact and magnitude of climate variability. Research conducted by Krishnamurthy, et al., (2014) shows a high correlation between hunger and climate risk, especially for areas most affected by food insecurity. Therefore, farmers are key stakeholders in the debate on climate change. Concern and perception about a problem, such as climate change, will shape action or action on the issue (Nzeadibe & Ajaero, 2010). This study aims to analyze the perceptions of rainfed farmers regarding causes, impacts, and uncertainty to climate variability and the factors that influence farmers' perceptions. Thus, understanding farmers' perceptions of the impact of climate change is significant because these perceptions shape the readiness of farmers to adapt and adjust cultivation techniques.

Theorizing of Farmers' Perception and Climate Change

In psychology and the cognitive sciences, perception is the process of attaining awareness or understanding of sensory information. According to the Wikipedia dictionary, perception comes from the Latin word "percepio" meaning receiving, collecting, and taking possession apprehension with the mind or sense. What one perceives is a result of interplays between the experience of one's culture and interpretation given to the perceived. If what is being perceived does not have support in any of the above-mentioned perceptional bases, it cannot be said to be perceptible. Perception is a person's understanding of everything seen or felt, especially about awareness of the environment, that can be used to study human relations with the environment as perceived by farmers on climate change (Walgito, 2010).

Climate change is defined as a change in the pattern and intensity of climate elements. Indications of climate change can be seen from changes in climate parameters, namely temperature, wind, rain, and other parameters. Changes in these parameters are due to various extreme events that occur in continuous climate variability. In addition, climate change is influenced by latitude, slope, altitude, distance to the waters, and ocean currents (Nugroho, 2016). According to the Intergovernmental Panel on Climate Change (IPCC), climate change refers to changes in the average change and/or variability of climate traits, which occur over a long period, usually decades or more.

Meanwhile, based on the United Nations Framework Convention on Climate Change (UNFCCC), climate change refers to 1). natural climate variability observed over a period of time; 2). climate change is caused by human activities that change the composition of the global atmosphere (IPCC, 2007).

Farmers perceive climate change through climate indicators. Farmers perceive the occurrence of climate change because 1). changes in temperature and precipitation (Bewket, 2012; Fosu-Mensah, *et al*., 2012; Bryan, *et al.*, 2013; Gebrehiwot & van der Veen, 2013; Kassie, *et al*., 2013; Sarker, *et al*., 2013; Roco, *et al*., 2014; Limantol, *et al.*, 2016; Arunrat, *et al*., 2017); 2). wind changes (Esham & Garforth, 2013; Yaro, 2013; Barrucand, *et al.*, 2017); 3). extreme climate events such as floods and droughts (Esham & Garforth, 2013; Sarker, *et al*., 2013); 4). shift of seasons (Kurniawati, 2012). The most perceived indicators of climate change by farmers are rainfall and temperature. Other climate elements, such as wind, are felt by farmers to be unchanged (Kurniawati, 2012).

Farmers know the occurrence of climate change through various ways such as feeling rising temperatures, erratic rainfall, warmer and stronger winds over the past few years. However, farmers perceive climate change more to the conditions felt by farmers such as drought, very hot air, changing rain patterns, strong winds, late start of the rainy season, ending of the rainy season and very hot sun are indications of climate change (Murniati, 2014). According to FAO (2011), farmers in Ethiopia and Uganda observed that there were marked increases in temperature and rainfall for the past five years. The same observation was made by Bryan, *et al*., (2013) through their study in Ethiopia and South Africa.

Climate change has an impact on farmers' lives. Climate change can affect the planting season and harvest time, decrease in planting area and harvest (Ruminta, 2015), cropping patterns and productivity (Rejekiningrum, *et al*., 2011), increase in the development of pests and diseases (Nirdayana, *et al.,* 2011), decline in soil conditions (Fatuase, 2016), reduced yields or even crop failures in farming (Le Dang *et al.*, 2013), decreased or lost income, condition of livestock becoming weak or even sick, loss of savings (Uy, *et al*., 2011). Climate change also causes an increase in migration to other areas because drought causes a decrease in agricultural production, and high rainfall causes flooding in low-lying areas (Shamsuddoha & Chowdhury, 2009). Disrupted agricultural production due to climate change can also affect food security (Rejekiningrum *et al*., 2011).

