



“Agro-Climatic Zone of Godavari Upper Basin and Crop Planning”

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Abstract:

Godavari Upper Basin Covered the some area of Nashik, Ahmednagar and Aurangabad Districts of Maharashtra state in India. The Basin area has been experiencing climate variability. Hence, it is associated with drought like condition influences agricultural land of an area. The Basin is lying in the rain shadow zone of Western Ghats where most of the area receives less amount of rainfall. The main objective of the present study is to identify the Agro-Climatic Zone and crop planning of the Godavari Upper Basin. Agricultural land has been facing various problems due to physiography and agricultural practices. Lack of knowledge about agricultural is also a prime factor of failure of crop and loss. The below study is based on secondary data. Agricultural department of Maharashtra is the source of information. For the detail analysis Geographical Information System (GIS) tools is applied. AgroClimatic Zone demarcated by Planning Commission and by Indian Council of Agricultural Research (ICAR). The study area is mostly part of hot and dry climate except south-west monsoon period. The present study introduces Agro-Climatic Zone of Godavari Upper Basin which based on physiography of an area. We suggest various methods for improve the crop productivity and profit; suggestions are based on Agro-Climatic Zone.

Keywords: Agriculture, Agro-Climatic Zone, Maharashtra, Godavari Upper Basin, Climate, Crop Planning, Irrigation.

Introduction

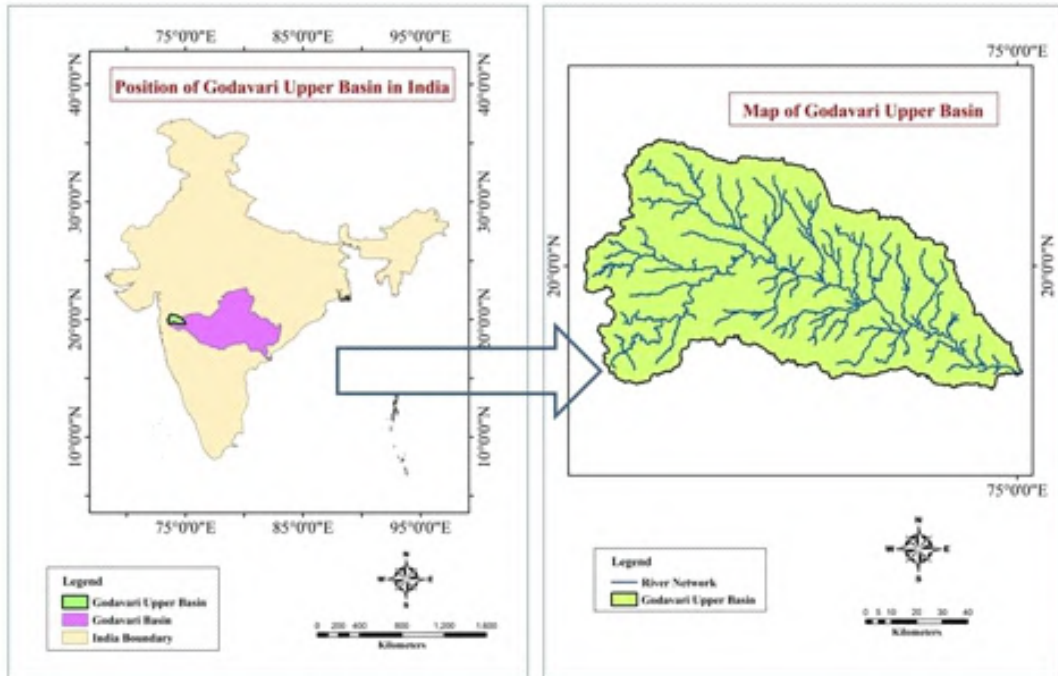
Introduction

Maharashtra state is 3rd largest state of India and it is located in North central part of the peninsular plateau of India. Maharashtra state is bounded by Arabian Sea on western side. Administratively it is bounded by Gujrat and Madhya Pradesh which lies on northern side, Chhattisgarh on eastern side. Southern side is bounded by Karnataka and Andhra Pradesh. The Western Ghats (Sahyadri) runs North-South direction separates Coastal area from main land. Due to topography of Maharashtra Western side of Sahyadri receives maximum amount of rainfall which is orographic in nature. While on the other hand eastern side of Sahyadri where suddenly drops in the amount of rainfall known as Rain Shadow Zone. Meteorologically Maharashtra state subdivided into four divisions namely Konkan, Madhya Maharashtra, Marathwada and Vidarbha (Report on Climate of Maharashtra). Principally Maharashtra State classified into three climatic classes namely Tropical Savana (Hot) Climate (Aw), Tropical Rainy Monsson Climate (Am) and Dry Climate (Bsh). The Maharashtra state receives rainfall mostly during South-West Monsoon period from June to September. The amount of rainfall is unevenly distributed over Maharashtra. The amount of rainfall received over Maharashtra state ranging from 600 cm at Ghats to less than 60 cm at Madhya Maharashtra. The Maximum temperature of Maharashtra varies between 270C and 400 C while minimum temperature of Maharashtra varies between 140C and 270C. The maximum temperature during summer season is between 360C and 410C and minimum temperature is during winter season which ranges between 100 C and 160 C (Report on Climate of Maharashtra).

