Revista de Estudios Andaluces (REA) | Núm. 47, febrero (2024) | e-ISSN: 2340-2776
https://dx.doi.org/10.12795/rea.2024.i47 | © Editorial Universidad de Sevilla 2024
https://editorial.us.es/es/revistas/revista-de-estudios-andaluces
https://revistascientificas.us.es/index.php/REA

SUMMARY OF ARTICLE: HTTPS://DX.DOI.ORG/10.12795/REA.2024.I47.04

Agro-environment zoning and growth periods of the municipality of Maravatio (Michoacán, México)

Genaro Aguilar-Sánchez
g_aguila@correo.chapingo.mx 0000-0003-1518-0801
Universidad Autónoma Chapingo (México). Chapingo, Texcoco, Estado de México. 56230

Daniel Aguilar-Sánchez
aguilarsanchez.daniel@gmail.com 0000-0001-6110-6499
Facultad de Filosofía y Letras, Universidad Nacional Autónoma de México.
Circuito Interior s/n, C.U., Coyoacán, Ciudad de México, México. 04510

KEYWORDS

Climate
Growth periods
Staple crops
Agro-environments

INTRODUCTION

The climate changes in the last fifty years, in the world and in Mexico, are a product of the excessive use of natural resources and the modernization of agriculture, where many chemical inputs are used in fertilizers and pesticides, significantly altering the natural ecosystems at various scales: national, state, and local. In addition, the growth of industrial and urban centers also contributes to the increase in temperature, such that it is mentioned that in the last 50 years the temperature has increased by 1 to 1.5 degrees Celsius in various parts of the world. For this reason, currently the number of public policies implemented to reduce the temperature by 1.5 degrees Celsius has increased, to return the temperature to the level of the pre-industrial period. Mexico and its agricultural, livestock and forestry activities are located in this context. Where it is necessary to delimit areas according to their agro-environmental conditions and their climatic characteristics.

GENERAL OBJECTIVE

Carry out agro-environment zoning and calculate the growth periods of the municipality of Maravatio, in the state of Michoacan.

METHODOLOGY

In agro-environmental differentiation, the proposal of Romero et al. (2003) is used, which consists of the application of the following sections:

1. Inventory the natural resources of the municipality of Maravatio, in a general way. Esc 1:500 000.
2. Characterize the natural resources of the selected municipality Esc 1:500,000, with maps of relief, geology, climate, soil, vegetation, and current land use. Using printed and digital cartography. As well as carrying out work in the field.

DOI: https://dx.doi.org/10.12795/rea.2024.i47.04
Formato de cita / Citation: Aguilar-Sánchez, G., & Aguilar-Sánchez, D. (2024). Agro-environment zoning and growth periods of the municipality of Maravatio (Michoacán, México). *Revista de Estudios Andaluces,*(47), 78-97. https://dx.doi.org/10.12795/rea.2024.i47.04
Correspondencia autores: g_aguila@correo.chapingo.mx (Genaro Aguilar-Sánchez)

3. Differentiate the study spaces into homogeneous cartographic units, using the digital topoform map of the National Institute of Statistics, Geography, and Informatics (INEGI) of Mexico as a basis.

For the growth periods section, the proposals of:

- Aguilar-Sanchez (1995), it indicates that the calculation of potential evapotranspiration (ETP) can be calculated according to the evaporation recorded in each climatological station and the formula recommended by García (1979) is used, "ETP= 0.8 EV", where ETP is Evapotranspiration potential, 0.8 is a constant with Empirical Value that considers the soil and the atmosphere and EV is Evaporation.
- On the other hand, Pájaro-Huertas (1988) mention that the beginning of the growing period is based on the beginning of the rainy season. It is defined when P= 0.5 ETP and it is considered that this amount of water is sufficient for the germination of seeds of different crops. The humid period is the interval in which precipitation is greater than potential evapotranspiration (P > ETP) and the end of the growing period, when there is a humid period; however, the termination of the growing period goes beyond the end of the rainy season, since crops often mature with moisture reserves stored in the soil profile. The end of the growing period generally exceeds a number of days after the end of the rainy season, so that it is sufficient to evapotranspiration 100 mm, which are considered the soil moisture reserves.

The proposals of previous researchers are used, where the basic indicators are selection of meteorological stations with more than ten years of observation, for which the following information was analyzed:

1. Average monthly precipitation.
2. Average monthly evaporation.
3. Number of days with frost each month.
4. Minimum monthly temperature.

Based on the previous data, it was calculated:

i. Frost-free period.
ii. Potential evapotranspiration.
iii. Growth period.

