RUMPHIUS PATTIMURA BIOLOGICAL JOURNAL
Volume 7, Issue 1 (2025), 001-008
E-ISSN: 2684-804X
DOI: 10.30598/rumphiusv7i1p001-008

Determination of Plant Season Based on Oldeman Agri Climate Zone And Utilization of Regulation Food Crops Cropping Patterns in Kisar Island, Southwest Maluku Regency

Semuel Laimeheriwa[1*], Elia Leonard Madubun[1], Robby Gerald Risamasu[2], Marcus Luhukay[2]

[1]Agrotechnology Study Program, Faculty of Agriculture, Pattimura University. Jl. Ir. M. Putuhena, Ambon 97233, Indonesia
[2]Soil Science Program, Faculty of Agriculture, Pattimura University. Jl. Ir. M. Putuhena, Ambon 97233, Indonesia

* Corresponding Author: elvissemuel@gmail.com

Check for updates

Article History:
Submitted:
December 16th 2024
Accepted:
Pebruary 10th 2025
Published:
March 20th 2025

Keywords:
oldeman,
plant season,
cropping pattern.

ABSTRACT

Oldeman agroclimatic zone is a classification system used to group areas based on rainfall distribution patterns and soil moisture potential available throughout the year. This system provides a clearer picture of which areas are suitable for certain crops based on their water needs, as well as optimizing the use of existing climate resources through cropping patterns arrangements. This study aims to identify and analyze Oldeman agroclimatic zones to determine the right planting season and develop efficient food crop cropping patterns on Kisar Island. This study combines two approaches, namely descriptive and quantitative with the following analysis stages: generating rainfall data, calculating average regional rainfall, determining agroclimatic zones, determining planting seasons, and arranging cropping patterns. The results of the study indicate that Kisar Island is included in Agroclimatic zone E3 with a planting season length of 7 months, starting in December and ending in June. Intercropping or mixed cropping patterns are options in corn and legume cultivation. To avoid water shortages during the reproductive phase of the plant, dryland rice planting should be carried out in the period from March to June.

How to cite this article:
Laimeheriwa, L., Madubun, E.L., Risamasu, R.G & Luhukay, M. (2025). Determination of plant season based on oldeman agri climate zone and utilization of regulation food crops cropping patterns in Kisar Idland, Southwest Maluku Regency. *Rumphius Pattimura Biological Journal.* 7(1), 001-007. https://doi.org/10.30598/rumphiusv7i1p001-008

Journal Homepage: https://ojs3.unpatti.ac.id/index.php/rumphius
Journal E-mail: rumphiusbiojournal@gmail.com
Research Article: Open Access

INTRODUCTION

The problem of food security in Indonesia is one of the important issues that must be addressed to ensure the welfare of the community, especially in facing global challenges such as climate change, population growth, and uncertainty in the world market. Food security is closely related to the determination of planting seasons and the regulation of cropping patterns, because both of thes affect reliable food production throughout the year. Determining the right planting season helps farmers plant at the most profitable time, based on appropriate climate and weather conditions. For example, planting in the rainy season for crops that require a lot of water, or choosing the dry season for crops that are more resistant to drought. This increases the chances of optimal harvests, thus supporting food security. Arranging cropping patterns by introducing various types of crops in one planting season or in different seasons can increase food diversity. This can help people reduce dependence on one type of food, which strengthens food security at the household or country level. By determining the right planting season and the right cropping pattern, the risk of crop failure due to extreme weather or natural disasters can be minimized. For example, by choosing crops that are more resistant to certain climate conditions, farmers can reduce losses and ensure a stable food supply (Reuter & Dariah, 2019; Salasa, 2021; Harini *et al*., 2022).

Indonesia, as a tropical country, has a diversity of climates and rainfall that varies between regions. The challenge that is often faced is the uncertainty of the rainy and dry seasons due to climate change which causes the planting season to be incompatible with existing conditions (Herlina & Prasetyorini, 2020). This uncertainty can have an impact on agricultural output, especially food crops. Research on determining planting seasons and cropping patterns based on Oldeman's agroclimatic zones is expected to be able to overcome this problem in a more systematic way and based on accurate climate data (Mardani & Wahid, 2022; Ridwan *et al*., 2023). Oldeman's agroclimatic zones are a classification system used to group areas based on rainfall distribution patterns and the potential for soil moisture available throughout the year. These zones can help determine the best time to start the planting season, as well as identify potential risks of drought or excess moisture. This system provides a clearer picture of which areas are suitable for certain crops based on their water requirements, as well as optimizing the use of existing natural resources through cropping pattern arrangements (Nasution & Nuh, 2019; Risamasu *et al*., 2023).

