The Influence of Climate Change on Rainfall and Rainy Days for Rubber Production of Kusen Clone in Rambang District, Muara Enim Regency

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Research Paper

The Influence of Climate Change on Rainfall and Rainy Days for Rubber Production of Kusen Clone in Rambang District, Muara Enim Regency

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Abstract
Extreme rainfall impacts rubber production, reducing effective tapping days and cumulative annual output and having a wide-ranging effect on rubber crop cultivation. This study aimed to find out how rainfall and rainy days affected the rubber production of the Kusen clone in Muara Enim Regency's Rambang District. The study was conducted on a rubber plantation of Kusen clone, which has an area of 1 ha. The initial stage in analyzing the impact of climate change on Kusen clone rubber production in Rambang District, Muara Enim Regency, was identifying the independent and dependent variables. The T-test was conducted to see whether each independent variable partially has a significant effect on the dependent variable. Rubber production has fallen year after year, with an average of 205.12 kg/ha in 2019 during the first year of tapping and 118.43 in 2023. The coefficient value (r) shows a 27.2% (sufficient correlation) magnitude association between the rainfall and rainy-day variables and the rubber productivity variable of the Kusen clone. In Correlation test results, rainfall and rainy days are strongly associated with producing Kusen clone rubber, as demonstrated by the correlation analysis value of 0.846. Regression research showed that rainfall and rainy days had a statistically insignificant effect on rubber production on the rubber clone Kusen in Rambang District, Muara Enim Regency.

Keywords
Climate Change, Kusen Clone, Rubber

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1. INTRODUCTION

Rubber is an essential agricultural product for the Indonesian economy and is heavily impacted by weather patterns like rainfall and cloudy days. Rubber production is wildly and widely affected by climate change (Hadi et al., 2022). Climatic factors are essential in rubber plantation management (Junaidi, 2019), making it susceptible to the detrimental effects of climate change, like the rising temperatures-related phenomena of rubber leaf fall and prolonged droughts (Azizan et al., 2023), resulting in decreased rubber productivity (Rosana et al., 2020). On the other hand, heavy rainfall enhances the attack of new diseases and plant-disturbing organisms, triggers pathogen evolution and transfer between species (Gautam et al., 2013; Lamichhane and Venturi, 2015), Weed evolution has become more aggressive (Waryszak et al., 2018). Furthermore, extreme rainfall has an impact on rubber production, as it reduces effective tapping days and cumulative annual production (Makkaew and Sdoodee, 2015), and has a wide-ranging effect on rubber crop cultivation (Golbon et al., 2018; Junaidi, 2019).

The earnings of rubber farmers are impacted by climate change and the quality of their sap. Since the yield of rubber latex is greatly influenced by climatic parameters (temperature, wind speed, rainfall, and relative humidity), it is necessary to assess the environmental conditions to decide whether or not the location is suitable for cultivation (Umar et al., 2017). Like other crops, rubber plant productivity depends on rainfall and relative rainfall days (Zhang et al., 2019). The conditions during the leafing phase, which correlate with variations in the monthly rainfall/rainy day pattern, significantly impact the diversity of latex yields (Purwaningrum et al., 2023).

Research on how climate change affects agriculture, particularly in South Sumatra, is crucial, given the decrease in rubber yield. The South Sumatra region is based on potential in the agriculture industry, specifically in the plantation sub-sector. More specifically, one of the areas with many plantations is in the Muara Enim Regency's Rambang District. One of the rubber seedling clones the Rambang sub-district community planted is the Kusen clone. As measured by rainfall and rainfall on rubber production by Manurung M.T and Haryati (2015) and Sinaga et al., climate change was seen on rubber plantations processed directly by the corporation and viewed through the lens of the rubber age. The study was conducted on community rubber plantations, beginning with rubber producers' planting, processing, and tapping. In addition, no research has examined how climatic conditions affect the production of Kusen clone rubber. This study aimed to find out how rainfall and rainy days affected the rubber production of the Kusen clone in Muara Enim Regency's Rambang District.

2. EXPERIMENTAL SECTION

2.1 Research Location and Methods

The study was conducted in Rambang Sub-district, Muara Enim Regency (Figure 1). According to the BPS data, Rambang District contributed the most to latex production in Muara Enim Regency in 2017, totaling 22,724.89 tons. This is followed by the plantation area, the largest rubber plantation in Muara Enim at 20,394 hectares. Almost all the people who live in the Rambang Sub-district depend on rubber production for their livelihoods.