Research Method

This research was conducted in food storage areas in Bengkulu Province, Indonesia (Seluma District). This area has the most extensive rain-fed rice fields in Bengkulu Province, which is 6,266 hectares (BPS Bengkulu Province, 2017). Therefore, Wetland with rainfed irrigation systems is very vulnerable to the impacts of climate variability. The research locations include Talo District (Lubuk Gio Village and Kembang Seri Village) and Ilir Talo District (Penago I Village) (Figure 1).

The survey was conducted in September-November 2020. Respondents of rainfed farmers as many as 100 farmers were interviewed by using a structured questionnaire. The first part of the questionnaire was about farmers' socio-economic characteristics consisting of age, years of schooling, farming experience, household size, farming income, and farming activities. Next was the perception of farmers on causes, impacts, and uncertainty to climate variability.

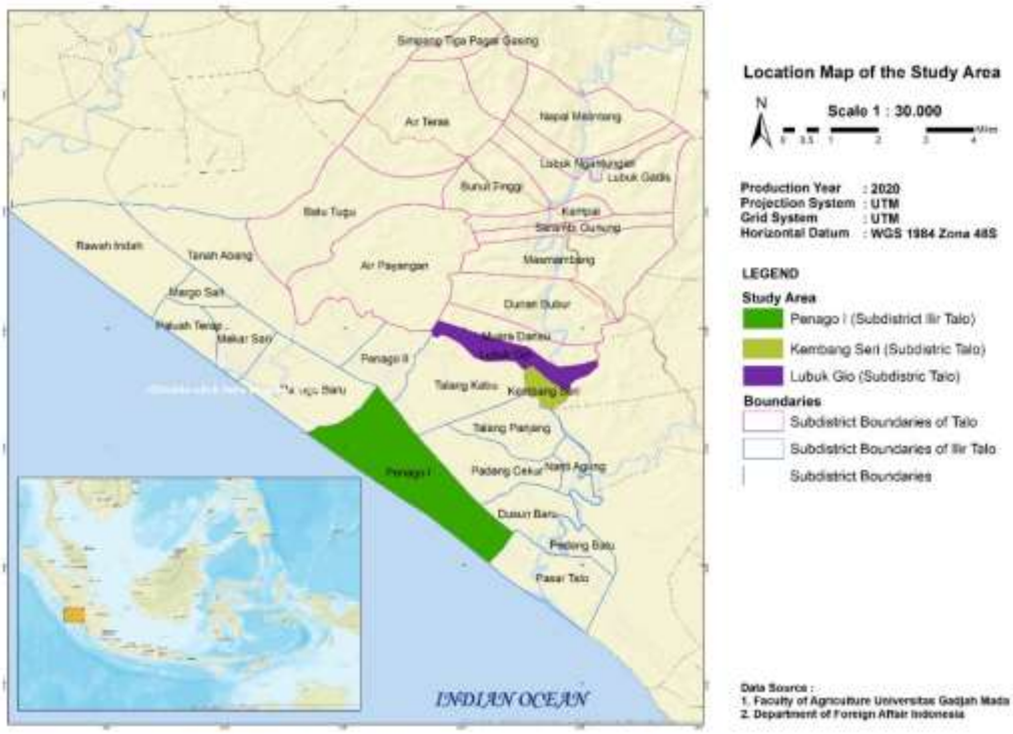

Fig.1. Research locations

Data were analyzed by ordinary least square (OLS) regression analysis. OLS was used to find out important determinants affecting the farmer's perception on climate change. Untuk mendapatkan model regresi yang terbaik maka dilakukan analisis terkait dengan asumsi klasik, yaitu normalitas, multikolinearitas, heteroskedastisitas, dan autokorelasi. Important determinants that affect farmers' perception in were selected based on the previous studies, such as age (Jha & Gupta, 2021) years of schooling (Ojo & Baiyegunhi, 2021), farming experience, farm size (Jha & Gupta, 2021), farming time, and membership organization. The description of each variable used in this study is presented in Table 1.

