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THE EFFECT OF RAINFALL ON RICE AND CORN CROP PRODUCTION IN SLEMAN DISTRICT

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ABSTRACT

Rainwater that falls to the surface of the earth is very important for the growth of agricultural crops such as rice and corn. Therefore, this study aims to know rice and corn production in 2018 and 2020, determine rainfall in 2018 and 2020 and analyze the effect of rainfall on rice and corn production in 2018 and 2020 in Sleman District. The data used by this research is data from Sleman District in 2018 and 2020 Figures. The data were analyzed in a qualitative descriptive manner. The results of the study found that rice production in 2018 amounted to 1,574.3 tons, rose to 16,135 tons in 2020, while corn production in 2018 was 452.7 tons, rose to 5,763 tons in 2020. The total rainfall in Sleman District in 2018 was 2,526 mm with the maximum rainfall occurring in December at 178 mm, while the total rainfall in 2020 was 3,272 mm with maximum rainfall occurring in December with rainfall of 184 mm slightly lower than in 2018. The study also found that rainfall in 2018 and 2020 directly affected rice and jangun production.

Keywords: *Production, Agriculture, Rainfall, Water*

INTRODUCTION

According to Weng (1985) in Irsan (2018), production is a real benchmark in the success of crop management which is the most important output economically. Plant productivity varies greatly according to environmental conditions (climate, land conditions) and genetic conditions (plant material and plant age) (Stoop et al., 2002). One of the climatic elements that can be used as an indicator in relation to agriculture is rainfall (Bär et al., 2015). Given that rainfall is an element of climate that fluctuates highly and its effect on crop production is quite significant (Kabubo-Mariara & Karanja, 2007). The overall amount of rainfall is crucial in determining the outcome (Xu et al., 2006). Increased rainfall in an area has the potential to cause flooding, on the other hand, if there is a decrease from normal conditions, there will be the potential for drought (Dube & Nhamo, 2020). Both of these will certainly have a negative impact on plant metabolism and potentially reduce production, until crop failure (Blum & Blum, 2011). Rainfall is one of the limiting factors in agricultural activities and production (Azizah et al., 2021).

Sleman District is a sub-district in Sleman Regency which consists of 5 villages, namely Caturharjo Village, Triharjo Village, Tridadi Village, Pandowoharjo Village and Trimulyo Village. Based on data from Sleman District in 2021 Figures, Sleman District has an area of 3,132 ha whose land use is divided into rice fields of 1,322 ha, non-paddy agricultural land of 824 ha, and non-agricultural land of 986 ha which are presented in Table 1.

Table 1. Land area according to its use (ha) per village in Sleman sub-district

Village	Area Size	Rice Fields	Non-Rice Farms	Non-Agricultural Land
Caturharjo	807	358	198	251
Triharjo	532	189	152	191
Tridadi	299	131	86	82
Pandowoharjo	948	387	244	317
Trimulyo	546	257	144	145
Total	**3.132**	**1.322**	**824**	**986**

Source: BPS Sleman District in 2021

Food crops that become commodities in Sleman District include rice, corn, sweet potatoes, peanuts and cassava. During their growth period, plants have different water needs. According to Kung (1971) in Rahman (2012) estimates that the average water consumption for some crops in several countries in Asia can be seen in Table 2.

Table 2. Average Water Consumption For Some Plants In Several Countries in Asia

Types of plants	Consumption per month (mm)	Growing period (month)	Total water consumption growing period (mm)
Rice	150-200	5	750-1000
Corn	85-100	4	350-400
Peanut	80-100	5	400-500
Soybean	75-100	3,5	300-350

Source: Kung (1971) in Rahman (2012)

Differences in water needs during the growth period in rice and corn food crops are behind this study. Therefore, this study aims to determine the effect of rainfall on agricultural production of rice and corn food crops in Sleman District.

METHOD

The method used in this study is qualitative descriptive method (Sugiyono, 2016). The data obtained will be explained through tables, graphs and maps. The data used are secondary data, namely rainfall data and rice and corn production data in Sleman District in 2018 and 2020 which are accessed online through the Central Statistics Agency (BPS) website.