The research was conducted on a rubber plantation of Kusen clone, which has an area of 1 Ha. The selection of research locations is based on the criteria of rubber plantations that have been tapped for more than five years to obtain rubber production data for five years. This Kusen clone rubber plantation is 11 years old. The owner of the rubber plantation, a rubber trader, provided data on rubber production during the previous five years. The Meteorological, Climatological, and Geophysical Agency provided the rainfall and rainy-day data. Five years' worth of rainfall and rainy-day data were collected.

2.2 Data Analysis

The initial stage in analyzing the impact of climate change on Kusen clone rubber production in Rambang District, Muara Enim Regency, was identifying the independent and dependent variables. Data were gathered, organized, clarified, and then subjected to descriptive correlation analysis and multiple linear regression analysis. Multiple linear regression analysis was employed to ascertain the functional influence between dependent and independent variables. Y represents the non-independent variable, which is impacted by the independent variable. Rubber production is the study's non-independent variable, while the variable designated by X is the independent variable that affects or modifies the non-independent variable (1).

$$Y = \alpha + {}^{\beta}1X1 + {}^{\beta}2X2\,\epsilon \tag{1}$$

Where: Y is rubber production; α is constant (Y score when X = 0); ${}^{\beta}1 - {}^{\beta}5$ is Variable coefficients; XI is rainfall; X2 is rainy days; ϵ is Unobservable factors (error). The correlation between rainfall, rainy days, and rubber production is as follows: 0 means no correlation; 0.00 - 0.25 means weak correlation; 0.25 - 0.50 means sufficient correlation; 0.50 - 0.75 means strong correlation; 0.75 - 0.99 means robust correlation; 1 indicates perfect correlation.

2.3 Hypothesis Test

2.3.1 Simultaneous test (F-test)

The F-test determines if the independent factors collectively impact the dependent variable. This investigation will use a significant 0.05 (α = 5%) or a 95% confidence level for hypothesis testing. The theories are as follows: Using the following criteria, one can perform the F test by comparing the F_{count} value with the F_{table}: If the value of $F_{count} > F_{table}$ H0 is rejected, and H1 is accepted. If the value of $F_{count} < F_{table}$, H0 is taken, and H1 is rejected.

2.3.2 Partial Test (T-test)

The T-test was used to determine if each independent variable has a statistically significant partial impact on the dependent variable. The degree to which the t-test can explain one separate variable accounts for its influence on the dependent variable. This investigation will use a significant 0.05 (α = 5%) or a 95% confidence level for hypothesis testing. The theories are as follows: The T-test can be done by comparing the T_{count} value with the T_{table} using the following criteria: If the value of $T_{count} > T_{table}$ value, then H0 is rejected, and Ha is accepted. If the value of $T_{count} < T_{table}$, then H0 is accepted, and Ha is rejected.

3. RESULT AND DISCUSSION

3.1 Rainfall and Rainy Days for Rubber Production

The relationship between rainfall and rainy days for the 2019-2023 period and the productivity of rubber of Kusen clone for five years (2019-2023) can be seen in Table 1. Rainfall is generally correlated with rainy days. The rainy season starts later, and the dry season lasts longer due to climate change. Frequent rainy days can have various effects, such as interfering with the tapping and collection procedure, diluting cup lumps, and raising the risk of plant diseases. High rainfall will start in December and gradually decrease after June, with September being the driest month (Table 1 and Figure 2). This is almost the same as the results of Nasution et al. (2019) research; the rain pattern at Aek Godang Meteorological Station in the 2014 rainy season occurs in January, March, April, May, August, October, November, and December, while the rest of the months are dry. This is followed by wet days, which vary each year. Over the last five years, the rainy days in the Rambang Sub-district have been low, indicating a dry era (Table 1 and Figure 3). Based on the criteria, it is called the rainy season if the cumulative rainfall amount for one month is 150 mm or more, while if the rainfall is smaller than 150 mm/month, it is called the dry season Manurung M.T and Haryati (2015).