Tab. 1. *Description of variables*

Variable	Description of variable
Perception	Farmers' perception of climate variability (score)
Age	Age of farmer in years
Years of schooling	Formal education of farmer in years
Farm size	Land area cultivated by farmer (hectare)
Farming time	Time spent by farmer working in the field (hours/day)
Membership organization	Participation of farmer in group (1 = if farmer join a group, 0 = otherwise)

Climate Variability in Seluma District Bengkulu Province, Indonesia

Climate Changes occur globally, but the impact is felt varies locally. The main indicators of climate change consist of changes in the pattern and intensity of various climate parameters, namely temperature, rainfall, wind, humidity, cloud cover, and evaporation. These indicators can be found in Indonesia, although some are very certain (such as temperature and rainfall), and some are very uncertain (for example, changes in evaporation). One of the main obstacles is the availability of data to determine a symptom of climate change over a long period of time. Therefore, this study uses several climate indicators to explain climate variability in Bengkulu Province, namely changes in rainfall, temperature, humidity, wind speed, air pressure, sunlight, and evaporation with monthly data from 2015 - 2017.

***Tab 2**. Climate Variability in Seluma District*

Climate Indicators	Mean	Std. Deviation	Sig.	Information
Temperature (^oC)	27.03	0.48	0.04**	downward trend
Rainfall (mm)	248,23	134,03	0,00***	upward trend
Radiation (%)	67,32	10,85	0,09*	downward trend
Air pressure (mb)	1010,47	0,64	0,04**	downward trend

Source: Secondary data is processed (2020)

Climate indicators were analyzed by using Mann-Kendall analyze with XLSTAT software

* Significant at the 0.1 level

** Significant at the 0.05 level

*** Significant at the 0.01 level

IPCC (2007) states that climate change refers to the variation in the average climatic conditions of a place or its statistically significant variability over a long period. Global warming occurs due to an increase in the greenhouse effect caused by the rise in the concentration of greenhouse gases in the atmosphere. The higher the concentration of greenhouse gases, the more heat radiation from the earth is trapped in the atmosphere and emitted back. This causes an increase in temperature at the earth's surface. But in Seluma district, the results of the analysis using Mann-Kendall show a decrease in temperature in Seluma district. The air temperature in Seluma Regency was analyzed using the average temperature from January 2015 to December 2017.

In the Bengkulu region, rainfall varies greatly according to topography. Rainfall varies from > 6000 mm per year in the western area of Bukit Barisan, to less than 1500 mm per year in the eastern region of Bukit Barisan where Bukit Barisan and the Malay Peninsula block moist air. However, in general, the station recorded that 70% of Bengkulu area received > 2500 mm of rainfall per year. Aldrian & Djamil (2006) explained a downward trend in annual rainfall in the Bengkulu region with a value of 71.79 mm/year from 1968 to 1997. The dry season in most areas of Bengkulu is related to the northeast monsoon, which occurs between December and March, while the primary rainy season occurs during the transition period before the northeast monsoon and after the southwest monsoon, which lasts from May to September. The secondary rainy season occurs around April. However, based on monthly data on average rainfall from January 2015 to December 2017, the Seluma Regency area experienced an increase in rainfall and the research results were obtained using Mann-Kendall analysis.

The sun is the source of life on this earth, emitting its energy in radiation with an extensive wavelength range. Global climate change that has occurred in recent decades is not only determined by human activities. The activity of the solar cycle is also believed to have contributed to the creation of global warming. Some researchers even point out that solar activity in triggering climate change is more dominant than human factors. This is marked by several parameters, including heating other planets in the solar system, especially Mars. Based on the Mann-Kendall analysis (Table 2), there is a downward trend in solar radiation in Seluma Regency. This is in line with the previously discussed climate indicator, namely a decrease in the average temperature in Seluma district.

Global warming has caused more and more unequal patterns of temperature and air pressure spatially (space). Temperature differences occur between the subtropics and the tropics, also in the subtropics or the tropics themselves, resulting in air movement. The higher the difference in air pressure due to the temperature difference, the stronger the winds it causes, leading to storms at certain latitudes. Extreme temperature differences can trigger the emergence of severe weather. Therefore, the calculation of planting season and fishing season is no longer precise. Disasters always come both in the dry season and in the rainy season. In contrast to the statement, the air pressure in Seluma Regency experienced a downward trend from January 2015 – December 2017 (Table 2).

Results and Discussions

Farmers' characteristics

Social and economic characteristics of farmers are used to determine the condition of farmers consisting of age, education, farming experience, number of dependents, land area, and farmers' income.