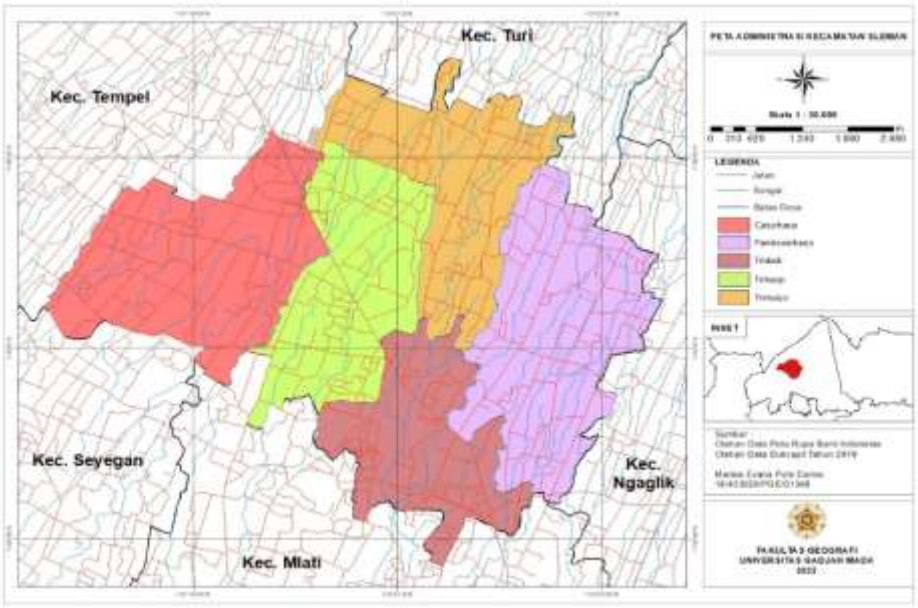

Figure 1. Map of Research Location

The flow chart in this study is as follows.