Study Area

The study area belongs to Godavari Upper basin. The latitudinal extension is 190 33' 58.505" to 200 26' 43.551" North and longitudinal extension is 730 28' 34.467" to 750 01'

4.485 East. The Study area is very irregular in nature. The North-South and East-West distance of the study area is 95.73 km and 166.26 km respectively. The study area occupied nearly 9654.06 sq. km. areas.



Administratively the study area having some area of 21 Tahsil; namely Nashik, Trimbakeshwar, Dindori, Peint, Niphad, Surgana, Kalwan, Chandvad, Nandgaon, Yeola, Igatpuri and Sinnar of Nashik district; Shahapur of Thane district; Akola, Kopargaon, Shrirampur, Rahata, Sangamner and Nevasa of Ahmednagar district; Vijapur and Gangapur of Aurangabad district, etc. The study area shares north, north-west and west boundary with Nashik district, north-east, east and south-east with Aurangabad district, south with Ahmednagar district, south-west with Thane district. The Study area has 1203 villages of districts of Nashik, Ahmednagar, Aurangabad and Thane (Census of India, 2011).

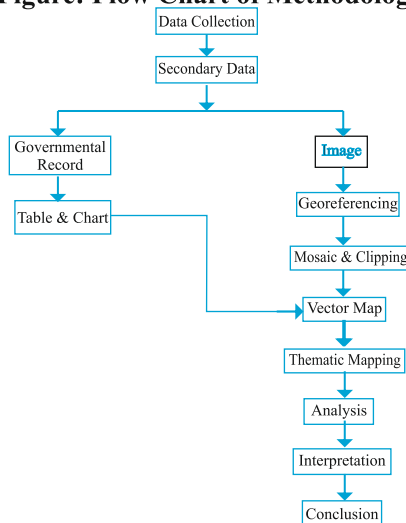
Objective

The main objective of the present study is to understand the Agro-Climatic Zone of the study area and various factors that associated with Agro-Climatic Zone. The second one is to outline effective crop planning for the region.

Database and Methodology

The present study is depends upon secondary data. The area of the study area is 9654.06 sq. km. and large enough for analysis. Physiography of an area plays vital role for zoning purpose like temperature, amount of rainfall, soil types, topography, vegetation, cropping pattern, etc.(ICAR). Geographical Information System (GIS) is applied for analysis the secondary data.

Figure: Flow Chart of Methodology



Agro- Climatic Region

“An Agro-Climatic Zone is a land in terms of major climatic condition which is ideal for a specific cropping pattern” (FAO, 1983). Maharashtra state has agrarian economy. The Agricultural activities are influenced by numerous natural and man- made factors. Climate of an area play a vital role in the agricultural practices and production as well. In order to maximize agricultural production with the help of available resources we need to utilize resources in proper ways and planning methods must be implemented. Planning Commission of Maharashtra classified Agro- Climatic Zone for Maharashtra.

Table 1: Agro- Climatic Zone

Zone	Agro Climatic Zone	Region/Districts	Average Rainfall	Average Temp.	Soil	Major Crops	Fruit Crops
I	South Kokan Coastal Zone (Very High Rainfall Zone With Lateritic Soil)	Ratnagiri, Sindhudurg	3100 mm	20-30 °C	Laterite, acidic and poor in nitrogen and potassium.	Rice	Mango, Coconut, Areca nut,
II	North Konkan Coastal Zone (Very High Rainfall Zone With Non Lateritic Soil)	Thane, Raigad	2600 mm	22-30 °C	Coarse and shallow, rich in Nitrogen, poor in potassium	Rice	Banana, Chikoo
III	Western Ghat Zone	Hilly areas of Kolhapur, Satara, Pune, Ahmednagar and Nasik; and a small part of Sindhudurg district.	3000 to 6000 mm	30-40 °C	Light laterite and reddish brown, acidic, low in phosphorus	Rice Ragi, Jowar	Mango, Cashew nut, Jackfruit, Jamun
IV	Transition Zone I (Sub Montane Zone)	Parts of Nasik, Pune, Satara, Sangli and Kolhapur	700 to 2500 mm	28-35 °C	Reddish brown to black, rich in nitrogen, poor in phosphorus and potash	Rice	Mango, Guava, Grapes
V	Transition Zone II (Western Maharashtra Plains)	Parts of Dhule, Ahmednagar, Nasik, Pune, Satara, and Kolhapur	700 to 1200 mm	30-40 °C	Greyish black, alkaline, fair content of nitrogen, potash and potassium.	Jowar, Bajra, Groundnut, Wheat, Sugarcane	Mango, Guava, Grapes
VI	Western Maharashtra Scarcity Zone	Parts of Dhule, Nasik, Aurangabad, Ahmednagar, Pune, Satara, Solapur, Sangli	500 to 750 mm	30-42 °C	Clay, poor in nitrogen, low in phosphate and well supplied in potash.	Jowar, Bajra, Groundnut, Wheat, Sugarcane	Mango, Guava, Grapes, Chikoo

