Analysis of rice production trends and the effect of harvest failure on insured land area in Aceh Province

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Abstract. Agricultural insurance is a risk transfer that can provide compensation due to farming losses so that the sustainability of farming can be guaranteed. Rice farming insurance (AUTP) is a pilot program or pilot project that has been implemented in Aceh Province since 2015. However, the realization of the insurance program is still very low from the target set. The central government coordinates with local governments to implement the AUTP program by issuing a policy of providing premium subsidies of 80 percent or IDR.144,000/Ha/MT of the total premium of IDR.180,000/Ha/MT. AUTP participants only pay a premium of 20% per hectare of land insured with an insured value of IDR.6,000,000/Ha with conditions damaged or failed in the event attack of the pest and natural disasters at least 75%. The purpose of this study is to see the effect of a simple regression analysis of the area of failed rice harvest on the area of land insured in Aceh Province. This study uses secondary data from 2010-2019. The results of this study via a simple regression analysis indicate that the effect of the area of rice harvest failure on the area of land insured in Aceh Province is not significantly affected.

1 Introduction

Aceh Province is one of the provinces in Indonesia which has extensive agricultural land for rice plants and is a center for rice production. Aceh province is targeted to become self-sufficient in rice and become a national rice barn. Aceh Province itself has 3 (three) main rice-producing centers, namely North Aceh, Aceh Besar and Bireuen Regencies. The data from the Central Statistics Agency (BPS) of Aceh Province in 2020[1] shows the development of harvested area and rice production in Aceh Province during 2015 to 2019 (Table 1).

Table 1. Harvested area and rice production in Aceh Province 2015-2019.

Year	Harvested Area (Ha)	Rice Prod. (Ton)
2015	461.060	2.331.046
2016	429.486	2.205.056
2017	470.351	2.494.613
2018	329.516	1.861.567
2019	310.012	1.714.438

Source: Aceh Central Statistics Agency, 2020

The area of agricultural land tenure is something that is very important in the production process of agricultural business [2]. The total area of agricultural land in Aceh Province has decreased almost every year in the amount of rice production [3]. The decrease in the amount of land is due to an increase in the number and activities of the population and development [4]. Rice farming is very vulnerable to climate change [3], [5]–[8]. This activity has a high level of dependence on climatic and weather conditions[9]–[10]. Therefore, rice farming will always be faced with quite high risks such as a reduction in harvested area and rice production [11].

According to [12] farmers find it difficult to predict when a disaster will occur. Thus the inability of farmers to handle the impact of the risk personally. Therefore the option to transfer or share the risks faced by farmers to fellow farmers or companies is the most rational [13]. Agricultural insurance shows partiality to anticipate the risk of farming losses. This is in line with the research in Nigeria [14] which states that agricultural insurance helps farmers reduce risk.

To minimize farmer losses, the Indonesian government through the Ministry of Agriculture issued the Minister of Agriculture Regulation No. 40 of 2015 concerning the facilitation of agricultural insurance which is technically rice farming insurance (AUTP).

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Agricultural insurance is a risk transfer that can provide compensation due to farming losses so that the sustainability of farming can be guaranteed [13]. With the existence of government policies in the agricultural sector related to agricultural insurance, at least farmers get a guarantee of certainty of the reimbursement of production costs in the event of crop failure and natural disasters that befall the farmers. Agricultural insurance is one of the important methods to protect farmers from big losses and ensures that farmers will have sufficient working capital to finance their rice farming in the following season from January to April 2021[3].

2 Research Method

2.1 Place and time of research

This research was conducted in Aceh Province using secondary data in the form of time series data in 2010-2019. This research was conducted from April to August 2020.

Fig. 1. Aceh Province, Indonesia

2.2 Object and Scope of Research

The object of this research is data on rice production in 2010-2019 in districts that are familiar with rice farming insurance (AUTP) in Aceh Province and data on rice harvest failure in 2015-2019. The scope of this research is limited to rice production trends and projections in districts that are familiar with rice farming insurance (AUTP) in Aceh Province, and to analyze the effect of crop failure on the area of land insured in Aceh Province.