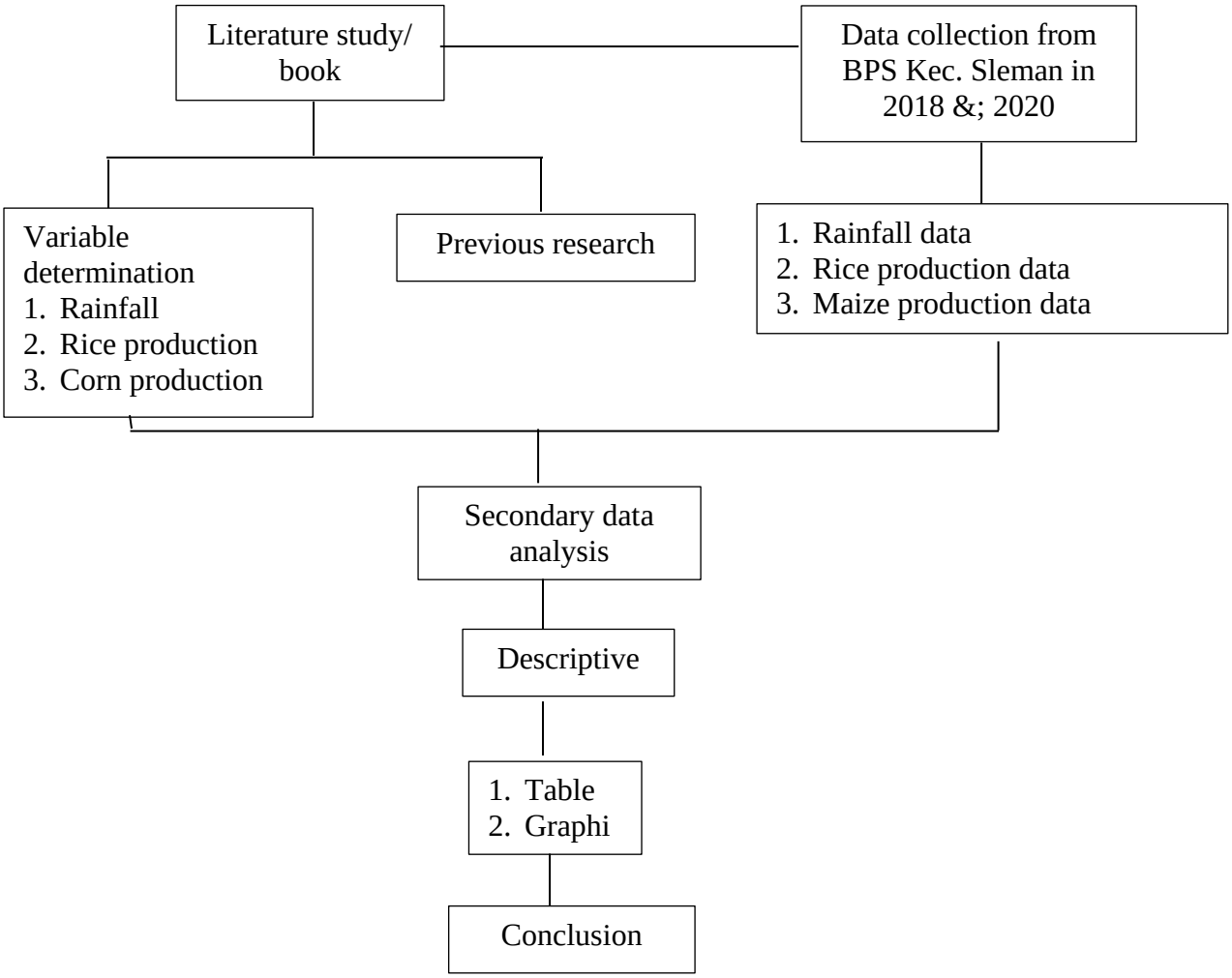

Figure 2. Research Flow Chart

RESULTS AND DISCUSSION

Production and Productivity of Rice and Maize

Table 3. Production and Productivity of Rice and Maize Crops in Each Village in Sleman District in 2018 and 2020

No.	Village	Production (tonnes)				Productivity (ton/ha)			
		Rice		Corn		Rice		Corn	
		2018	2020	2018	2020	2018	2020	2018	2020
1.	Caturharjo	406,99	409,3	120,37	146,3	0,53	0,61	0,72	0,69
2.	Triharjo	221,60	233,6	68,81	79,4	0,54	0,61	0,73	0,69
3.	Tridadi	183,92	168,4	42,26	54,5	0,54	0,61	0,73	0,69
4.	Pandowoharjo	457,78	483,1	141,56	174,6	0,53	0,61	0,73	0,69
5.	Trimulyo	303,99	319	79,68	121,5	0,54	0,61	0,73	0,69
Total		**1574,3**	**1613,4**	**452,7**	**576,3**				

Source: BPS Sleman District in 2019 and 2021

Based on data from BPS, rice and corn production in Sleman District has increased. Rice production in 2018 amounted to 1,574.3 tons, rising to 1,613.4 tons in 2020, while corn production in 2018 amounted to 452.7 tons, rising to 576.3 tons in 2020. Pandowoharjo Village is the village with the highest rice production in 2018 and 2020 with a value of 457.78 tons and 483.1 tons respectively. For rice productivity in 2018 and 2020, there is no significant difference in each village. However, rice productivity has increased, in 2018 productivity of 0.54 tons / ha rose to 0.61 tons / ha in 2020.

In addition to rice crops, Pandowoharjo Village is also the village with the highest corn production in 2018 and 2020 with a value of 141.56 tons and 174.6 tons, respectively. Similar to rice productivity, corn productivity both in 2018 and 2020 also did not have a significant difference in each village. However, corn productivity has decreased, in 2018 corn productivity of 0.73 tons / ha fell to 0.69 tons / ha in 2020.

The decrease in corn productivity is due to the beginning of the dry season in May, the rainfall is quite high, which is around 254 mm (Table 4.10). According to Herlina and Prasetyorini (2020), rainfall that exceeds the limit will result in an increase in the volume of water on the soil surface so that it can affect plant growth. While excessive rainfall will affect plant productivity resulting in disrupted plant growth. In addition, according to Santoso (2011) high rainfall can cause crop failure because the roots of corn plants are prone to excess water. This condition requires corn to be harvested before the harvest period with the moisture content in the seeds still high. The water content in corn kernels that are still high can cause corn kernels after drying to become low weight.