Tab 3. *Characteristics of Farmers*

Characteristics	Mean			Sig
	Lubuk Gio	Kembang Seri	Penago I	
Age (years)	45.70	51.04	52.00	0.998^{ns}
Years of schooling (years)	8.06	8.10	5.85	0.000***
Farming experience (years)	28.38	21.27	29.55	0.950^{ns}
Household size (person)	3.00	2.00	2.00	0.576^{ns}
Farm size (Ha)	0.51	0.40	0.52	0.252^{ns}
Farming income (Rp/month)	2,480,000.-	2,848,000.-	2,985,000.-	0.014**

Source: Primary data is processed, 2020

a Significance based on One-Way ANOVA for the compare means in proportions between the three groups

*** Significant at 1% level

** Significant at 5% level

ns Not significant

Based on age, farmers are grouped into productive farmers, i.e., between 15-64 years old, and unproductive farmers, i.e.,>64 years old (BPS, 2020). The average age of rice farmers in Seluma Regency is the productive age category with 27 – 76 years. Age is an important variable because it is related to a muscular physique, an essential requirement in work as a farmer and is also related to farmer's work productivity. There is no difference in the age of farmers between the study areas (Table 3). Almost all farmers in Kembang Seri village, Lubuk Gio village, and Penago village have productive age to support work as farmers who require physical solid.

Education is a significant effort made by every human being to improve knowledge and skills and be cultured to increase the quality of resources to participate appropriately in development. Tadjuddin (1995) suggests that education increases knowledge and the skills (expertise) of the workforce, which in turn can increase productivity. This affects the way of thinking, reasoning, insight, flexibility, and depth of knowledge. However, there are differences in the level of education of farmers in the study area (Table 3). The average level of formal education of farmers in Seluma Regency is 7.34 years and rice farmers in Penago I Village have the lowest intermediate education compared to Lubuk Gio Village and Kembang Seri Village. This is because many rice farmers still do not go to school or do not take formal education. Overall, the average education of farmers does not reach the nine-year education target that has been proclaimed and set by the Indonesian government. The level of education of farmers is deficient and reflects the poverty of farmer households in Indonesia.

Experience is an essential factor in working as a farmer and is the primary capital for developing a farm. The longer experience a farmer has in doing rainfed rice farming, the greater the ability for the farmer to manage his farm and face various obstacles in rice farming. There is no difference in the experience of farmers in the three research areas (Table 3). Overall, rice farmers have a relatively high average experience of 26.48 years. This shows that farmers never switch jobs as farmers. The low level of education means that farmers do not have the opportunity to get other jobs outside the agricultural sector. Based on the study results, most farmers have farming experience ranging from 23 - 31 years. Although rice farming has been started for a long time, the geographical conditions that support Indonesia as an agricultural country make most people dependent on their livelihood as farmers.

The results showed that the number of dependents of rice farming families in Seluma Regency ranged from 0 - 6 people and did not differ in the three research villages (Table 3). Farmers can use labor in the family to carry out rice farming and to earn income from outside rice farming. In addition, most rice farmers still cultivate rice on a small scale, namely 0.50 hectares with an average land area of 0.56 hectares. The land area will affect the ability of farmers to adapt to climate variability. The larger land area will require resources, significantly larger funds to take adjustment steps in rice farming to reduce the negative impact of climate variability.

According to Suratiyah (2020) the amount of income is influenced by complex factors, namely internal factors, and external factors. There is a significant difference between the income of farmers in the study area. The average income of rice farmers in Lubuk Gio Village is the lowest compared to rice farmers in Penago I Village and Kembang Seri Village. This is due to the rice fields in Lubuk Gio Village, adjacent to the river, so it is often flooded when the rainy season comes. As a result, farmers experience a higher risk of failure compared to farmers in other areas.

Perceptions on Causes to Climate Variability

The causes of climate variability are assessed from various indicators which are factors that cause changes in various climate indicators based on previous research and felt by rice farmers in the research area, which include forest fires, continuous cultivation of plants, burning of plant/household waste, smoke from burning industry, excessive use of agricultural chemical inputs, motor vehicle fumes, deforestation, use of firewood for cooking, and high use of irrigation water.

The results (Table 4) show that most farmers perceive climate variability to be due to deforestation. In the vicinity of the research location, there have been a lot of area expansions carried out by felling trees to open oil palm plantations. Not even a few rice farmers have converted their paddy fields into oil palm plantations. Around the riverbanks, many people have turned them into oil palm plantations, which can damage the Talo watershed.