Also, according to Pájaro-Huertas (1988), it is possible to establish the frost-free period and the dates of occurrence of the last and first frost. The growth period established by water availability can be superimposed on the dates of occurrence of such events and in this way obtain the effective growth period with adequate humidity and temperature conditions. Which in turn reduces the possibility of being interrupted by the presence of the last and first frost. In calculating the frost-free period, the following equation was used:

$$PLH = 1.7713 + 31.0214\ (Tmin) - 0.6361\ (Tmin)2$$

Where:

PLH = Frost-free period, in days

$Tmin$ = Average annual minimum temperature, in °C

$$UH = 225.3605 - 0.7396\ (PLH) + 0.0004385\ (PLH)2$$

Where:

 | e-ISSN: 2340-2776 | doi: https://dx.doi.org/10.12795/rea.2024.i47.04

UH = Coded date of occurrence of the last frost PLH = Frost-free period in days.

$$PH = 229.5781 + 0.2262\ (PLH) + 0.0005098\ (PLH)2$$

Where:

PH = Coded date of occurrence of the first frost PLH = Frost-free period, in days.

The delimitation of the areas of influence is carried out with the polygon procedure of Thiessen (1911), which has been used in various works on the average quantification of precipitation in large areas, the delimitation of runoff and the differentiation of agroclimatic zones.

RESULTS

The municipality of Maravatio, Michoacán is located between parallels 19°46' and 19°58' north latitude; the meridians 100°12' and 100°38' west longitude; altitude between 2,000 and 3,500 m. It borders to the north with the state of Guanajuato and the Municipalities of Epitacio Huerta and Contepec; to the east with the municipalities of Contepec, Tlalpujahua and Senguio; to the south with the municipalities of Senguio, Irimbo and Hidalgo; to the west with the municipalities of Hidalgo and Zinapecuaro and the state of Guanajuato. Its surface is 696.67 km^2 and represents 1.17 percent of the state's total.

Natural resources are basic for the delimitation of agro-environments, the characteristics of the topography are: mountains, hills, plateaus and valleys, with the presence of bodies of water and urban areas. Geology of extrusive igneous rock such as basalt, andesite, rhyolite and volcanic breccias. The climate is semi-warm, temperate, and semi-cold. In the semi-warm subtype there is the type: humid, subtype ((A)C(w0)(w)), in the temperate subtype there is the sub-humid type, subtypes (C(w2)(w) and C(w1)(w).)), in the semi-cold subtype is the humid type, subtype (C(E)(m)(w)). In soil predominates: Vertisol, Andosol, Phaeozem, Leptosol, Planosol, Luvisol, secondarily there is Durisol, Gleysol, Fluvisol and Regosol. In the use of soil and vegetation, Agriculture, Grassland, Forest, and Urban Area are the main ones. The timber forest area is occupied by pine and oak; the non-timber forest consists of bushes of different species. In the municipality, forests predominate, such as mixed forests with pine, oak, aile, poplar, ash, willow and juniper, and the coniferous forest, with fir, juniper and pine.

9 agro-environments were delimited: Lomerio de tuffs with plateaus (LT1 and LT2). Tent Slope Valley (VLT1 and VLT2). Volcanic mountain range with stratum volcanoes or isolated stratum volcanoes with plateaus (SVE1). Complex saw (SC1). Volcanic mountain range with steep slopes (SVL1) and basaltic plateau with ravines (MB1 and MB2).

The growing periods, PC, vary from 136 to 164 days and in most climatological stations, frost-free periods are recorded, PLH, fluctuates from 198 to 249 days, only station 00016071 Los Azufres reports 108 days of PLH. Therefore, short cycle crops such as early corn varieties, three and a half months, and intermediate cycles of 5 and a half months, can be produced with the humidity provided by seasonal rains. In addition to planting corn, beans, chickpeas, and broad beans can be produced in the rain. The Los Azufres station is limited by frost; However, in the area of influence of this climatological station there is pine and oak vegetation, in an abrupt relief, typical of the mountains.

CONCLUSIONS

The relationship of relief, soil, and climate are important to estimate growth periods and their use by farmers, technicians, agricultural geographers, and agronomists. To estimate risks in agricultural production, since soil characteristics such as slope, depth and texture are essential to store and retain moisture for crops and natural and induced vegetation.

 | e-ISSN: 2340-2776 | doi: https://dx.doi.org/10.12795/rea.2024.i47.04

By having calculated the days that a growing period lasts, it can be recommended which crop variety of corn, beans, sorghum, or other grass crops, legumes and even short-cycle vegetables can be planted in good humidity conditions.

The favorable agroenvironments for agricultural production are Lomerio of tuffs with plateaus. Valley of Tended Hills, those not favorable for agricultural and livestock production, as happens in the Sierra territories, and hills with a slope of more than 15%, should not be used for said activity. And priority must be given to the conservation of forest and deciduous forest vegetation.

It can be concluded that approximately 70% of the territory of Maravatio Michoacan has favorable conditions to produce crops with agricultural cycles that fluctuate between 130 to 150 days. The rest should be used as spaces for the conservation of natural resources and for recreational activities, but in a controlled manner.

 e-ISSN: 2340-2776 | doi: https://dx.doi.org/10.12795/rea.2024.i47.04