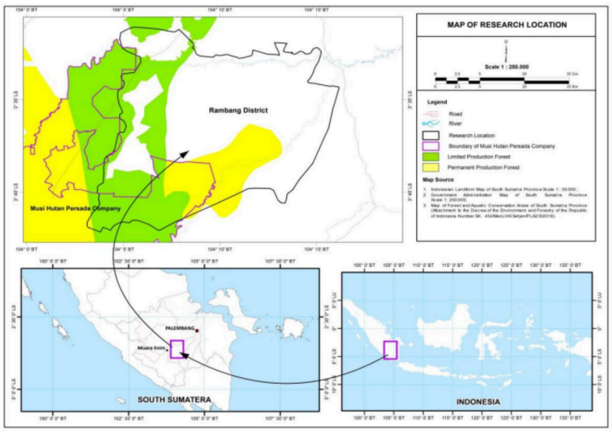

Figure 1. Map of Research Location

Rubber production, which has seen a yearly decrease in income, can be attributed to factors other than rainfall and rainy days. Rubber production has fallen year after year, with an average of 205.12 kg/ha in 2019 during the first year of tapping and 118.43 in 2023. Rubber experienced a decline in production of almost 50% (Table 2 and Figure 4). Increased rainfall due to climate change caused a 14.44 percent decrease in rubber productivity in Burai Village, which went from 1,345.80 kg per ha in 2012 to 1,151.42 kg per ha in 2016 (Rosana et al., 2020). Based on average rubber production each month, December had the lowest output at 137.89 kg/ha, while January had the greatest at 199.21 kg/ha (Table 2). Several variables, including December, can cause this to be a transitional month from dry to rainy with high intensity. Therefore, rubber production has remained relatively high despite reduced tapping days due to increased rain intensity. According to field observations, a rise in mild rainy days can result in the loss of tapping days, which are influenced by wet tapping paths that make tapping impossible (Hadi et al., 2022).

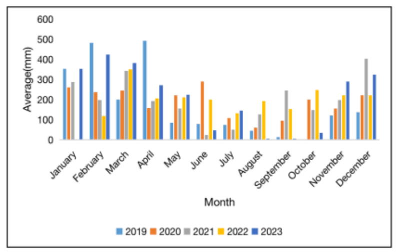

Figure 2. Rainfall Data in Rambang District

3.2 Effect of Rainfall and Rainy Days on Rubber Production

Multiple linear analyses will be used to ascertain whether rainfall and rainy days will impact rubber productivity. Tables 3, 4, and 5 display the findings of the multiple linear regression analysis conducted on the rubber plant clone Kusen. The coefficient value (r) shows a 27.2% (sufficient correlation) magnitude association between the rainfall and rainy-day variables and the rubber productivity variable of the Kusen clone (Table 3). The coefficient of determination (R2) shows that fluctuations in rainfall factors and rainy days can account for 7.4% of variations in rubber productivity (Table 3). In contrast, other variables not included in the model account for 92.6% of the variance in productivity (Table 3). Fertilization, tapping time, light intensity, temperature, humidity, and other conditions are essential to consider. Solar radiation, rainfall, and temperature have a dominant role in growth and production. In contrast, air humidity directly affects several types of plants but is indirectly closely related to the development of plant pests and diseases (Syahfari et al., 2023).

Multiple Regression Analysis of Kusen clone: $\hat{Y}$ =

Table 1. Rainfall Data for 2019-2023 in Rambang District

Months	Years														
	2019			2020			2021			2022			2022		
	R	RD	RP	R	RD	RP	R	RD	RP	R	RD	RP	R	RD	RP
January	352	25	3.72	262	16	2.76	288	21	1.90	0	0	4.65	352	31	3.48
February	481	23	4.57	238	17	1.74	199	18	2.02	118	14	2.00	425	15	2.20
March	200	18	4.95	244	16	2.99	342	20	3.64	351	16	1.50	382	23	1.72
April	492	19	5.40	159	16	2.94	193	9	3.86	205	17	1.72	271	25	1.64
May	85	7	5.45	222	15	1.02	155	13	3.10	210	18	2.74	223	14	2.10
June	79	10	4.91	289	16	3.04	23	5	2.98	201	11	2.60	48	7	1.98
July	73	4	1.40	108	12	4.38	50	4	1.56	133	9	3.72	146	14	1.68
August	44	3	2.10	60	5	5.13	126	12	3.02	192	15	3.10	6	3	1.70
September	15	3	2.00	96	10	2.80	246	12	3.24	153	14	2.80	1	2	1.62
October	0	0	2,68	200	14	1.48	149	14	4.60	249	21	2.98	34	4	1.80
November	121	10	1.50	157	18	1.78	197	18	5.28	221	17	3.22	291	17	1.54
December	138	11	1.48	221	17	61	402	26	4.05	221	20	3.25	323	19	2.01

R: Rainfall (mm), RD: Rainy Days (day), and RP: Rubber Production (picul).