Kisar Island is a semi-arid area with a rainfall pattern that tends to be equatorial (Laimeheriwa, 2014) and is one of the centers of food production, especially corn and beans in Southwest Maluku Regency. The implication is that information on agro-climate resources in this area is important for agricultural planning, such as how long agricultural land can be cultivated during a year and how to arrange cropping patterns based on the available planting season that is adjusted to the water needs of each type of crop being cultivated. Based on the above, this study aims to identify and analyze the Oldeman agroclimatic zone to determine the right planting season and develop efficient food crop cropping patterns on Kisar Island. The results of the study will provide recommendations to farmers and policy makers on optimal planting season scheduling and appropriate cropping patterns to increase agricultural productivity.

MATERIALS AND METHOD

This study used data from the Kisar Island area which is administratively included in the Southwest Maluku Regency, Maluku Province. This area of 839,900 ha is astronomically located between 08º01'12" - 08º06'29" South Latitude and 127º08'36" - 127º13'52" East Longitude.

This study combines two approaches, namely descriptive and quantitative. The data collected are in the form of monthly rainfall data for the period 1994 - 2023 from the Saumlaki Meteorological Station, historical data (average value) of rainfall from the Wonreli Rain Station. Supporting data in the form of types of food crops cultivated by farmers on Kisar Island, the astronomical location of the area, elevation, and other data.

Data analysis stages include:

(1). Generating rainfall data for Kisar Island for the period 1994 - 2023 using a simple mathematical method, namely the weighted average technique (Manulang *et al*., 2023; Sitorus *et al*., 2023).

(2). Calculating the average rainfall for the Kisar Island area using the algebraic average technique,

(3). Determining the Oldeman agroclimatic zone based on the average monthly rainfall value (Table 1), followed by determining the planting season using the Oldeman triangle (1975) in Figure 1, and

(4). Arranging food crop cropping patterns based on the available planting season.

Table 1. Division of main types and subdivisions in the Oldeman climate classification system

Main Types	Number of Sequentially Wet Month
A	>9
B	7 – 9
C	5 – 6
D	3 – 4
E	< 3
Sub-Division	**Number of Sequentially Dry Month**
1	< 2
2	2 – 3
3	4 – 6
4	>6