Rainfall in Sleman District

Table 6 Rainfall in Sleman District in 2018

Moon	Amount of Rain a Month (mm)	Number of Rainy Days (days)	Maximum Rainfall (mm)
January	660	28	112
February	418	18	130
March	322	16	116
April	152	13	31
May	52	6	36
June	36	5	16
July	0	0	0
August	0	0	0
September	3	2	2
October	5	4	2
November	430	19	91
December	448	19	178
Total	**2.526**	**130**	**714**

Source: BPS Sleman District in 2019

The total rainfall in Sleman District in 2018 was 2,526 mm with 130 rainy days. The maximum rainfall occurs in December with a rainfall of 178 mm. January is the month with the highest amount of rainfall reaching 660 mm and is also the month with the highest number of rainy days, which is 28 days. In July and August the rainfall is recorded at 0 mm. Djoko Budiono as Head of the Data and Information Group of the BMKG Yogyakarta Climatology Station said that the peak of the dry season in 2018 took place in August and entering July there had been recorded a strengthening of the dry season.

Table 7 Rainfall in Sleman District in 2020

Moon	Amount of Rain a Month (mm)	Number of Rainy Days (days)	Maximum Rainfall (mm)
January	327	17	58
February	317	21	55
March	812	25	107
April	374	17	92
May	254	11	58
June	77	4	52
July	1	1	1
August	26	3	14
September	44	6	19
October	238	14	64
November	342	18	85
December	460	21	184

Total	**3.272**	**158**	**424**

Source: BPS Sleman District in 2021

The total rainfall in Sleman District in 2020 was 3,272 mm with 158 rainy days. The maximum rainfall occurs in December with a rainfall of 184 mm. March is the month with the highest amount of rainfall reaching 812 mm and is also the month with the highest number of rainy days, which is 25 days. July is the month with the lowest rainfall, which is 1 mm.

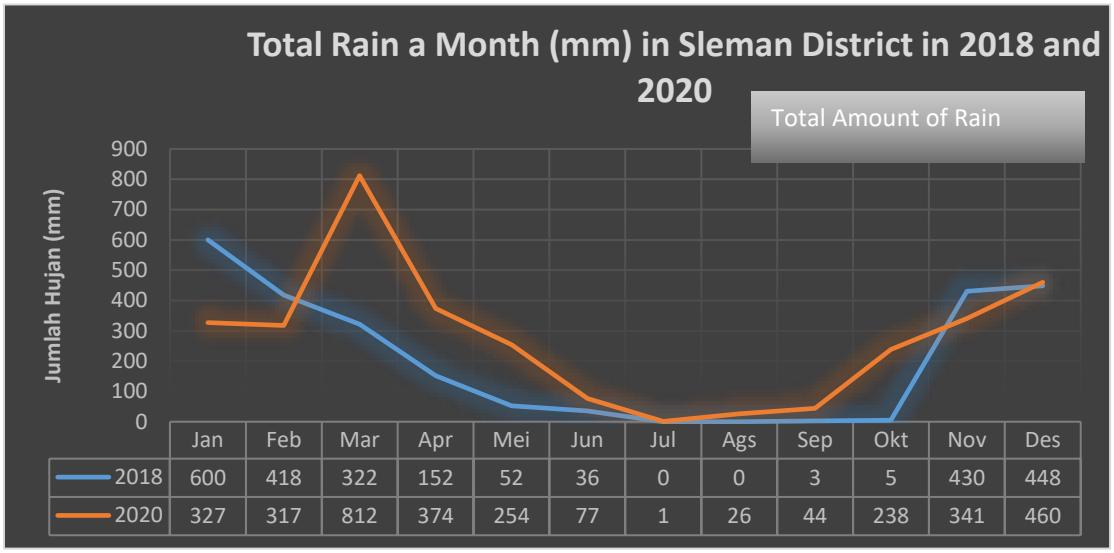

Figure 4. Total Rain for a Month (mm) in Sleman District Year 2018 and 2020

The Link Between Rainfall and Rice and Maize Production and Productivity

In Figure 5 and Figure 6, rice and corn production in 2018 and 2020 in each village increased with the lowest to highest production respectively, namely Tridadi, Triharjo, Trimulyo, Caturharjo and Pandowoharjo Villages. When viewed from the rainfall that occurred in 2018 (Table 4.9) and 2020 (Table 4.10) there was an increase in rainfall, so that rainfall had an influence on the increase in rice and corn production. This happens because plant growth is very dependent on the availability of water sources derived from rainwater (Aguilar et al., 2012). According to Prasmani (2018), high rainfall followed by high rice production levels indicates that water needs for rice are well fulfilled, on the other hand, if rainfall is high but rice production falls, it indicates disasters such as floods, tornadoes which result in decreased rice production until crop failure.

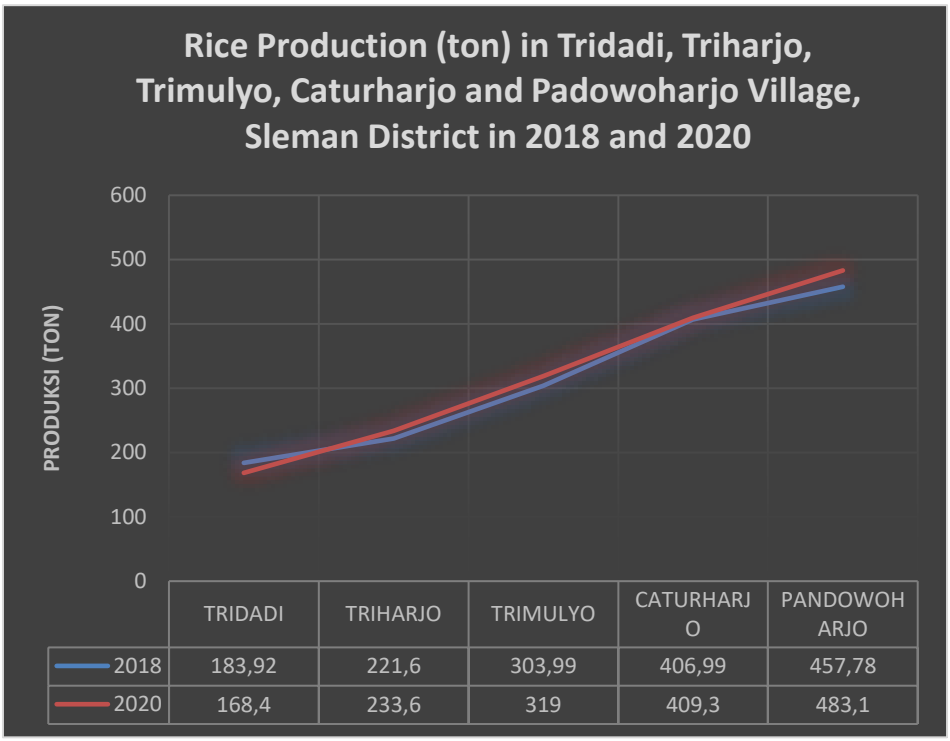

Figure 5. Rice Production in Sleman District in 2018 and 2020

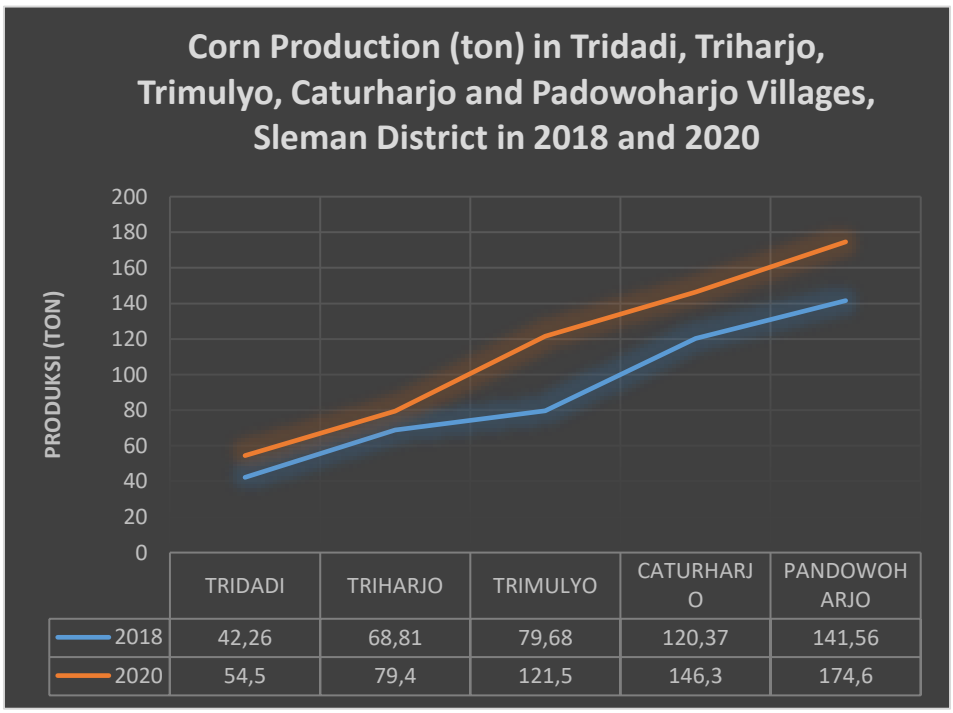

Figure 6. Corn Production in Sleman District in 2018 and 2020

The Link Between Harvest Area and Rice and Maize Production and Productivity

Table 8 Rice Production, Harvest Area and Productivity of East Village in Sleman District in 2018 and 2020

No.	Village	Production (tonnes)		Harvest Area (ha)		Productivity (ton/ha)	
		2018	**2020**	**2018**	**2020**	**2018**	**2020**
1.	Caturharjo	406,99	409,3	762	671	0,53	0,61
2.	Triharjo	221,60	233,6	412	383	0,54	0,61
3.	Tridadi	183,92	168,4	342	276	0,54	0,61
4.	Pandowoharjo	457,78	483,1	863	792	0,53	0,61
5.	Trimulyo	303,99	319	568	523	0,54	0,61

Source: BPS Sleman District in 2019 and 2021

Based on Figure 4.2, it can be seen that Pandowoharjo Village is the village with the highest rice production both in 2018 and 2020, each of which produced 457.78 tons and 483.1 tons. Pandowoharjo Village is the village with the highest rice production in Sleman District because the harvest area is the highest compared to other villages, covering an area of 863 ha in 2018 and 792 ha in 2020. Furthermore, the second highest rice production is Caturharjo Village, which is 406.99 tons in 2018 and 409.3 tons in 2020. Meanwhile, Tridadi Village is the village with the lowest rice production in Sleman District, which was 183.92 tons in 2018 and decreased to 168.4 tons in 2020. The decline in rice production that occurred in Tridadi Village was caused by a decrease in its harvest area, where in 2018 the harvest area of 342 ha dropped to 276 ha in 2020.

Based on the results of the study above, it can be concluded that the variable area of harvest has a positive effect on rice production. This result is in accordance with research conducted (Khakim et al, 2013) in the Central Java region that the variable land area has a positive and very significant effect on rice production in Central Java, which means that if the larger the land area, the greater the amount of rice production that will be obtained. Land as one of the factors of production which is a factory of agricultural products that have a considerable contribution to food availability. Agricultural land is a determinant of the influence of factors of production of agricultural commodities. In general, it is said, the larger the land area, the greater the amount of production produced by the land (Yulianto, 2017).

Table 9 Production, Harvest Area and Productivity od Maize in Each Village in Sleman District in 2018 and 2020

No.	Village	Production (tonnes)		Harvest Area (ha)		Productivity (ton/ha)	
		2018	2020	2018	2020	2018	2020
1.	Caturharjo	120,37	146,3	166,03	212	0,72	0,69
2.	Triharjo	68,81	79,4	94,63	115	0,73	0,69
3.	Tridadi	42,26	54,5	58,13	79	0,73	0,69
4.	Pandowoharjo	141,56	174,6	194,69	253	0,73	0,69
5.	Trimulyo	79,68	121,5	109,59	176	0,73	0,69

Source: BPS Sleman District in 2019 and 2021

In Table 4.12, it can be seen that the increase in the harvest area of corn crops in each village in Sleman District also has a positive impact on the increase in the amount of production. This result is also in accordance with research conducted by Latief (2018) in the North Sumatra region that rainfall variables and harvest area have a positive and significant influence on corn production in South Sumatra.

CONCLUSION

Rice production in 2018 amounted to 1,574.3 tons, rising to 1,613.4 tons in 2020, while corn production in 2018 amounted to 452.7 tons, rising to 576.3 tons in 2020. The total rainfall in Sleman District in 2018 was 2,526 mm with the maximum rainfall occurring in December at 178 mm, while the total rainfall in 2020 was 3,272 mm with maximum rainfall occurring in December with rainfall of 184 mm slightly lower than in 2018. When viewed from the rainfall that occurred in 2018 and 2020, it directly affected rice and corn production. This happens because plant growth is very dependent on the availability of water sources derived from rainwater.

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