Tab 4. *Farmers' perception on causes to climate variability*

Indicators	Distribution of farmers (%)			Seluma District
	Lubuk Gio	Kembang Seri	Penago I	
Forest fire	53.33	54.00	50.00	52.44
Continuous planting/farming	0.00	0.00	0.00	0.00
Crop waste or household waste burning	0.00	0.00	0.00	0.00
Industrial fuel burning smoke	60.00	44.00	40.00	48.00
Excessive use of farm chemical inputs – pesticide and fertilizer	6.67	4.00	5.00	5.22
Pollution from motor – vehicle fuel	56.67	42.00	40.00	46.22
Deforestation	73.33	70.00	80.00	74.44
Use of woods for cooking	0.00	0.00	0.00	0.00
Irrigation water overuse	13.33	16.00	20.00	16.44

Source: Primary data is processed, 2020

Forest fires are also a factor causing climate variability perceived by some rice farmers in the study area. The problem of land conversion is the reason for the occurrence of forest fires. All forest land clearing processes are carried out by burning land considering that heavy equipment is too expensive and takes a long time while burning forests only requires low cost and more efficient time. And the land that has occurred in recent years has indeed become a significant threat to Indonesia. In addition to damaging tropical wetland ecosystems, forest and land fires will accelerate the process of climate change/variability. Forest and peatland fires on Sumatra Island in 2015 had reached 1.5 million hectares. Fires occur due to the destruction of forest ecosystems after being converted into industrial forest plantations, especially for oil palm plantations. Recovery of damaged land and forest ecosystems that are burned will take a long time of around 30 to 50 years.

Perceptions on Impacts to Climate Variability

Climate change/variability has many negative impacts on rice farming: faster harvesting, declining rice quality, increasing irrigation costs, using more inputs to increase production costs, hotter temperatures making it difficult for natural enemies to thrive. In addition, increased pest attacks, decreased productivity, improved harvest handling and marketing costs, higher risk of crop failure, and high risk of farming losses affect the sustainability of farming.

The majority of farmers felt that pest attacks increased during long droughts so that many rice plants were damaged and grain production decreased (Table 5). Many farmers finally choose to sell grain because they do not have the cost to mill the grain. Where the price of grain sold by farmers is around Rp. 4,000,-/kg up to Rp. 4.500,- /kg. In addition, most farmers also feel a high risk of crop failure and decreased productivity due to climate variability. Farmers' perceptions of the negative impact of climate variability on farming confirm the results of previous research conducted by Rejekiningrum, *et al.* (2011), Bewket, *et al.* (2012), Moghariya (2012), Swe (2015), Ayanlade, *et al.* (2017), Berhe, *et al*. (2017) and Adiyoga & Basuki (2018). Adiyoga & Basuki (2018) state that the prolonged dry or rainy season due to climate variability causes the yield produced per unit area (productivity) to decrease. Climate variability impacts warmer temperatures, making it difficult for natural enemies to develop, and an increase in pest attacks and the emergence of new pests.

Lack of access to climate information, low level of education, and recent experience in farming have caused farmers to have limited ability and knowledge in responding to climate variability. For example, farmers understand climate variability is only limited to changes in the rainy season and dry season, while for other climate indicators, farmers do not understand.

Tab 5. *Farmers' Perception on Impacts to Climate Variability*

Indicators	Distribution of farmers (%)			Seluma District
	Lubuk Gio	Kembang Seri	Penago I	
Earlier harvesting date	23.33	18.00	30.00	23.78
Hot temperature pressure that causes decreasing product quality	40.00	48.00	35.00	41.00
Increasing cost of irrigation both in long dry season – buying extra water and in longest season – adjusting drainage	10.00	12.00	10.00	10.67
Changes in cultural practices that tend to demand more intensive use of input – increasing cost of production	20.00	10.00	15.00	15.00
Higher air temperature that causes difficult development of natural enemies	20.00	10.00	15.00	15.00
Higher air temperature that causes the increase of pests/diseases incidence and the emergence of new pests and diseases	70.00	80.00	70.00	73.33
Extremely long dry or wet season that causes yield decrease	40.00	54.00	55.00	49.67
Increasing post-harvest and marketing cost per unit product	23.33	18.00	20.00	20.44
Higher risks of crop failure	60.00	68.00	75.00	67.66
Increasing loss-risk in the farming business that may directly affect farm sustainability	53.33	54.00	55.00	54.11

Source: Primary data is processed, 2020

Perceptions on uncertainty to climate variability

Rice farmers' perceptions of climate uncertainty can be seen from changes in various climate indicators, such as rainfall patterns, temperature, rainfall intensity, time, and rainy and dry seasons. The results showed that about 42.68% of farmers felt climate uncertainty in rice farming (Table 6). Farmers most think that there has been a long dry season, especially in 2019 and 2020. In addition, due to the long dry season, the beginning of the rainy season has experienced a setback so that farmers experience delays in planting rice. However, not a few farmers were forced to grow rice even though the rainy season had not yet come by giving water to the rice planting holes. This is because the rice seeds that farmers have prepared through the nursery stage have to be planted, and if they are not planted, the farmers will experience losses.

Le Dang, *et al.* (2013) stated that farmers feel that the abnormal rainfall pattern is related to the time and distribution of rainfall. Rice farmers in Seluma Regency also feel a change in rainfall patterns in recent years. The results of the Mann-Kendall analysis also show that there is an increasing trend in rainfall in Seluma Regency but the rainfall pattern is uncertain, and the distribution of rain is uneven. This is in line with research conducted by Yaro (2013), Abidoye, *et al*. (2014), Debela (2015), Roco, *et al*. (2014), Kibue, *et al.* (2016), Bewket (2012), and Adiyoga & Basuki (2018).

Tab 6. *Farmers' perception on uncertainty to climate variability*

Indicators	Distribution of farmers (%)			Seluma District
	Lubuk Gio	Kembang Seri	Penago I	
The rainy season is unusually earlier and then followed by dry weeks	36.67	24.00	20.00	26.89
Very uncertain rainfall patterns	33.33	42.00	30.00	35.11
The beginning of the rainy season is postponed	93.33	98.00	90.00	93.78
The long period of the dry season	100.00	100.00	100.00	100.00
Heavy rains and the long period of the rainy season	6.67	8.00	5.00	6.56
Decreasing rainfall	10.00	12.00	10.00	10.67
Increasing air temperature	23.33	34.00	20.00	25.78

Source: Primary data is processed, 2020

Table 6 also shows that farmers do not feel that the rainfall decreases and the rainy season gets longer. Yaro (2013) added that the rainfall pattern is an indicator that is difficult to assess correctly by farmers so that farmers' perceptions of rainfall are sometimes inaccurate. Rainfed rice farming has a high dependence on rainwater, and when the rainy season lasts, farmers have no difficulty doing rice farming. Only most of the farmers in Penago I Village experienced flooding in their rice fields due to the high intensity of rain in the early period of the rainy season. So farmers do pumps to dispose of the water that flooded their areas. Farming is very dependent on rainfall as a source of water, so that farmers will be more aware of changes in rain patterns in this location. According to Yaro (2013), farmers will feel more rainfall patterns in areas with little water.

Uji asumsi klasik

Normality test

In this study, the normality test used was the one-sample Kolmogorov-Smirnov test. The data is normally distributed if the asymp sig value is more than 5%. It can be seen that the value of asymp sig is greater than the value of , which is 0.205 > 0.05. This means that the model used in this study is normally distributed (Table 7).

Tab 7. *Normality test result*

One-Sample Kolmogorov-Smirnov Test	Unstandardized Residual
Kolmogorov-Smirnov Z	1.067
Asymp. Sig. (2-tailed)	0.205

a. Test distribution is Normal.

Source: Primary data is processed, 2020

Heteroscedasticity test

The method used to test heteroscedasticity is the glejser test. Heteroscedasticity test is if the sig value of each independent variable is greater than the value of . The table shows that the sig value of the variable age, years of schooling, farming time, farming size, and group membership is > 0.05. This means that all independent variables do not have heteroscedasticity problems or the model is well used (Table 8).

Tab 8*. Heteroscedasticity test result*

Variable	Sig.
Age	0.692
Years of schooling	0.893
Farming time	0.840
Farming size	0.958
Membership group	0.951

Source: Primary data is processed, 2020

Multicollinearity test

Multicollinearity can be known if an independent variable has a VIF value of less than 10 and a tolerance value of greater than 0.1. It can be seen that the variables of age, years of schooling, farming time, farming size, and group membership obtained VIF value < 10 and tolerance value > 0.1. This means that all independent variables do not have multicollinearity problems or good models (Table 9).