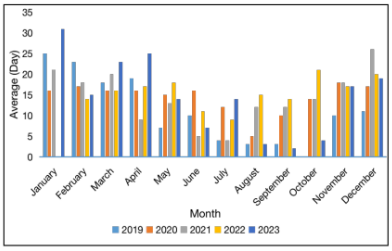

Figure 3. Rainy Days Data in Rambang District

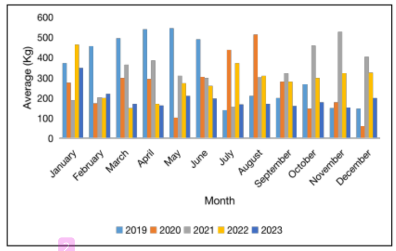

Figure 4. Rubber Production of Kusen Clone for 2019-2023 in Rambang District

$200.076 + 0.1165 + 3.294 + \epsilon$. Based on the multiple linear regression equation, the constant value is 200.076 (Table 4). This explains that if the variable value of rainfall (X1) and rainy days (X2) is equal to zero, then rubber production (Y) is 200.076. This means that adding one unit of rainfall value rainfall will increase the productivity value of productivity by 0.1165 units, and every addition of one unit of rainy day will increase the value of rubber productivity by 3.294 units (Table 4)

3.3 Simultaneous Test (F-test)

From Table 3 above, the value of $T_{count} > T_{table}$ ($2.269 < 3.158$), and the significance value $< \alpha$ ($0.113 > 0.05$), then H0 is rejected, and H1 is accepted, so it can be concluded that rainfall and rainy days do not have a significant effect on rubber production of Kusen clone in Rambang District Muara Enim Regency (Table 5).

3.4 Partial Test (T-test)

Based on the equation table of multiple regression results above, the partial test (t-test) can be explained as follows:

3.4.1 Rainfall (X1)

In the variable level of rainfall (X1), the T_{count} value $< T_{table}$ ($0.454 < 2.002$) with a significance value $> \alpha$ ($0.652 > 0.05$) (Table 6). Thus, it can be said that rainfall has little effect on the rubber produced by Kusen clones in Rambang District, Muara Enim Regency, as H0 is accepted and Ha is refused. This contradicts the research findings of Hadi et al. (2022), who found that rainfall significantly affects rubber production in Ogan Komering Ilir. This is supported by previous studies by Setyawan et al. (2016), which show that rainfall significantly affects Ogan Komering Ilir's rubber production. The rainfall variable substantially affects rubber production acquisition in Sukamangli Garden, Kendal Regency, as evidenced by a significant value less

Table 2. Average Rubber Production of Kusen Clone for 2019-2023 in Rambang District

Months	Years					
	2019 (kg/ha)	2020 (kg/ha)	2021 (kg/ha)	2022 (kg/ha)	2023 (kg/ha)	Average
January	224.9818	164.5028	114.91	281.2273	210.4669	199.21
February	276.3889	105.2334	122.1675	120.958	133.054	151.56
March	299.371	180.8322	220.1435	90.7185	103.4191	178.90
April	326.587	177.8082	233.4489	104.0238	101.6047	188.70
May	329.6105	61.68856	187.485	165.7124	127.006	174.30
June	329.6105	183.8561	180.2274	157.245	119.7484	194.14
July	84.6706	264.8979	94.34721	224.9818	101.6047	154.10
August	127.006	310.2572	182.6465	187.485	102.814	182.04
September	120.958	169.341	195.9519	169.341	97.97595	150.71
October	162.0837	89.50889	278.203	180.2274	108.862	163.78
November	90.7185	107.6526	319.329	194.7423	93.13763	161.12
December	89.50889	36.89218	244.9399	196.5567	121.5628	137.89
Average	205.12	154.37	197.82	172.77	118.43	

Table 3. The Coefficient Value of the Multiple Linear Rn Equation on Rubber Plants of Kusen Clone

Rubber clone	Coefficient Score		
	r	R2	Adjusted R^2
Kusen	0.272	0.074	0.041

than alpha 0.05 from the t-test.

3.4.2 Rainy Days (X2)

In the age variable (X2), the value of $T_{count} < T_{table}$ (0.725 > 2.002) and the significance value > α (0.472 < 0.05) (Table 6). Then H0 is rejected, and Ha is accepted, so it can be concluded that rainy days don't significantly influence the rubber production of Kusen clones in the Rambang sub-district of Muara Enim Regency. This is not in line with the research of Nasution et al. (2019), who found that rainfall and rainy days highly correlate with rubber production in Padang Bolak.

The regression analysis showed that rainfall and rainy days had a statistically insignificant effect on latex production in Rambang District, Muara Enim Regency, using the Kusen clone. This is thought to be caused by other factors that promote excellent or optimum growth for rubber production, such as the presence of good and balanced water and air conditions, which can aid in the absorption of nutrients that can increase rubber production, implying that rainfall and rainy days have no effect. This is in line with Manurung M.T and Haryati (2015) research, which found that variance analysis of multiple linear regression equations revealed that rainfall and rainy days have no significant effect on increasing latex production in rubber plants aged 6, 10, and 14 years at the PT. Bridgestone Sumatra Rubber Estate. Hasibuan and Irsal (2018) conducted another study, and the regression analysis findings revealed that rainfall and rainy days had no significant effect on enhancing the production of 10-, 15-, and 20-year-old rubber in the Aek Pamienke Plantation of PT. Socfin Indonesia. Rainfall and rainy days in the model did not significantly affect latex production in 7-, 10-, and 13-year-old rubber plants (Sinaga et al.). However, this is not in line with Hadi et al. (2022), results of the study with the regression analysis show that each climate element significantly affects rubber production. In addition to climate factors such as rainfall and rainy days, additional factors influence rubber production. Nutrients on rubber rods may boost latex and dry rubber content (Ginting and Astuti, 2018). If diseases, ineffective tapping methods, and inappropriate agronomic practices—factors that result in the loss of rubber tree stands on the plantation—are adequately managed, the economic life of a rubber plantation can even be prolonged until the age of forty.

Correlation analysis aims to ascertain the degree of association between the independent variables (rainfall and rainy days) and the dependent variable (latex production). The results of the correlation analysis test on the rubber plant clone Kusen showed a weak relationship between the variable rainfall and rubber production of 0.113, and a very weak correlation also occurs in the relationship between rubber production and rainy days of 0.080 (Table 7).

This fragile relationship shows that the variables of rainfall, rainy days, and rubber production have no natural effect. This can be seen from the significance value greater than 1% alpha ($Sig < \alpha 0.01$), and other correlations show a robust correlation found in the variable rainy days and rainfall, namely 0.846 (Table 7). Regression research showed that rainfall and rainy days had a statistically insignificant effect on latex output on the rubber clone Kusen in Rambang District, Muara Enim Regency. This is believed to be caused by other elements that encourage good or optimal

Table 4. Results of Multiple Regression Analysis

Model		Coefficient Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	Constant	200.076	37.271		5.368	0.000
	Rainfall (X1)	0.1165	0.257	0.109	0.454	0.652
	Rainy days (X2)	3.294	4.545	0.173	0.725	0.472

Table 5. Simultaneous Test (F Test)

	ANOVA[a] Model	Sum of squares	df	Mean Square	F	Sig.
1	Regression	74171.421	2	37085.711	2.269	0.113[b]
	Residual	931507.579	57	16342.238		
	Total	1005679.00	59			

plant growth, such as excellent and balanced water and air conditions, which can aid in the absorption of nutrients and boost plant output, implying that rainfall and rainy days have no significant influence. Because biological variables, soil, and natural boundaries all have an impact on plant productivity.

In addition to the growth factor of rubber plants, this is thought to be due to the average rainfall and rainy days in Rambang Subdistrict for five years have been sufficient for the growth requirements of the Kusen clone rubber plant, namely rainfall of 2292.4 mm/year and rainy days of 146 days/year, so it is stated that the productivity of the Kusen clone rubber plant is no problem when viewed from the climatic point of view of rainfall and rainy days. This is consistent with the literature of the (Directorate General of Plantation, 2014), which specifies that the optimal rainfall for rubber plants is between 1,500 and 3,000 mm/year, with dry months of fewer than three months and rainy days of about 100. Suitable locations include from latitude 150 LU to 100 LS, with a 0-200 m height above sea level and a maximum wind speed of *leq* 30 km/h. Furthermore, climatic ambient elements surrounding the plant influence the absorption and availability of water.

Various climate change-related variables cause the yearly drop in Kusen clone rubber production. One of these is widespread rubber leaf disease, which attacks rubber plants. In specific rubber plant clones, a *Pestalotiopsis* sp. infection produces leaf fall disease in newly arrived plants (Damiri et al., 2022). In addition to the state of the rubber tree, several additional factors significantly impact rubber production. Rubber production is critical to the country's economic stability. According to Suri et al. (2021), the volume of rubber exports is positively correlated with rubber production.

3.5 Strategies for Mitigating and Adapting to Climate Change

Three actions can be taken to combat climate change: mitigation, adaptation, and anticipation. While mitigation is primarily focused on attempts to lessen the likelihood that climate change will occur, anticipation and adaptation are more concerned with lowering the risk of harm or death because of climate change. In the absence of adaptation, rubber consumption is anticipated to rise, and production will fall (Jacob et al., 2022). Better management, breeding, and medium-term planning of plantation renewals and extension are examples of adaptation strategies. Numerous beneficial outcomes from the research are available, including significant discoveries for adaptation. Two complementary approaches can be used to adapt rubber agriculture to climate change: climate-resilient agronomic techniques and breeding and genomic marker-assisted selection to create climate-resilient, high-yielding clones (Jacob et al., 2022). Many strategies have been implemented to help rubber systems adjust to climate change. For the first two years after planting, shading is advised.

Moreover, rubber farmers may plant intercrops or use agroforestry systems (Landicho et al., 2016). Effective handling of nutrients, especially initially, can significantly improve a rubber plantation's ability to operate. Rubber has distinct immature and mature phases, with the mature phase characterized by a progressive improvement in soil quality (Gay et al., 2021). Rain guards can protect the bark from excessive rainfall, and tapping can be managed adaptively. A time of non-tapping and low-intensive tapping could be included in tapping management to reduce the number of tapping days and related expenses while maintaining annual output.

Rubber farmers face two issues related to climate change: adapting to varying climates and implementing mitigating

Table 6. Result Based on Partial Test (T-test)

Model		Coefficient				
		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	Constant	200.076	37.271		5.368	0.000
	Rainfall (X1)	0.1165	0.257	0.109	0.454	0.652
	Rainy days (X2)	3.294	4.545	0.173	0.725	0.472

Table 7. Correlation Analysis Test for Rubber of Kusen Clone

Clone	Variable	Statistics Test	Variable		
			Rubber production	Rainfall	Rainy days
Kusen	Rubber production	Pearson Correlation	1	0.113	0.080
		Sig	-	0.196	0.271
	Rainfall	Pearson Correlation	0.113	1	0.846
		Sig	0.196	-	0.000
	Rainy days	Pearson Correlation	0.080	0.846	1
		Sig	0.271	0.000	-

strategies. Rubber farmers can implement climate change adaptation strategies such as working a side job to supplement their income, increasing fertilization intensity, selecting the clone that is most resistant to climate change, and determining the tapping time that produces more rubber than other times. Rubber clones were introduced to combat leaf-fall illnesses. The study on *Colletotrichum gloeosporioides*, *Oidium heveae*, and *Corynespora cassiicola* revealed that clones RRIC 100 and PB 260 exhibited superior resistance against the three leaf fall diseases. These clones were succeeded by PB 254, PB 312, PB 314, and RRIM 921, which were categorized as moderately resistant.

It is necessary to take mitigation measures in line with 1.5 °C warming targets to prevent significant harm to economic growth and other well-being (Moore and Diaz, 2015). Globally speaking, climate mitigation portends a future with fewer dangers of climate change and conflict (Gilmore and Buhaug, 2021). Climate mitigation is any measure to permanently eliminate or lessen climate change's long-term danger and hazard to human life (Panepinto et al., 2021). There is a great deal of promise for natural rubber systems to enhance their role in mitigating climate change. It includes using Hevea trees as carbon sinks, managing land use and change better, using better management techniques to promote soil carbon and yield, and using more rubber wood and natural rubber instead of non-renewable resources (Kadir et al., 2022).