2.3 Data Types and Sources

The types of data and their sources are from the Central Statistics Agency (BPS) [1] and related agencies. The type of data used in this study is secondary data in the form of a time series from 2010 to 2019.

2.4 Analysis Method

The data analysis methods used in this research are trend analysis and simple regression analysis. The first analysis is trend analysis to make an estimate or forecast in the future. Linear trend is the trend of data where the change based on time is constant (constant). The linear trend has the following model [15]:

$$Y_t = \beta_0 + \beta_1 T \quad (1)$$

Where; Y_t is Rice production value in year t ; β_0 is Constant, which shows the value of the data in the initial year; β_1 is The amount of data change from one period to another; T is Year

The second analysis is a simple regression analysis to determine the effect of the area of crop failure (x) with the variable the amount of land area insured (y) where the variable is causal (influence) positive or negative. The simple regression formula is as follows[16]:

$$Y = a + bX + e \quad (2)$$

Where, Y is Total area of land insured; X is area of crop failures; e is Error term; a is Constant (Y value if X is 0); b is Number of regression coefficient direction (value increase or decrease).

The use of sections to divide the text of the paper is optional and left as a decision for the author. Where the author wishes to divide the paper into sections the formatting shown in Table 2 should be used.

2.4.1 Normality test

The normality test aims that the data that is good and suitable for use in research is data that has a normal distribution. The normality test Kolmogorov Smirnov is used to test whether the distribution is normal or otherwise, the results of this analysis are then compared with the critical value. Normality test can be done by looking at the Kolmogorov Smirnov quantity with the following test criteria: Significant number (Sig) ≥ 0.05 , the data is normally distributed; and Significant number (Sig) < 0.05 , the data is not normally distributed.

2.4.2 Classic assumption test

The classical assumption test used in this study is the heteroscedasticity test. Heteroscedasticity test aims to test whether the variance of the residual variance from one observation to another observation occurs in the regression model. The glejser test is carried out to predict the presence or absence of heteroscedasticity in a model by performing absolute regress of residuals from the estimated model on the independent variables. The data is said to be free from heteroscedasticity if the significance value obtained is greater than the confidence level (value) which is 0.05.

2.4.3 Hypothesis testing

a. T Statistic Test (Partial)

The t-statistical test shows how far the influence of one variable area of crop failure individually in explaining the variation of the variable area of insured land. To

perform the t test, namely is by looking at the probability value and the degree of confidence determined in the study. If the significance value < the level of confidence (value) is determined then an independent variable individually affects the dependent variable

b. Coefficient of Determination (R²)

The coefficient of determination (R²) essentially measures how far the independent variable's ability to explain the variation of the dependent variable. The value of R² is used to indicate the magnitude of the regression that is able to explain the dependent variable. The value of the coefficient of determination is between zero and one. A small value of R² indicates the ability of the independent variables to explain the variation of the dependent variable with a very limited extent and a value close to one means that the independent variables provides almost all the information needed to predict the variation of the dependent variable.

3 Result and Discussion

Analysis of Rice Production Trends and Projections in Regencies That Know Rice Farming Insurance (AUTP) Analysis of trends and projections of rice production is a trend movement (tendency) up or down in the long term in a straight line. The average change can increase or decrease. If the trend has an upward trend then the trend is positive. On the other hand, if the trend has a downward trend, the trend is negative[17][18]. The following is an analysis of trends and projections of rice production in districts that are familiar with rice farming insurance (AUTP) in Aceh Province. Districts that have recognized rice farming insurance (AUTP) consist of South Aceh District, Southeast Aceh District, East Aceh District, West Aceh District, Aceh Besar District, Pidie District, Bireuen District, North Aceh District, Southwest Aceh District, Aceh Tamiang District and Aceh Jaya District.

The results of the analysis of trends and projections of rice production in districts that have recognized rice farming insurance (AUTP). There are 7 districts experiencing trends and projections of increased rice production which are Southeast Aceh District, West Aceh District, Aceh Besar District, Pidie District, Bireuen District, North Aceh District, and Aceh Jaya District. However, there are 4 districts whose rice production trends and projections have decreased, namely South Aceh District, East Aceh District, Southwest Aceh District, and Aceh Tamiang District.