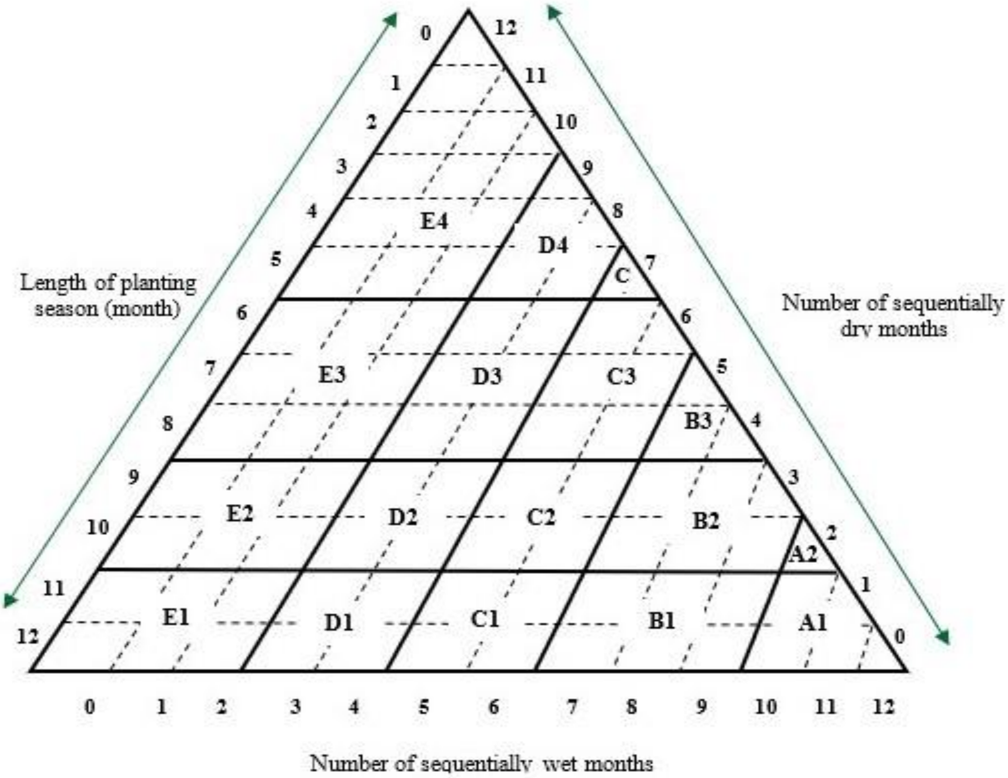

Figure 1. Oldeman's triangle to determine agroclimate class

RESULTS AND DISCUSSION

Rainfall

Kisar Island is located in the southern part of the Maluku Islands group, including a relatively dry area. The amount of annual rainfall during the period 1994 to 2023 ranged from the lowest of 663 mm in 1997 to the highest of 2385 mm in 2010 with an average value of 1266 mm/year (Figure 2). Lawalata *et al*. (2023) and Sopamena *et al*. (2024) reported that 1997 was an El Nino event year and 2010 was a La Nina event year with strong intensity.

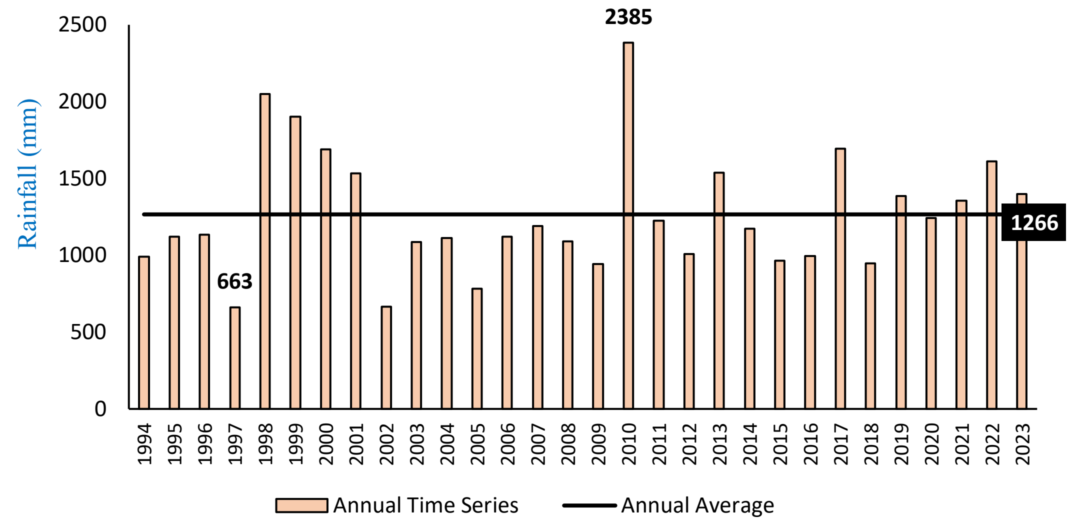

Figure 2. Annual rainfall distribution of Kisar Island

Rainfall is usually high in May with an average of 280 mm, while October is the driest month of the year with rainfall of 8 mm (Figure 3). This condition is in accordance with that reported by Laimeheriwa (2020) and Uspessy *et al*. (2020) that rainfall in areas with equatorial rainfall patterns in the Southwest Maluku Islands Regency and Tanimbar Islands Regency is usually high in May and low in October.

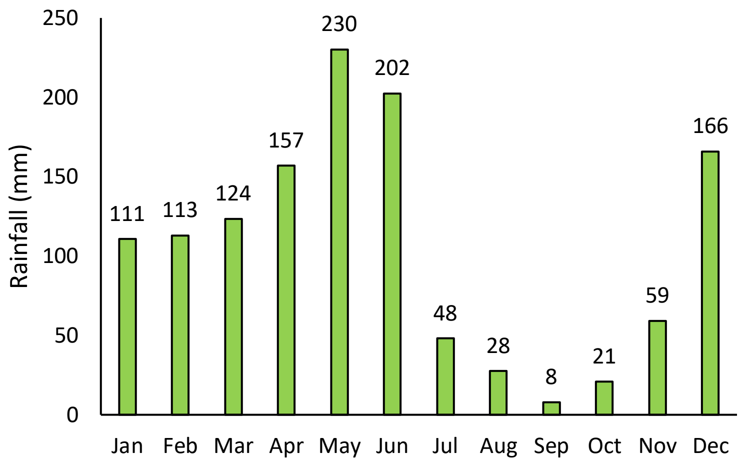

Figure 3. Monthly average rainfall of Kisar Island

As seen in Figure 3, during the period from July to November the average monthly rainfall was less than 100 mm, ranging from 8 mm to 59 mm. During the period from December to April the amount of rainfall was more than 100 mm and less than 200 mm, ranging from 111 mm to 166 mm. May and June are the wettest months of the year with an average rainfall of > 200 mm, namely 230 mm and 202 mm respectively.