4. CONCLUSIONS

In Rambang District, Muara Enim Regency, rainfall and rainy days did not significantly affect the production of Kusen clone rubber, according to the variance analysis of multiple linear regression coefficients. According to the correlation test results, rainfall and rainy days are strongly associated with producing Kusen clone rubber, as demonstrated by the correlation analysis value of 0.846. Even so, the rubber plant clone Kusen showed a weak relationship between the variable rainfall and rubber production of 0.113, and a very weak correlation also occurs in the relationship between rubber production and rainy days of 0.080. Regression research showed that rainfall and rainy days had a statistically insignificant effect on rubber production on the rubber clone Kusen in Rambang District, Muara Enim Regency. In addition to rainfall and rainy days, more research is needed to determine the effect of temperature, humidity, and sunlight intensity on rubber production. Comparison studies on rubber production in multiple places using the exact clone are also required.

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REFERENCES

Azizan, F., I. Astuti, A. Young, and A. A. Aziz (2023). Rubber Leaf Fall Phenomenon Linked to Increased Temperature. *Agriculture, Ecosystems & Environment*, **352**; 108531

Damiri, N., Y. Pratama, T. Febbiyanti, S. Rahim, D. Astuti, and Y. Purwanti (2022). *Pestalotiopsis* Sp. Infection Causes Leaf Fall Disease of New Arrivals in Several Clones of Rubber Plants. *Biodiversitas Journal of Biological Diversity*, **23**(8); 3943–3949

Directorate General of Plantation (2014). *Pedoman Budidaya Karet (Hevea brasiliensis) yang Baik*. Kementrian Pertanian, Direktorat Jenderal Perkebunan, Indonesia (in Indonesia)

Gautam, H., M. Bhardwaj, and R. Kumar (2013). Climate Change and Its Impact on Plant Diseases. *Current science*, **105**(12); 1685–1691

Gay, F., A. Brauman, R. Chotiphan, E. Gohet, J.-P. Laclau, S. Lienprayoon, L. Mareschal, P. Malagoli, A. Thoumazeau, and Y. Nouvellon (2021). Managing Soil Quality to Improve Sustainability of Rubber Plantations, What Do We Know? In *Natural Rubber System and Climate Change*. CGIAR, pages 42–45

Gilmore, E. A. and H. Buhaug (2021). Climate Mitigation Policies and the Potential Pathways to Conflict: Outlining a Research Agenda. *Wiley Interdisciplinary Reviews: Climate Change*, **12**(5); 722

Ginting, C. and Y. T. M. Astuti (2018). Increasing Latex Production of Rubber Tree (*Hevea brasiliensis*) by Nutrient Infusion. *AGROISTA: Jurnal Agroteknologi*, **1**(2); 163–170

Golbon, R., M. Cotter, and J. Sauerborn (2018). Climate Change Impact Assessment on the Potential Rubber Cultivating Area in the Greater Mekong Subregion. *Environmental Research Letters*, **13**(8); 084002

Hadi, P. W., Y. Oktarina, Y. Sari, F. P. S. Fifian, and D. Kurnia (2022). A Study of the Impact of Climate Change on Rubber Production in Ogan Komering Ulu Regency. *International Journal of Social Science*, **2**(3); 1591–1596

Hasibuan, W. A. and I. Irsal (2018). Influence of Rainfall and Rainy Day on the Rubber Productivity (*Hevea brasiliensis* Muell-Arg.) in 10, 15 and 20 Years Old in Aek Pamienke Plantation Pt. Socfin Indonesia (socfindo). *Jurnal Pertanian Tropik*, **5**(1); 147–157

Jacob, J., V. Gitz, E. Gohet, A. B. Kadir, L. Nair, S. Pinizzotto, N. A. Nghia, S. Blagodatsky, M. Brady, and P. O. Cerutti (2022). Natural Rubber Contributions to Adaptation to Climate Change. In *XV World Forestry Congress*. KFS, pages 1–9

Junaidi, J. (2019). Hevea Rubber Cultivation Challenges under Global Climate Change. *Warta Perkaretan*, **38**(2); 91–108

