

Impact Variability of Rainfall Intensity to Horticulture Productivity at West Pasaman Regency, Province of West Sumatera, Indonesia

Ratna Wilis

Department of Geography Education
Fakultas Ilmu Sosial Universitas Negeri Padang
ratna_geounp@yahoo.com

Abstract

The changing of rainfall pattern and rising up rainfall intensity as phenomenon climate extreme, it has giving impact to dryness and floods, where that will give high potential to pressing agricultural productivity or make it be failure. The horticulture is the one of excellent sub-sector product in the region. The aim of the research is to analyst the climate change and connecting with distribution of horticulture commodity at West Pasaman Regency. Method of the research used the climatic data (data of rainfall intensity) from BMKG office, observation including re-analyst data of horticulture productivity since the years (2011 to 2015). The tools used software RCLimDex, is *Expert Team for Climate Change Detection and Indices* (ETCCDMI) to detecting and monitoring climate change, as the focus to climate extreme, During period of years 2000 to 2015, the rainfall variation between coastal area and terrain it so difference, if we compare with all has happened in the terrain area of West Pasaman the rainfall in the coastal has small variation every years. The global phenomenon ENSO (El Nino and La Nina) isn't significant influence the moonly record of rainfall variability at West Pasaman Regency, in the costal or hinterland. The sub-district has highest as productivity horticulture at the coastal area is Sungai Beremas, the middle grade productivity is Sungai Aua, and the lowest is Sasak.

Keywords: Rainfall Variability, Productivity, Horticulture

1. Introduction

Horticulture is one of the sectors growing so fastest in Indonesian agriculture. The types of plants cultivated in horticulture include fruits, vegetables, flowers and ornamental plants. While in The sector vegetable of the horticulture is one source of vitamins and minerals that is very useful to society. The agricultural sector in West Pasaman Regency consists of 5 sub-sector, is that food crops, horticulture, plantation, farm, forestry and fishery sub-sector. The five agricultural sub-sectors that provide the existent of (GRDP) gross regional domestic product, of the largest agricultural sub-sector is the agricultural sector are food crops sub-sector, horticulture and plantation sub-sector. The selection of food crops as sub-sector, horticulture and plantation sub-sector due to higher sub-sector contributes higher GRDP compared to other sub-sectors as well as this sub-sector has competitive and give advantage so compared to other sub-sectors.

West Pasaman regency is one of the districts in West Sumatra Province the located at 0 ° 33 N to 0 ° 11' S and 99 ° 10 E up to 100 ° 04 E that consists of 11 Sub-districts, 19 village.

Administratively and geographically the area of Pasaman Barat Regency is surrounded by:

- North: Mandailing Natal Regency of North Sumatra Province
- South: Tanjung Mutiara Sub-district, Regency of Agam
- East: Tigo Nagari Subdistrict and Panti Subdistrict, Pasaman District
- West side: Indian Ocean sub-district.

in the case of poverty alleviation in the field of horticultural and livestock food crops, the department of agriculture of horticultural crops and husbandry of West Pasaman regency has produced programs aimed at: first: developing food crops to produce basic food commodities (rice) for poor families, second: developing the livestock business for poor families with the aim that the poor families have savings, third: synergize the garden and cattle business cattle farm to increase the income of farmers with the target of 1 farmer 1 cow.

The agricultural sector is one of the dominant sectors to supporting the economy of West Pasaman Regency. This could happen because 70% of the population is engaged in agriculture, both food crops, plantations, fisheries and livestock (cattle farm). In the order to carry out the task, the department of agriculture of food crops and horticulture shall prepare a performance plan, for the development of the agricultural sector, especially the food crops and horticulture sub-sector. The goal of strategic of agriculture development 2015 -2019, the ministry of agriculture launched four strategic goals, namely: (1). increased food security, (2) export development and import substitution of agricultural products, (3). development of supply of bio-industry and bioenergy raw materials, (4) agricultural infrastructure development.

Main commodities of food crops in this regency is rice, maize, peanut, cassava, sweet potato, soybean and peanut. While horticultural commodities is chilly, onion, tomato, carrot, eggplant, onion, cabbage, beans, mustard and potato, other horticultural commodities are fruits such as papaya, avocado, durian, rambutan and bananas.

In the middle of the lesser risks have to faces of farmers, there is climate change as phenomenon whose impact so large for farmers, especially rice farmers. Global climate change has been happen because a long dry season or an excessive rainy season of rainfall with high rainfall intensity. Changing rainfall patterns and increasing the intensity of extreme climate events, because droughts or floods that will have great potential to decrease productivity and even harvest crops. This condition can also cause stressful livestock and result in deterioration of production (Guntoro, 2011).

The phenomenon of climate change with all impact, is that not only we can see from the negative side alone. Because behind the phenomenon also raises various opportunities and challenges, especially for Indonesian farmers to be able to seize the opportunity. Some things we need to make opportunities as well as challenges for us to meet include: (1) increasing food and feed production, (2) production of alternative energy, especially bioenergy, and (3) optimizing the utilization of local resources. At the moment there not available the information on the impact of climate change and the spread of food crop commodities and horticulture in every sub-district in West Pasaman Regency. The spread of this commodity needs to be done with the consideration of knowing what the superior commodities of food crops and horticulture for every sub-district.

2. Research Method

The research has been done in West Pasaman District, where has used climate data (especially rainfall data), observation data and re-analysis data of rainfall and data of food crops and horticulture production for 5 years (2011-2015). To detect the occurrence of climate change in the region of West Pasaman, the data necessary climatological elements, especially rainfall, maximum air temperature, air temperature has at least 30 minutes of continuity of data.

Data processing

- CDO

Climate Data Operator (CDO) is a software developed by Uwe Schulzweida and Luis Kornblueh from Max Plank Institute for Meteorology, Germany in 2009 (CDO Version 1.4.1). In this research the CDO software is used to manipulate the multi-dimensional data of ERA-Interim into numeric data.

- GrADS

Grid Analysis and Display System (GrADS), a software developed by Brian Doty in 1995. In this study the GrADS software is used to extract ERA-Interim data into data points on the coordinates that have been determined. ArcGIS

ArcGIS software, in addition to used to display (layout) map research results are also used to interpolate air temperature data extraction results ERA-Interim data in the study area.

- Mann-Kendall Test

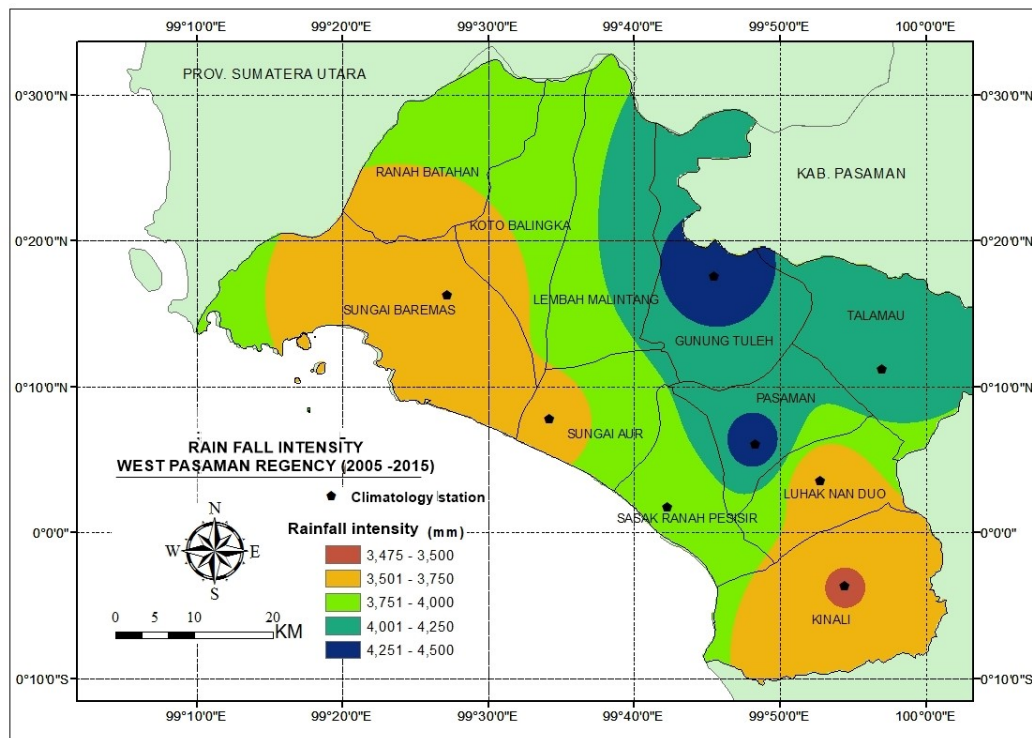
To find out the trend and the significance of extreme indexes are tested trend by using Mann Kendal test by using Makensen program. Makensen is a statistical template run on Microsoft Excel, a statistical program used to calculate the variations of annual trends created by the Finnish Meteorological Institute in 2002.

3. Result and Discussion

A. Rainfall

1. Spatial Distribution of Rainfall in Kab. Western Pasaman

In Figure 1 it is seen that annual rainfall in Kab. West Pasaman ranges from 3500-4500 mm

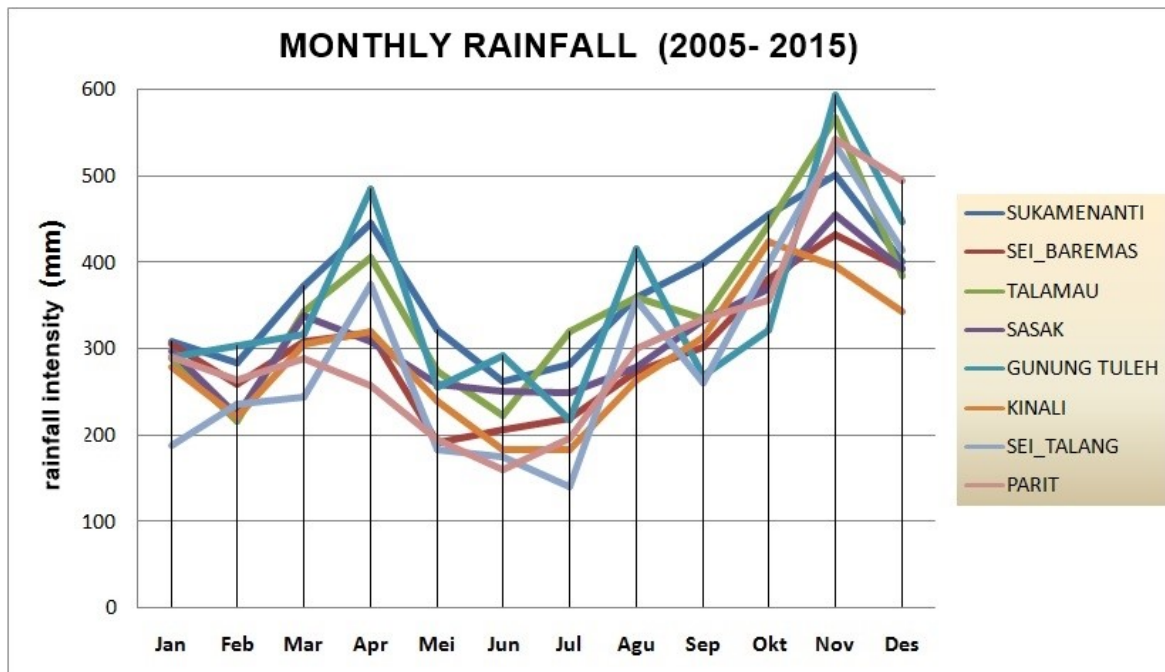


Capture 1: The Spatial distribution of Rainfall intensity

2. Monthly Rainfall Pattern

In the West Sumatera The general patterns of monthly rainfall, the pattern of rainfall in the region of West Pasaman, is also has a pattern or type equatorial, the rainfall pattern with two peaks of rain in each year, it has occurs because of the influence of the movement of pseudo solar. For rainfall in Pasaman Barat, the peak of the first rainfall, it occurred in April and the second peak occurred in November, as shown in capture 2. The interesting thing about the rainfall pattern in West Pasaman, is the rainfall that occurred in August -September where the August rainfall is higher than September. So it seems as if August becomes like the third peak of rain, as happened at Tuleh, Talamau and Sei Talang. However, it is not visible for areas located on the western coast of West Pasaman such as Sei Baremas, Sasak and Parit (Sei Aur), meaning that August rainfall is lower than September rainfall at these locations.

From Figure 2, it is also known that the lowest monthly rainfall occurs between May-July, with an amount not less than 150 mm per month, which means that the area of Pasaman Barat is not included in the zone zone, which means in Pasaman Barat never experienced the dry season

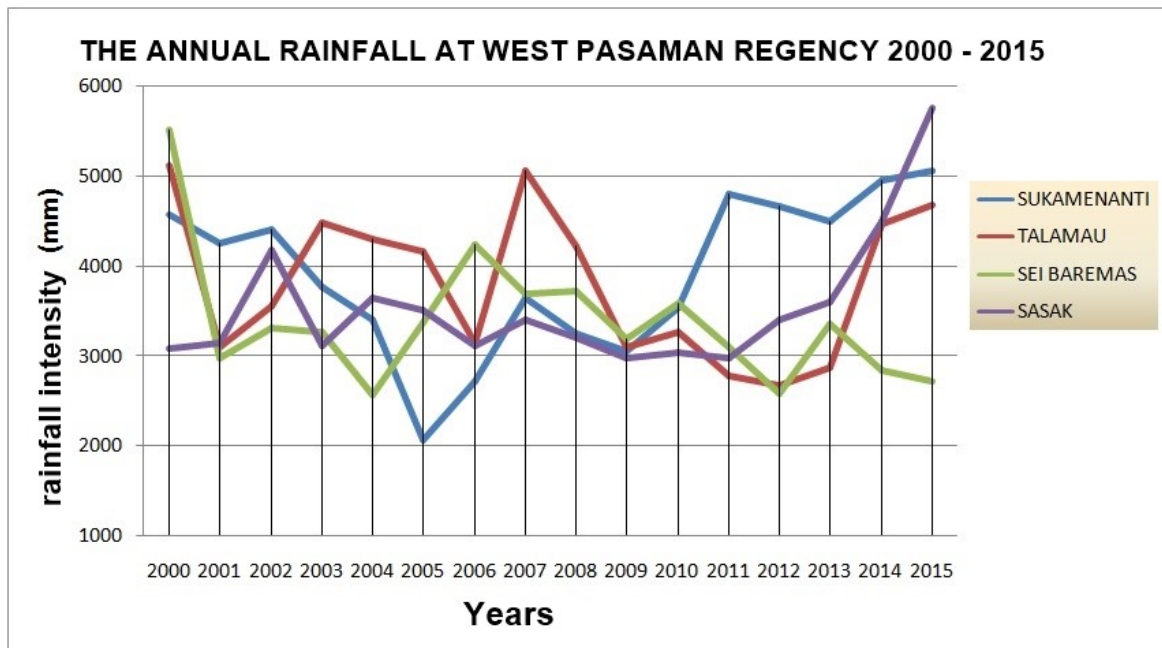


Capture 2: The graphic of monthly rainfall at West Pasaman

3. Annual Rainfall Pattern in West Pasaman

In West Pasaman The annual rainfall pattern, as shown in capture 3. The aims display data to see the annual trend of rainfall in the region of West Pasaman. In capture 3. There four rainfall observation sites, with two locations each representing coastal areas, namely Sasak and Sei Baremas and two other locations, namely Sukamenanti and Talamau to represent the inland plains. From the Figure it can be seen that during the period of 2000-2015, the rainfall in the coastal areas has a relatively small annual variation in comparison with annual rainfall in the inland area of Pasaman Barat.

In capture 3. There is also a decrease in the annual rainfall trend for rainfall in coastal areas as seen clearly for the location of observations in Sei Baremas and Sasak, although during the last five years (2011-2015) the observation of rain in Sasak showed an increase. In the inland area of West Pasaman, represented by rain observation post in Sukamenanti and Talamau, were found, besides having relatively higher annual variation, the annual rainfall trend in Sukamenanti decreased from 2000-2005, to reach the lowest rainfall point (2000 mm) then the trend became positive in the year 2005-2015. Another case with the rainfall in Talamau, the stabilize the amount of rainfall between 3000-5000 mm.



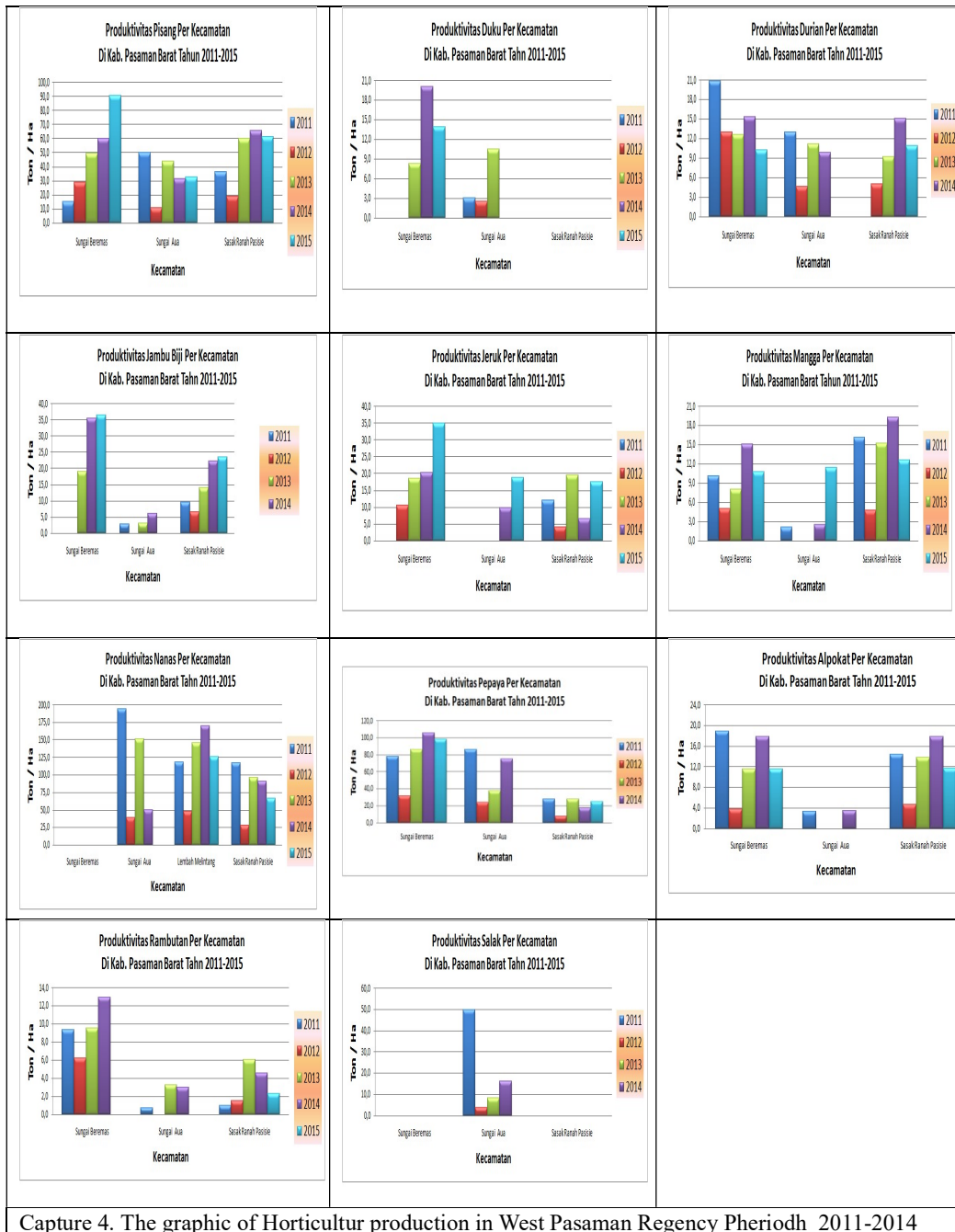
Capture 3 : The graphic of Annual Rainfall Pattern in West Pasaman

B. Distribution of Horticulture Plants in West Pasaman Regency

The total area of West Pasaman Regency is ± 3,887.77 km² or 9.29% of the total area of West Sumatra Province, with a coastline of 152 km, has 11 districts with 19 Village and 202 Jorong, located between 00°03' North Latitude to 00°11' Latitude South and between 99°10' up to 100°04' East Longitude, place height 0 - 2912 m above sea level.

The fertile West Pasaman landscape extends from North to South, very suitable for agriculture in the broad sense such as Food Crops, Horticulture, Livestock, Plantations and others. West Pasaman is a central corn production, catfish smoke, banana, palm oil, cocoa and patchouli in West Sumatra Province. The development of this flagship commodity is driven by the Department of Agriculture of Horticultural Crops and Animal Husbandry of Pasaman Barat Regency after a joint discussion (Synergic Program) in BAPPEDA West Pasaman. The main commodity types of fruit plants in West Pasaman district is bananas, avocado, rambutan, salak, duku, durian, pineapple and others.

The following illustrate the distribution of horticulture commodity production in West Pasaman District (2011-2015) as shown below:



Capture 4. The graphic of Horticultur production in West Pasaman Regency Pheriodh 2011-2014

From figure 10, we can see the grown productivity of horticultural crops, with productivity varies for 3 districts each year. In general, Sungai Beremas district has a good improvement for the production of horticultural crops compared to the other 2 sub-districts, shown in Table 2 below.

Table 2. Productivity of Fruit Crops in West Pasaman Coastal Area period 2011-2015

No	District	Productivity (Ton/Ha)										
		Banana	Avocado	Rambutan	Salak	J.Biji	duku	durian	mangg	Pineapple	Orang	Papaya
1	S.Beremas	48.72	12.70	9.49	-	30.31	14.12	14.42	9.80	-	21.06	79.90
2	S. Aua	33.66	3.42	2.33	19.54	3.96	5.33	9.69	5.33	108.49	14.26	55.66
3	Sasak R.Pasisi	48.30	12.49	3.10	-	15.20	-	8.03	13.62	79.76	11.92	21.23

From table 2 above, we can observed the horticultural crops planted in 3 districts in the coastal area of West Pasaman. Sungai Beremas district doesn't produce salak and pineapple plants. Aua River District produces all horticultural crops. While Sasak District does not produce salak and duku plants. The evaluation of the spread of fruit plants in West Pasaman can see in table 3 below

Table 3. Evaluation of Fruit Productivity Spreading in West Pasaman period 2011-2015

No	Kecamatan	Fruit Name										
		Banana	Avocado	Rambutan	Salak	J.Biji	duku	durian	mangg	Pineapple	Orange	Papaya
1	S.Beremas	S	T	T	-	T	T	T	S	-	S	S
2	S. Aua	R	R	R	R	R	R	S	R	T	R	S
3	Sasak R.Pasisi	S	T	R	-	S	-	S	T	R	R	R

Evaluation productivity of fruit plants distribution for coastal area of West Pasaman is clearly seen in table 3. Sungai Beremas District is superior for some fruit plants. High rank for pokat, rambutan, guava, duku and durian. The ranking for mango, citrus, banana and papaya. Sungai Aua Sub-district has a high rank for pineapple, medium rank for papaya and durian, while for other plants are in low grade. Sasak sub-district is ranked high for productivity of pokat and mango plants, moderate for guava and durian. For banana plants, rambutan, pineapple and others are in low grade.

Despite of decline in the annual rainfall trend for rainfall in the coastal areas as seen so clearly for the observation sites in Sei Baremas and Sasak, although for the last five years (2011-2015) The observation of rainfall in Sasak showed an increase. West Pasaman region experienced the highest rainfall in August compared to September. But in the coastal areas district of Beremas, Sungai Aua and Sasak the lowest rainfall intensity in August. This difference doesn't imply a direct influence on the productivity of horticultural crops. Clearly coastal areas have the potential to be planted horticulture crops as seen above.

4. Conclusion

The results from the research can rising up conclusions include: During the period of 2000-2015, rainfall in the coastal areas has a relatively small rainfall annual variation in comparison with annual rainfall in the inland area of Pasaman Barat. The global phenomenon of ENSO (El Nino and La Nina) does not significantly affect the variability of monthly rainfall in the West Pasaman, both for coastal areas and inland areas. The sub-district for productivity so highest of its fruit trees in coastal areas is Sungai Beremas District. The rating is on the District of Sungai Aua, while the lowest area is Sasak Ranah Pasisie Subdistrict.

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