3.1 Issues Related to the Lower Level of Rice Production Trends in Several Districts in Aceh Province

3.1.1 South Aceh District

Geographically, the position of the South Aceh District includes the West-South coast of Aceh Province, where most of the residential areas are directly adjacent to the South West coast of Aceh. According to BPS data from 2010-2019 the results of the amount of rice production in South Aceh District tend to fluctuate, whereby in the

past few years there had been a decline in harvested area and yields of rice production. It was recorded in 2019 that the rice harvested area in South Aceh District was 8,607.52 Ha, with a total rice production of 43,980 tons. Quoted from bpbaacehprov.go.id in 2019 there was a flood in South Aceh District which affected 9 sub-districts and also caused landslides in several areas. The impact of the floods that hit a number of areas in South Aceh District caused hundreds of hectares of rice crops owned by farmers in several sub-districts to experience crop failure.

Quoted by [9] in 2018 at least a total of 68.5 hectares of rice fields were flooded, caused by heavy rain that hit several submerged sub-districts namely Tapaktuan, Kota Bahagia, and Bakongan in South Aceh District. In 2017, quoted from Antaranews.com in North Kluet District, tens of hectares of rice plants experienced crop failure caused by the attack of sparrows[21]. This is because farmers in North Kluet District have not implemented a simultaneous rice cropping pattern system, which makes them very vulnerable to the attack by sparrows.

3.1.2 East Aceh District

Quoted from [20] in 2018, East Aceh District experienced drought that hit a number of sub-districts in East Aceh District. Rice fields that experienced drought on average were rainfed rice fields where water sources only existed during the rainy season, other factors the land experienced is the unavailability of irrigation channels in the area. The drought in the area is due to being in a non-technical irrigation area. In 2019, quoted from Baranewsaceh.com, rat pests that attacked rice plants in the Serbajadi Sub-district also greatly disturbed the residents, especially the rice farmers in the villages of Loot, Sekualan, Jering Sunti and Umah Tarin. Rat attacks begin when the plants are 60 days old or when the rice plant begins to contain.

Quoted from [21], thousands of hectares of rice fields experienced drought that hit a number of sub-districts in East Aceh District. Rice fields that are threatened with crop failure include the sub-districts of Nurussalam, Darul Falah, Julok, Darul Aman and Idi Rayeuk. On average, rice fields that experience drought are rainfed rice fields. During the drought, farmers only used river water, which is now running dry. The absence of irrigation or large reserves of water stored in the area during a drought has an impact and the threat of crop failure.

3.1.3 Southwest Aceh District

In early 2018 the Southwest Aceh Agriculture and Food Service (Distanpan) distributed M400 variety seeds to farmers in Southwest Aceh Regency. The M400 seed variety is one of the superior rice seeds developed by the central government, considering the very good yields due to having larger stems with full grains of rice on each stalk, M400 rice varieties are also resistant to pests and weather anomalies. However, many of the seeds of the M400 variety that had been sown by the farmers did

not grow, and some farmers experienced a decrease in the number of harvests, which usually reached 7.5 tons/hectare. Now the average harvest is only about 4.5 tons/hectare caused by planthoppers and rats, and also water drought.

In 2018 in Tangan-Tangan District hundreds of hectares of rice plants owned by farmers were threatened with crop failure caused by the high attack of the pest walang sangit (*Leptocorisa oratorius*). Hundreds of hectares of rice plants that were attacked by the pest walang sangit (*Leptocorisa oratorius*) in the Tangan-Tangan sub-district are now producing panicles. Almost every year the pests attack rice plants in the sub-district, even though the attacked rice plants are already thriving and will soon enter the harvesting period. Walang sangit (*Leptocorisa oratorius*) is a pest that generally attacks rice plants during the panicle releasing phase to ripening by sucking the liquid rice grains. In 2018 in Kuala Bate District, about 10 hectares of the rice plants experienced crop failure caused by planthoppers and rats, and also water drought.