Kadir, A. B., V. Gitz, E. Gohet, J. Jacob, L. Nair, S. Pinizzotto, N. A. Nghia, S. Blagodatsky, M. Brady, and P. O. Cerutti (2022). Natural Rubber Contributions to Mitigation of Climate Change. In *XV World Forestry Congress*. KFS, pages 1–9

Lamichhane, J. R. and V. Venturi (2015). Synergisms between Microbial Pathogens in Plant Disease Complexes: A Growing Trend. *Frontiers in plant science*, **6**; 1–12

Landicho, L., R. Paelmo, R. Cabahug, C. de Luna, R. Visco, and L. a. Tolentino (2016). Climate Change Adaptation Strategies of Smallholder Agroforestry Farmers in the Philippines. *Journal of Environmental Science and Management*, **19**(1); 37–45

Makkaew, K. R. K. and S. Sdoodee (2015). The Impact of Rainfall Fluctuation on Days and Rubber Productivity in Songkhla Province. *Journal of Agricultural Technology*, **11**(1); 181–191

Manurung M.T, I. and H. Haryati (2015). Influence of Rain Fall and Rain Day on Rubber Plants Production 6, 10, and 14 Years Aged in PT Bridgestone Sumatra Rubber Estate Dolok Merangir. *Jurnal Agroekoteknologi Universitas Sumatera Utara*, **3**(2); 564–573

Moore, F. C. and D. B. Diaz (2015). Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy. *Nature Climate Change*, **5**(2); 127–131

Nasution, I., T. H. Siregar, and E. Pane (2019). The Relationship of Climate to Production and Income of Rubber Farmers in the District of Padang Lawas Utara. *AGRISAINS: Jurnal Ilmiah Magister Agribisnis*, **1**(1); 56–67

Panepinto, D., V. A. Riggio, and M. Zanetti (2021). Analysis of the Emergent Climate Change Mitigation Technologies. *International Journal of Environmental Research and Public Health*, **18**(13); 6767

Purwaningrum, Y., Y. Asbur, J. Junaidi, A. Atminingsih, and C. Hanum (2023). Latex Production of Rubber Plants Based On The Physiological Aspects. *JoTEC (Journal of Tropical Estate Crops)*, **1**(1); 31–34

Rosana, E., Y. Yulius, T. Thirtawati, and D. Paramita (2020). The Impacts of Climate Change and Price Fluctuations to Income of Rubber Farmers at Burai Village Ogan Ilir. *Jurnal Penyuluhan*, **16**(1); 49–63

Setyawan, E., R. Subantoro, and R. Prabowo (2016). Analisis Faktor Yang Berpengaruh Terhadap Produksi Karet Di PT Perkebunan Nusantara IX Kebun Sukamangli Kabupaten Kendal. *Mediagro*, **12**(1); 35–44

Sinaga, D. M., I. Irsal, and L. Mawarni (). Influence of Rainfall and Rain Day on Rubber Production 7, 10, 13 Years Aged in Sei Baleh Estate PT. Bakrie Sumatera Plantations, Tbk. *Jurnal Agroekoteknologi Universitas Sumatera Utara*, **5**(1); 93–102

Suri, T. N., Rahmanta, and R. P. Wibowo (2021). Analysis of Affecting Factors on the Natural Rubber Exports Volume in North Sumatera. *Indonesian Journal of Agricultural Research*, **4**(1); 58–64

Syahfari, H., A. Ramayana, A. Suhaimi, N. Hafizah, and M. Tirkaamiana (2023). Identification of Climate Influence on Upas Fungus (*Corticium* sp.) Disease Intensity on Rubber Plants (*Hevea brasiliensis* Muell.Arg.). *Universal Journal of Agricultural Research*, **11**; 146–157

Umar, H., N. Okore, M. Toryila, B. Asemota, and I. Okore (2017). Evaluation of the Impact of Climatic Factors on Latex Yield of *Hevea brasiliensis*. *International Journal of Research*, **3**(5); 28–33

Waryszak, P., T. I. Lenz, M. R. Leishman, and P. O. Downey (2018). Herbicide Effectiveness in Controlling Invasive Plants under Elevated CO_2: Sufficient Evidence to Rethink Weeds Management. *Journal of Environmental*

Management, **226**; 400–407
Zhang, C., T. Xu, H. Feng, and S. Chen (2019). Greenhouse Gas Emissions from Landfills: A Review and Bibliometric Analysis. *Sustainability*, **11**(8); 1–16

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