Zone	Agro Climatic Zone	Region/Districts	Average Rainfall	Average Temp.	Soil	Major Crops	Fruit Crops
VII	Assured Rainfall Zone (or Central Maharashtra Plateau Zone)	Latur, Buldhana, Parts of Aurangabad, Jalna, Beed, Osmanabad, Parbhani, Nanded	700 to 900 mm	30-40 °C	Clayey, red to black, slightly alkaline	Jowar, Bajra, Safflower	Mango, Banana, Grape, Mosambi, Santra,
VIII	Moderate Rainfall Zone (Central Vidarbha)	Wardha, major parts of Nagpur and Yavatmal, Parts of Chandrapur, Aurangabad, Jalna Parbhani, Nanded	1130 mm	35-40 °C	Medium to deep black soil, alkaline	Cotton, Jowar, Tur, Wheat	Mango, Banana, Grape, Mosambi, Santra,
IX	High Rainfall Zone With Soils From Mixed Parent Material (Eastern Vidarbha)	Bhandara, Gadchiroli, and parts of Chandrapur and Nagpur.	1300 to 1800 mm	20-37 °C	Brown to red, slightly acidic	Paddy, Pulses, Oilseeds	Mango, Banana, Grape, Mosambi, Santra,

(Source: Agricultural Department of Maharashtra, Indian Council of Agricultural Research)

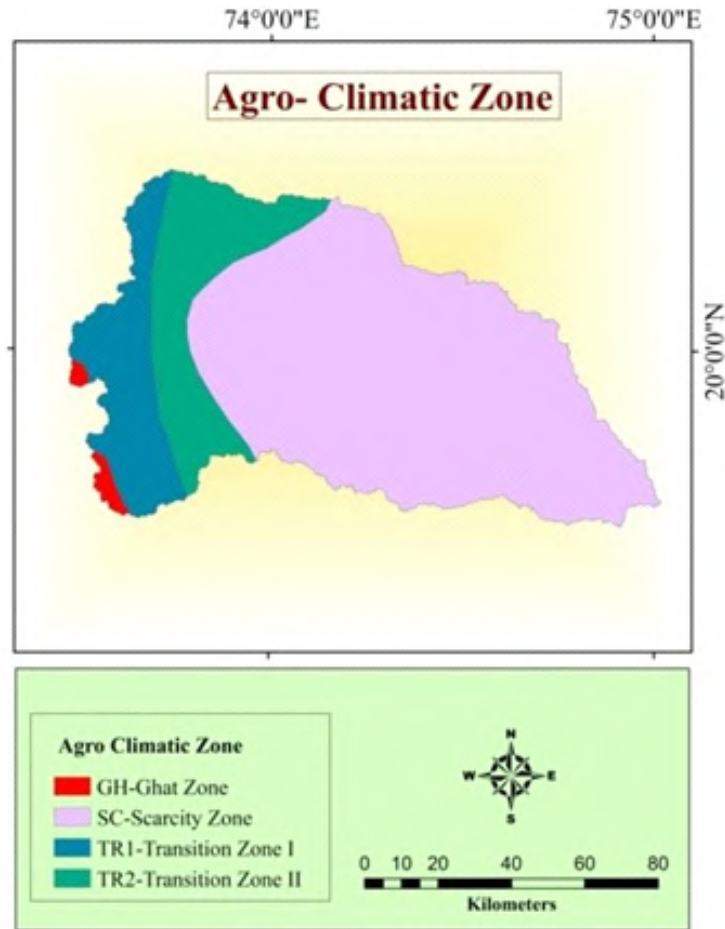
Agro-Climatic Zone is most important for agricultural development and planning processes. The Survival or failure of agricultural system is totally depends upon Agro- Climatic condition of an area (Hemant Kumar Bhuarya et al., 2018). The Agro- Climatic Zones are based on topography, temperature, amount of rainfall, type of soil, Vegetation, and cropping pattern (ICAR). Based on parameters the Planning Commission classified Maharashtra into above nine Agro-Climatic Zones. As per the Agro- Climatic Zone of Maharashtra the study area has four Agro- Climatic Zones namely; Zone- III (Western Ghat), