IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 12 Issue 05, May 2025
ISSN (Online) 2348 – 7968 | Impact Factor – 6.72
www.ijiset.com

Rainfall Data and Mapping of Cropping Patterns in Lima Kaum District

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Abstract

Climate is the average weather conditions based on the length of time for a particular location on earth. Climate elements are solar radiation, air temperature, wind, clouds, air pressure and air humidity. This method was carried out on 14 Oktober 2024, which was carried out online via the BPS Tanah Datar Regency website. Rainfall data for the last ten years was searched through the Tanah Datar Regency BPS website, after which the data was analyzed and classified using the Schmidt-Ferguson, Oldeman, and Mohr climates and then crop patterns were created. Mohr's climate classification in Lima Kaum District is classified as type III. Oldeman's climate classification in Lima Kaum District is classified as C3. The Schmidr-Ferguson climate classification in Lima Kaum District is type C. Based on the different climate types, the crop pattern mapping is rice-secondary crops-secondary crops, with the secondary crops being corn, soya bean and mung bean.

***Keywords**: Lima Kaum, Mohr, Oldeman, Rainfall, Schmidt-Ferguson*

1. Introduction

Climate is the average weather conditions over a long period of time in a certain area. Climate is the average weather conditions over a period of one year that is studied over a long period of time (at least 10 years or more) and covers a wide area (1). Rain occurs because clouds have a collection of water droplets due to the condensation of water vapor in the atmosphere. The existence of clouds occurs from a collection of water droplets that occur due to the condensation of water vapor in the atmosphere (2) Air pressure can be influenced by the presence of the weight of the air layer. Air pressure is influenced by the presence of the weight of the air layer (3)

Humidity can be influenced by water vapor in certain air that can warm intensively. Air humidity is influenced by the water vapor content in the air that moves quickly or slowly, so that the air mass can warm intensively (4) Indonesia uses three types of climates, namely Schmidt - Ferguson, Oldeman, and Mohr. The climate classification commonly used in agriculture in Indonesia is the climate of Mohr, Schmidt-Ferguson, and Oldeman (5) The Schmidt-Ferguson climate is a climate classification based on the rainfall that falls each month so that the wet months, humid months, and dry months are known. The Schmidt-Ferguson climate is the amount of rainfall that falls each month so that the wet, humid, and dry months are known (6)

Lima Kaum District has an area of around 1336 km2. Lima Kaum District has an area of 1336 km2 and is one of the corn barns in West Sumatra Regency (7) Lima Kaum District obtained 19.13 tons of corn in 2013. Based on BPS data from Lima Kaum District, information was obtained that in 2013 corn production was 18.51 million tons and in 2014 it was 19.13 million tons (8)

The purpose of the climate event and crop pattern mapping research is to find out the Mohr, Oldeman and Schmidt-Ferguson climate types based on rainfall. The benefit of this practicum is that it can create a planting pattern for Lima Kaum District, Tanah Datar Regency based on rainfall for ten consecutive years.

2. Methodology

The materials used in the Climate Mapping and Planting Patterns practicum include tools and materials. The materials used in this practicum are rainfall data in Lima Kaum District, Tanah Datar Regency, for the last ten years. The tools used in this practicum are a laptop to search for rainfall data on the BPS (Central Statistics Agency) website and Ms Excel to process the data.

This research was conducted on October 14, 2024, which was conducted online through the BPS City/Regency website. The method applied in this practicum event was rainfall data for the last ten years searched through the BPS Tanah Datar Regency website. The data was processed into a table and analyzed according to climate types according to Mohr, Schmidt-Ferguson, and Oldeman. Mapping of cropping patterns for rice and secondary crops was made based on the analysis that had been carried out based on the climate type in Lima Kaum District.