3.1.4 Aceh Tamiang District

Quoted from [20] in 2018 Aceh Tamiang Regency experienced a number of problems in rice farming which resulted in a decrease in the amount of rice production. The problems that occurred in Aceh Tamiang Regency during 2019 included water shortages and uneven water flow to irrigate rice fields, drought in the dry season which resulted in cracked land in the rice fields, no construction of irrigation networks and land conversion of rice fields into palm plantation. Quoted from analysisdaily.com in 2019 in Banyak Payed District and the Bendahara District of about 450 hectares of rice plants were attacked by planthoppers and clovers. The average age of rice plants attacked by the pests is 80 days to three months before harvest. The impact of the planthopper epidemic made the grains of rice blackened like scorched fire which resulted in the rice production of farmers in Aceh Tamiang Regency falling sharply during the harvest season.

The dry season that hit parts of Aceh Tamiang Regency was also the cause of the decline in rice production. At the beginning of 2019 in Banyak Payed District, farmers in the area experienced two time harvest failures due to lack of water and drought in the dry season which caused the rice fields to crack. This is the impact of minimal rainfall, because farmers in the area only rely on rainwater for their rice fields due to the unavailability of irrigation channels in the area.

The decline in the amount of rice production in Aceh Tamiang Regency is related to the increasing conversion of agricultural land to non-agricultural uses. The problems caused are the conversion of rice fields to oil palm plantations will have an impact on disrupting food availability and decreasing the amount of Padi production. The impact of the loss of agricultural land results in permanent loss of agricultural yields, so that if conditions are not controlled, it is certain that there will be a decrease in rice production and the Aceh Tamiang District area will ultimately experiences instability in food security. Data from BPS Aceh Tamiang District

shows that the area of oil palm plantations in Aceh Tamiang District has increased from 19,702 hectares in 2018 to 20,429 hectares in 2019.

3.2 Analysis of the Effect of Harvest Failed Areas on the Insured Land Area

3.2.1 Normality test

The normality test aims to test whether the regression model has a normally distributed residual value or otherwise. A good regression model has a residual value that is normally distributed or close to normal[22]. The normality test in this study used the Kolmogrov-Smirnov non-parametric statistical test. In the Kolmogrov-Smirnov test, if the significance value is below 0.05, it means that the data is not normally distributed and if the significance value is above 0.05, the data is normally distributed.

Table 2. Kolmogorv-Smirnov Normality Test

	Unstandardized Residual
N	5
Asymp. Sig. (2-tailed)	0,753

Based on the results of the normality test regression using the One Sample Kolmogorov Smirnov method via the SPSS application in Aceh Province, the Asymp.Sig value 0.753 was obtained which is greater than the significance level of 0.05 ($0.753 > 0.05$). It can be concluded that the data is normally distributed. This can be interpreted that the variable data on the area of crop failure is normally distributed.

3.2.2 Classic assumption test

Classical assumption test is a requirement in performing a simple regression analysis test. Heteroscedasticity test aims to detect whether in the tested regression model there is an inequality of variance from the residuals of one observation to another observation. If the variance of the observation residuals remains with each other, it is called homoscedasticity and if the variance is different then it is called heteroscedasticity. A good regression model is one that does not occur heteroscedasticity

Table 3. Hypothesis Test Results

Model	t	Sig
Constant	.360	.743
Rice Harvest Failed Area	.326	.766

Where, H0 is The Variable Area of Rice Harvest Failure has no effect on the Insured Land Area variable, and Ha is The Variable Area of Rice Harvest Failure affects the Insured Land Area variable.

From the results of the SPSS output of linear regression analysis, there is a t-count value of the variable area of crop failure of 0.326 which is greater than the t-table of 3.182. So, it can be concluded that H0 is accepted, meaning that the variable area of crop

failure has no effect on the variable area of the insured land.

3.2.3 Coefficient of Determination Test (R²)

The coefficient of determination (R²) is a coefficient to measure how far the ability of a model to explain the variation of the dependent variable. To see more details or to find out how far the variable of rice harvested area to the area of land is insured, it can be seen in the following table.