Agroclimatic Zones and Planting Seasons

Agroclimatic zones are very important in agriculture because they function as guidelines in determining the types of plants that can grow well in an area. This zone refers to the climate conditions in an area, such as temperature, rainfall, humidity, and solar radiation, which affect plant growth. One of the climate classification systems aimed at developing seasonal crops such as food crops (rice and crops) in Indonesia is the Oldeman climate classification system or what is known as the Oldeman Agroclimatic zone.

The criteria in the Oldeman classification are based on the calculation of dry months, humid months, and wet months whose limits take into account the opportunity for rain, effective rain and plant water needs. The main type of classification is divided into 5 types based on the length of the wet month period (months with rainfall > 200 mm) in succession. While the subdivisions are divided into 4 based on the length of the dry month (months with rainfall < 100 mm) in succession, as shown in Table 1 and Figure 1 previously.

Referring to Table 1, then based on the average monthly rainfall value of the research location associated with the climate classification criteria, the following Table 2 presents the determination of the Oldeman agroclimatic zone of Kisar Island.

Table 2. Determination of the Oldeman agroclimate zone of Kisar Island

Month	**Average Rainfall (mm)**	**Dry Month**	**Humid Month**	**Wet Month**	**Oldeman Agroclimate Zone**
January	111		√		
February	113		√		Based on Table 1:
March	124		√		Number of sequently wet months : 2
April	157		√		
May	230			√	**Main Types : C**
June	202			√	Number of sequently dry month : 5
July	48	√			
August	28	√			**Sub Division: 3**
September	8	√			
October	21	√			**Agroclimatic Zone: E3**
November	59	√			
December	166		√		

Table 2 above shows that the number of consecutive wet months on Kisar Island is 2 months (May and June), and the number of consecutive dry months is 5 months, namely July to November. During the period from December to April are the humid months where plants will grow and develop well. Related to these conditions and referring to Figure 2 above, the length of the planting season on Kisar Island lasts for 7 months, namely December to June (Figure 4). July to September is a fallow period that is sensitive to drought or lack of water in the soil. If planting is desired throughout the year, other water sources are needed besides rain, such as wells and reservoirs, especially to anticipate water shortages during the fallow period.

<table>
<tr><td>Components</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td><td>Jan</td></tr>
<tr><td>Rainfall (mm)</td><td>111</td><td>113</td><td>124</td><td>157</td><td>230</td><td>202</td><td>48</td><td>28</td><td>8</td><td>21</td><td>59</td><td>166</td><td>111</td></tr>
<tr><td>Category</td><td>HM</td><td>HM</td><td>HM</td><td>HM</td><td>WM</td><td>WM</td><td>DM</td><td>DM</td><td>DM</td><td>DM</td><td>DM</td><td>HM</td><td>HM</td></tr>
<tr><td>Planting Season</td><td colspan="6"></td><td colspan="6">Fallow Period</td><td></td></tr>
</table>

DM=dry month; HM=humid month; WM=wet month

Figure 4. Determination of planting season in Kisar Island

Food Crop Cropping Patterns

Cropping patterns are ways or methods of arranging and planning the planting of various types of crops on agricultural land. The purpose of this cropping pattern is to increase agricultural yields by considering factors such as season, water requirements, soil fertility, and pest and disease control. Good cropping patterns can increase the efficiency of land and resource use, and support agricultural sustainability.

The decreasing availability of agricultural land due to population growth and physical development activities will certainly affect the reduction in harvested area and lead to low agricultural production. Arranging the right cropping pattern is one alternative policy in the efficiency of agricultural land use and increasing crop productivity (Sari *et al*., 2020; Julianto *et al*., 2023).