3. Literature Review

Rainfall Distribution and Its Impact on Cropping Patterns
Rainfall distribution plays a pivotal role in determining the suitability of land for specific crops. In Lima Kaum District, the timing and quantity of rainfall can either enhance or hinder crop production. For instance, early rainfall distribution has been shown to promote vegetative growth in certain species, such as Bromus berteroanus, leading to higher dry matter production (9) Conversely, late rainfall distribution may favor seed production in species like Erodium moschatum, as it ensures water availability during the reproductive phase (10)

The quantity of rainfall is equally important. In dry years, early rainfall distribution maximizes phytomass production, while in normal or rainy years, late distributions are more beneficial (9) This highlights the need for farmers to align their cropping patterns with the expected rainfall regime to optimize yields.

Cropping patterns in Lima Kaum District are influenced by water use efficiency, which is a function of rainfall distribution and soil type. Research indicates that annual pastures, common in Mediterranean regions, exhibit strong linear relationships between water use and production, up to a threshold of 440 mm of growing-season water use (11) Beyond this point, factors such as soil water-holding capacity and rainfall distribution become limiting.

Management practices, such as promoting early growth and maintaining adequate leaf area, can enhance water use efficiency and yield (11) These practices are particularly relevant in Lima Kaum District, where water is a scarce resource, and optimizing its use is essential for sustainable agriculture.

Germination patterns and seed production are critical components of cropping systems in Lima Kaum District. The timing of the first persistent rain significantly influences germination success, with species exhibiting varying sensitivities to temperature and moisture availability (11) For example, Hordeum murinum, a common crop in arid regions, relies on late rainfall distributions for seed production, as early distributions may lead to water stress during the reproductive phase (9)

Seed production is further influenced by plant density and intraspecific competition. In dense populations, reproductive inequality increases, leading to variability in seed yield (12) This underscores the importance of optimizing sowing densities to maximize seed production and maintain crop viability.

False break events, where rainfall occurs but is followed by a prolonged dry period, can disrupt cropping patterns by inducing premature germination and reducing seed viability. In Mediterranean regions, these events are most frequent during early autumn, coinciding with the dormancy release period of species like subterranean clover (13) This highlights the need for cropping systems that are resilient to such events, potentially through the selection of species with late dormancy release strategies.

Plant communities in arid zones, such as Lima Kaum District, are characterized by a high proportion of annual species that are adapted to fluctuating rainfall regimes. These species often exhibit strategies that allow them to capitalize on ephemeral water availability, such as rapid germination and short life cycles (14) However, in extremely dry years, even these adaptations may be insufficient to sustain plant growth, emphasizing the need for diversified cropping systems that include drought-tolerant species.

4. Results and Discussion

The variation in climate classification offers a comprehensive overview of the climatic potential and constraints in Lima Kaum Subdistrict. In general, the area has good agricultural potential, but water conservation strategies and the selection of climate-resilient crop varieties are essential for optimizing productivity, especially during dry months. Supplemental

irrigation or rainwater harvesting technologies could serve as effective solutions to mitigate drought risks. The following table shows the results of climate classification in Lima Kaum Subdistrict.

Table 1. Type of climate classification in Lima Kaum subdistrict

Subdistrict	Average Number of Wet Months in Ten Years	Average Number of Dry Months in Ten Years	Climate Type	Classification
Lima Kaum	7	2	Mohr	III
	5	5	Oldeman	C3
	7.2	2.4	Schmidt-Ferguson	C

Mohr Climate Classification

Based on Mohr's climate type classification for ten years in Lima Kaum District, Tanah Datar Regency, it is known that the Mohr climate classification in Lima Kaum District, Tanah Datar Regency is classified as type III with an average of 7 wet months and an average of 2 dry months, which means that the area has been classified as rather dry for the last 10 years. This is in accordance with the opinion of (15) who stated that the Mohr type III climate has 2-4 dry months and 4-9 wet months with a fairly wet type and a fairly weak dry period. The Mohr climate type classification is determined based on average rainfall data for ten years in Lima Kaum District using wet and dry month data. This is in accordance with the opinion of (16) who states that the Mohr climate is a climate classification that uses data on the number of wet and dry months in ten years.