Table 6. Coefficient of Determination Test Results (R²)

Model	R	R ²	Adj R ²	Std Error of The Estimate
1	0.185	0.034	-.288	1129.35137

Based on the regression results that have been obtained, it is known that the R square value is 0.034 = 3.4%. This means that the independent variable of rice harvested area affects the dependent variable of insured land area by 3.4% and the rest is influenced by other variables (not included in this study). The results of this study strengthen the findings of previous researchers which state that research on rice farming insurance (AUTP) is still in the pilot project stage.

4 Conclusion

Trends and projections of rice production in districts that have recognized rice farming insurance (AUTP) in Aceh Province, are increasing. However, there are 4 districts with declining trends and projections for rice production, namely South Aceh District, East Aceh District, Southwest Aceh District, and Aceh Tamiang District in 2010-2024. There is no significant effect between the area of rice harvest failure and the area of land insured. This shows that the rice farming insurance program (AUTP) has not been the main strategy for farmers in Aceh Province to prevent financial risks. This research proves that the rice farming insurance program (AUTP) is just a pilot project.

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References

1. Badan Pusat Statistik, Provinsi Aceh dalam Angka, 2020. Banda Aceh.
2. D. Clarke, N. Das, F. De Nicola, and R. Hill, The value of (customized) insurance for farmers in rural Bangladesh, in Proceeding Res. Conf. Micro Insur. Twente, August (2012)
3. S. M. Pasaribu, J. AASPRO **1** (2010)
4. A. Haris, L. B. Subagio, F. Santoso, and N. Wahyuningtyas, JPG **5**, 2 (2019)
5. K. Y. Clement, W. J. Wouter Botzen, R. Brouwer, and J. C. J. H. Aerts, J.IJDRR **28** (2018)

6. H. T. Abebe and A. Bogale, J. Energy Environ., **1**, 2 (2014)
7. N. K. Budhathoki, J. A. Lassa, S. Pun, and K. K. Zander, J. Landusepol **85** (2019)
8. M. Mustika, A. Fariyanti, and N. Tinaprilla, FAGB **9**, 2 (2019)
9. R. Zhang and D. Fan, J. Agric. Sci., **8**, 3 (2016)
10. C. Mina, C. Reyes, R. Gloria, and S. Mercado, Discuss. Pap., (2015)
11. M. Algazali, M. H. Jamil, and N. Lanuhu, Persepsi Petani Terhadap Asuransi Usahatani Padi (AUTP) Di Kecamatan Paletang Kabupaten Pinrang,
12. P. C. Ajieh, J. Agric. Sci., **1**,1 (2010)
13. Insyafiah and I. Wardhani, Kajian Persiapan Implementasi Asuransi Pertanian Secara Nasional, Kementerian. Keuang. Badan Kebijakan Fiskal, Asuransi pertanian (2014)
14. F. M. Eptimehin, SSRN Electron. J., (2012)
15. A. B. Santoso, J. Penelit. Pertan. Tanam. Pangan, **35**, 1 (2016)
16. N. Utika, . M., and H. Yozza, J. Mat. UNAND, **2**, 2 (2013)
17. A. M. Razmy and A. N. Ahmed, J. Manage., **HI**, (2005)
18. A. Arifin and M. A. Sadat, J. Agribis, **13**, 1 (2021)
19. TDMRC, Buku Studi Kelayakan Penanganan Banjir Trumon Aceh Selatan Kerjasama dengan Perguruan Tinggi (Swakelola) (2019) [Online].
20. R. Fachlevi, Agussabti, and Ismayani, J. Bisnis Tani, **4**, 2 (2018)
21. R. Afrian and Z. R. Islami, J. Pendidik. Geogr., **24**, 2 (2019)
22. A. Nasrum, Uji Normalitas Data Untuk Penelitian, Jayapangus Press Books (2018)
23. N. N. Suindah, D. P. Darmawan, and I. K. Suamba, J. Sos. Ekon. Pertan.,**4**,1 (2020)