Tab 9*. Multicollinearity test result*

Variable	Collinearity statistics	
	Tolerance	VIF
Age	0.841	1.189
Years of schooling	0.833	1.200
Farming time	0.817	1.224
Farming size	0.943	1.060
Membership group	0.980	1.021

Source: Primary data is processed, 2020

Autocorrelation test

This study uses the Durbin Watson test method to see the presence of autocorrelation. The results of the analysis (Table 10) show that the Durbin Watson value is 1.900 with a DU (Durbin Upper) value of 1.7804 (k = 5 and n = 100). The DW value is greater than the DU value, which means that there is no autocorrelation in the regression model used.

Tab 10*. Autocorrelation test result*

Model Summary	
Std. Error of the Estimate	Durbin-Watson
6.35059	1.900

Source: Primary data is processed, 2020

Determinants of farmers' perception to climate variability

The results of linear regression analysis of the factors that influence rice farmers' perceptions of climate variability show the R^2 value of 0.146, which means the variable that is thought to be able to explain the variance in the accuracy of rice farmers' perceptions of climate variability that occurs is 14.60%. In contrast, other factors explain the rest outside the model that has not been included. Therefore, judging from the F test, the model built is feasible, which can be seen from the significance of the F test (Table 11).

Tab 11. *Result estimation*

Variable	Regression Coefficient	t-hit	Sig t
Constant	42.088	6.388	0.000
Age	-0.198 ns	-0.946	0.828
Years of schooling	0.778 ***	3.744	0.001
Farming time	1.105 ns	0.204	0.889
Farm size	-1.996 ns	-0.694	0.381
Membership group (dummy)	0.435 ns	0.328	0.558
R^2	0.136		
Sig-F	0.016 **		

Source: Primary data is processed, 2020

*** Significant at 1% level

** Significant at 5% level

ns Not significant

Farmer's age does not affect rice farmers' perceptions of climate variability. Farmers in carrying out rice farming are only based on their experience and instincts. Both young and old farmers view climate variability only as changes in the rainy and dry seasons. This is different from Nursalam & Pariani (2001) opinion, which states that age greatly affects a person's level of knowledge and experience, and the older they are, the level of maturity and strength of a person will be more mature in thinking and working.

The analysis results (Table 11) show that years of schooling positively affect farmers' perceptions of climate variability. This shows that the higher the level of education of farmers, the more farmers can feel climate variability and its impact on rainfed rice farming. However, the reality is that people in the research area who perceive have low average education. This follows Soekartawi (2011) opinion, which states that the higher a person's formal education and the more often he attends non-formal education, the more rational a person's mindset is. This means that the low level of education of farmers in the research location makes farmers know and gives a low perception of climate variability.

The length of work and the area of land cultivated by farmers also did not affect farmers' perceptions of climate variability. However, Bengkulu Province belongs to regions with no apparent difference between the rainy and dry seasons. This means that the average rainfall pattern does not distinguish between the dry and rainy seasons (BMKG, 2018). So it is difficult for farmers to understand the symptoms of climate variability.

The participation of farmers in farmer groups does not affect farmers' perceptions of climate variability. The existing farmer groups never discussed changes in climate indicators. Limited access to information and the lack of assistance by extension workers cause farmers not to understand climate variability. In addition, farmer groups are also formed to use the government's inputs and make it easier for farmers to do grain milling.

Conclusion

Climate variability is a symptom caused by climate change. Climate variability causes changes in rainfall and rainfall patterns that result in a shift at the beginning of the planting season and the planting period. Climate variability also causes unpredictable rainfall fluctuations and tends to be erratic. The impact of climate variability threatens the sustainability of rainfed paddy farming in Seluma Regency. The majority of farmers perceive climate variability to occur due to deforestation. In the vicinity of the research location, there have been a lot of area expansions carried out by felling trees to open oil palm plantations. However, not even a few rice farmers have converted their paddy fields into oil palm plantations.

The majority of farmers also feel that pest attacks are increasing due to the uncertain rainy and dry seasons. During the prolonged drought, many rice crops were damaged, and grain production decreased. Many farmers finally choose to sell grain because they do not have the cost to mill the grain. The long dry season also causes the beginning of the rainy season to decline so that farmers experience delays in planting rice. Not a few farmers were forced to plant rice even though the rainy season had not yet come by giving water to the paddy planting holes. This is because the rice seeds that farmers have prepared through the nursery stage have to be planted, and if they are not planted, the farmers will experience losses.

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