By utilizing the planting season information available in an area, better cropping patterns can be arranged. Tentua *et al*. (2021) reported that so far, the determination of cropping patterns on dry land at the farmer level has been guided by hereditary habits, including based on the month of rainfall. This kind of determination, in addition to suboptimal cropping patterns, also often brings the risk of low productivity and even crop failure due to prediction failure. To avoid such failure, accurate information about the characteristics of rainfall and water requirements at each phase of plant development as well as plant adaptability and tolerance is an important thing to consider in arranging cropping patterns. Patty *et al*. (2023) reported that minimal soil water content negatively affects plant growth during the reproductive phase because the mechanism of nutrient absorption by plant roots cannot take place properly even though the availability of nutrients in the soil is sufficient.

Various types of food crops that are generally cultivated by farmers on Kisar Island are corn, dryland rice, cassava, sweet potatoes, other tubers, red beans, cowpeas, and other beans. By considering the available planting season, water requirements at each phase of plant development as well as plant adaptability and tolerance to climate conditions, alternative cropping patterns that can be applied on Kisar Island are shown in Figure 5.

<table>
<tr><th>Cropping Pattern</th><th>Dec</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th></tr>
<tr><td>Sequential</td><td colspan="4">corn/red beans/cowpea/other beans</td><td colspan="3">dryland rice</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td rowspan="2">Monoculture</td><td colspan="7">cassava, sweet potato, other tubers</td></tr>
<tr><td colspan="7">corn/red beans/cowpea/other beans</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td rowspan="2">Intercropping/ Mixed Cropping</td><td colspan="7">cassava, sweet potato, other tubers</td></tr>
<tr><td colspan="4">corn/red beans/cowpea/other beans</td><td colspan="3">corn/red beans/cowpea/other beans</td></tr>
</table>

Figure 5. Alternative cropping patterns on Kisar Island

Figure description:

(1) The planting season period on Kisar Island for seven months (December to June) indicates a planting index of 2 for corn, beans, dryland rice, and 1 for cassava, sweet potatoes, and other tubers.

(2) If the water source for plants only depends on falling rain, dryland rice should be planted during the high rainfall period, namely March to June. This plant requires more water per month than other types of food crops, especially during the plant development phase which is sensitive to water shortages. Several scientific references including Samosir (2002) and Patterson *et al*. (2006) state that corn, beans and tubers are more resistant to drought than dryland rice.

(3) To avoid pest and disease attacks, alternative types of plants selected in intercropping and/or mixed cropping patterns should not be the same for the first and second plantings.

(4) Alternative cropping patterns of intercropping or a mixture of corn, cowpeas/kidney beans/other beans, tubers, and sequential cropping patterns such as corn - dryland rice, beans - dryland rice are options.

CONCLUSION

Kisar Island is included in the Agroclimatic zone E3 with a planting season of 7 months, namely starting in December and ending in June. Intercropping or mixed cropping patterns are options in the cultivation of corn, beans, and tubers. To avoid water shortages during the reproductive phase of the plant, planting dry rice should be done in the period March to June after corn and beans.

AUTHORS CONTRIBUTION

S.L designed and conducted the study, analyzed and interpreted, and wrote the draft of the manuscript. E.L.M, R.G.R & M.L designed the study and interpreted the data, designed the graphs, and reviewed the draft of the manuscript and supervised the entire process.

REFERENCES

Harini, R., Ariani, R. D., Yulianda, Y., & Widyantari, R. (2022). Adaptation strategies for food security to climate change in the outskirts of Yogyakarta City. *J. Indonesian Geography* 36(1), 1-9. https://doi.org/10.22146/mgi.60245

Herlina, N., & Prasetyorini, A. (2020). Effect of climate change on planting season and productivity of maize (Zea mays L.) in Malang Regency. *J. Indonesian Agricultural Science* 25(1). 118-128. https://doi.org/10.18343/jipi.25.1.118

Julianto, N., Widaryanto, E., & Ariffin. (2023). Land use efficiency through setting cropping patterns intercropping of shallots (Allium ascalonicum L.) and chili (Capsicum annum L.). *J. Agro Bali* 6(2), 350-360. https://doi.org/10.37637/ab.v6i2.1286

Laimeheriwa, S. (2014). Analysis of rainfall change trends in three regions with different rainfall patterns in Maluku Province. *J. Agriculture* 10(2), 71-78.

Laimeheriwa, S. (2020). Climate characteristics of Romang Island. *J. Agrologia* 9(1), 20-29. http://dx.doi.org/10.30598/a.v9i1.1059

Lawalata, I. J., Rehatta, H., Laimeheriwa, S., & Leatemia, J. A. (2023). The effect of climate change on the productivity of clove plants (Syzigium aromaticum) on Haruku Island, Central Maluku Regency. *J. Agrologia* 12(1), 99-108. http://dx.doi.org/10.30598/ajibt.v12i1.1808

Mardani, I., & Wahid, K. A. (2022). Mapping of Oldeman agroclimate zones in Central Java Province using Climate Hazards Group Infrared Precipitation with Station (CHIRPS) data. *J. Geosains and Remote Sensing* 3(2), 95-102. https://doi.org/10.23560/jgrs.v3i2.99

Manulang, S. M. M., Laimeheriwa, S., & Amba, M. (2023). Rainfall anomalies and their effects on clove plant productivity in two areas with different rainfall patterns in Maluku. *J. Agriculture* 19(1), 48-57. https://doi.org/10.30598/jbdp.2023.19.1.48

Nasution, M. I., & Nuh, M. (2019). Climate study based on Oldeman classification in Langkat Regency. *J. of Islamic Science and Technology*, 3(2), 1-19. https://dx.doi.org/10.30829/jistech.v3i2.3157

Oldeman, L. R. (1975). An agroclimatic map of Java. Contr. Centr. Res. Inst. Agric., 17, Bogor. 22p+map.

Patterson, G. A., Unger, P. W., & Payne, W. A. 2006. Dryland agriculture. American Society of Agronomy, Crop Science Society of American, Soil Sicence Society of America. 946p.

Patty, J. R., Ririhena, R. E., & Leiwakabessy, C. (2023). Utilization of cocoa shell ash (Theobrema cocoa L) as a source of potassium and different soil water levels in corn plants. *J. Small Island Agriculture* 7(2), 104-114. https://doi.org/10.30598/jpk.2023.7.2.104

Reuter, T. A., & Dariah, A. (2019) Chapter 2, Agriculture, food security and climate change. In book: Indonesia Facing Climate Change; Vol 2; Development and greenhouse gas emissions, edited by Nurbaya S. Kompas Book/Indonesian Ministry of Environment and Forestry Publisher. pp.32-44.

Ridwan, R., Amin, M., & Asmara, S. (2023). Agroclimate zoning of Central Lampung Regency for rice plants based on Geographic Information System. *J. Tropical Agrotech* 11(2), 217–226. https://dx.doi.org/10.23960/jat.v11i2.7185

Risamasu, R. G., Laimeheriwa, S., Madubun, E. L., & Luhukay, M. (2023). Analysis of rainfall changes and mapping of Oldeman's agroclimate zone, Seram Island, Maluku Province. *J. of Social Science Research* 3(3), 1010-1024. Retrieved from https://j-innovative.org/index.php/Innovative/article/view/ 2317

Salasa, A. R. (2021). Paradigm and dimensions of Indonesia's food security strategy. *Public Administration Network*, 13(1), 35-48. https://doi.org/10.20473/jap.v13i1.29357

Samosir, S. S. R. 2002. Dryland management. Faculty of Agriculture and Forestry, Hasanuddin University, Makassar. pp. 50-93.

Sari, S. H., Ghulamahdi, M., Suwarno, W. B., & Melati, M. (2020). Study of various planting pattern in increasing the productivity of maize and soybean with various maize varietas, *J. Agron. Indonesia.* 48(3), 227-234. https://dx.doi.org/10.24831/jni.v48i3.32267

Sitorus, B.W.M., Laimeheriwa, S., &. Madubun, E. L. (2023). Analysis of planting seasons and planting patterns for food crops based on climate conditions in Taniwel District, West Seram Regency. *J. Small Island Agriculture* 7(1), 9-22. https://doi.org/10.30598/jpk.2023.7.1.9

Sopamena, F. S., Pattiselanno, A. E. & Laimeheriwa. S. (2024). Women, rainfall anomalies and sources utilization of corn farmers' households in Babar Islands, Southwest Maluku Regency. *Migration Letter 21*(5), 222–232. Retrieved from https://migrationletters.com/index.php/ml/article/view/8820.

Tentua, E. V., Laimeheriwa, S., & Patty, J. R. (2022). Analysis of planting seasons and regulation of food crop planting patterns in various rainfall conditions in the Amahai area, Central Maluku Regency. *J. Small Island Agriculture* 6(1), 23-37. https://doi.org/10.30598/jpk.2022.6.1.23

Uspessy, J. F., Laimeheriwa, S. & Patty, J. R. (2020). Determination of growing season based on land water balance calculation in Saumlaki Area, Yamdena Island. *J. Agriculture* 16(2), 173-179. https://doi.org/10.30598/jbdp.2020.16.2.173