Based on the Mohr climate type classification, Lima Kaum District over the last 10 years has had 7 wet months, 3 humid months, and 2 dry months. This is in accordance with the opinion of (17) who stated that the dry month group (BK) is a month with rainfall of around (CH) < 60 mm, a humid month (BL) is a month with 60 mm ≤ CH ≤ 100 mm, and a wet month (BB) is a month with CH > 100 mm. Determination of the Mohr climate type is very suitable for use in tropical climate areas. This is in accordance with (18) who stated that the Mohr system has created a climate classification specifically for tropical areas.

Oldeman Climate Classification

Based on Oldeman's climate type classification for ten years in Lima Kaum District, Tanah Datar Regency, it is known that the Oldeman climate classification in Lima Kaum District, Tanah Datar Regency has an average of 5 wet months and an average of 5 dry months, so it is classified into the Oldeman C3 climate classification (5-6 dry months and wet months). This is in accordance with the opinion of (19) who stated that according to Oldeman, Type C-3 (5-6 dry months, 5-6 wet months). The Oldeman classification is widely used by Indonesia because it is a tropical area and has a very large influence on the diversity of plant production both according to time and location. This is in accordance with the opinion of (18) In tropical areas, the main weather element that greatly influences the diversity of plant production is rain because its diversity both according to time and location is very large.

Cropping patterns using Oldeman's climate classification can show the amount of water needed by annual plants or food crops. This is in accordance with the opinion of (20) who stated that annual plants such as rice, corn, and soybeans require a very short time to harvest, so they require sufficient water for the growth and fruit filling process. Oldeman's classification is carried out to determine the success of a farmer's activity by considering the amount of water between the amount of water available in the land and the amount of water needed by plants during their growth period. This is in accordance with the opinion of (21) who stated that the success of an agricultural activity is largely determined by the consideration of the amount of water available in the land and the amount of water needed by plants during their growth period. The amount of water available on agricultural land can be seen from the rainfall conditions.

Schmidt-Ferguson Climate Classification

Based on the Schmidt-Ferguson climate type classification for ten years in Lima Kaum District, Tanah Datar Regency, it is known that the Schmidt-Ferguson climate type in Lima Kaum District, Tanah Datar Regency type is C with a Q value of 0.33, meaning it is rather wet. This is in accordance with the opinion of (22) which states that climate type C is rather wet with a Q value of 33.3 to 60.0%. The Schmidt-Ferguson climate type classification is often used to determine suitable

plants in the world of agriculture, forestry, plantations, and animal husbandry. This is in accordance with the opinion of (23) which states that in Indonesia, the management of natural biological resources (agriculture, forestry, plantations, fisheries, and animal husbandry) often uses the Schmidt-Ferguson climate zoning as its basis for rainfall data.

The climate classification carried out using the Schmidt-Ferguson climate is carried out based on the average number of dry months and the average number of wet months. This is in accordance with the opinion of (21)) who stated that this climate classification is made based on climate conditions in tropical areas, the basis is the amount of rainfall that falls each month and the level of wetness called the gradient (Q), Gradient Q is the percentage of the comparative value between the average number of dry months and the average number of wet months. The Schmidt-Ferguson climate classification divides rainfall into three, namely BK (less than 60 mm), BL (60 mm to 100 mm), and BB (more than 100 mm). This is in accordance with the opinion of Tasiyah et al. (2024) who stated that the Schmidt-Ferguson climate classification is divided into three types of rainfall, namely dry months (<60 mm), humid months (60-100 mm), and wet months (> 100 mm).

Planting Pattern Calendar

The rice-secondary crops planting pattern calendar or mapping is carried out based on the Oldeman climate type C3 guidelines with 5 wet months and 5 dry months and the planting pattern table is as follows:

Table 4. Cropping Pattern Mapping in Lima Kaum Subdistrict, Tanah Datar Regency

	Month											
	January	February	March	April	May	June	July	August	September	October	November	December
Presipitation (mm)	212	221	178	157	68	83	89	70	77	304	218	245
Scheme 1 Rice												
Maize												
Soybean preparation												
Scheme 2 Rice												
Secondary crops preparation												

Based on the table above, it is known that Oldeman's analysis over the last ten years can be carried out with a rice scheme because it is included in the C3 agroclimate zone, rice can only be planted once and should not fall in the dry month. This is in accordance with the opinion of (18)The Oldeman C3 classification is 68.7 percent or approximately 134 villages, meaning that rice can only be planted once a year and the second secondary crop planting must be careful not to fall in the dry month. Lima Kaum District has an irrigation area of 4.5 Ha and rainfed 187 Ha, making it possible to plant in the dry month (May - September). This is in accordance with the opinion of (24) Lima Kaum District has a land area of 500 Ha consisting of 5.5 Ha of irrigated rice fields, 190 Ha of rainfed, 15.5 Ha of community plantations, 35.5 Ha of settlements, and 0.5 Ha of fields.

Soil cultivation can be done in between each crop change with a period of 1 week. This is in accordance with the opinion of (25) who stated that with soil cultivation for crop changes every one week, it is hoped that soil density can be reduced so that soil aeration becomes better (air and water management) which will encourage root development. Water irrigation is very promising because it can increase agricultural production and can maintain sustainability and increase the productivity of farmers' rice fields. This is in accordance with the opinion of (26) who stated that water irrigation is very promising for increasing rice field productivity and can increase agricultural production and can maintain sustainability. Rainfed can be increased with proper land management and in accordance with soil characteristics. This is in accordance with the opinion of (27) who stated that thus the rice yield of rainfed rice fields can be increased with proper land management, in accordance with soil characteristics and nutrient needs for plants.

Rice planting can be done in December to March with an average rainfall of >100 mm/month and containing a lot of water vapor. This is in accordance with the opinion of (28) which states that rice plants can grow well in hot areas and contain a lot of water vapor. Good rainfall averages 100 mm per month or more, with a distribution of 4 months. Planting of secondary crops is carried out twice a year, namely in April to June and September to November. Corn planting can be done in April to July. This is in accordance with the opinion of Paski et al. (2017) (29)which states that corn is usually suitable for dry land, less suitable for land with stagnant water. Soybean planting can be carried out in September to November with rainfall above 50 mm/month. This is in accordance with (5) which states that soybean plant growth takes place from September to November with optimal rainfall of 50-200 mm/month. Mung beans can be planted 3 times a year. This is in accordance with Tampubolon and (30) which states that the climate conditions desired by mung bean plants to be able to grow and produce well in lowland areas up to an altitude of 500 meters above sea level with optimal rainfall of 50 - 200 mm/month.

In July to August, soil cultivation is carried out to inhibit the growth of weeds and pests using simple tools. This is in accordance with the opinion of (31) who stated that manual weed control can be done by cultivating the land, namely using simple tools such as sickles and lawn mowers. In addition, soil cultivation aims to provide optimal growing conditions for seedlings to be planted and preparation for planting plants. This is in accordance with the opinion of (32) stated that soil cultivation is also part of the land preparation technique (site preparation) with the aim of providing optimal growing conditions for seedlings to be planted.

5. Conclusion

Based on the research that has been done, it was concluded that Lima Kaum District has a different average rainfall. Where the different rainfall causes the types of plants planted to also be different because each plant has different water needs. According to Mohr's classification, Lima Kaum District is included in class III, which is quite wet, according to the Schmidt-Ferguson climate, Lima Kaum District is in class C, which is quite wet, and according to the Oldeman climate type, Lima Kaum District is included in group C3. Based on the different climate types, the mapping of crop patterns is rice - secondary crops - secondary crops, with types of secondary crops such as corn, soybeans, and green beans.

Acknowledgments

The author would like to express sincere gratitude to the Department of Agrotechnology, Faculty of Agriculture, Diponegoro University, for the facilities and support provided during the observation period.

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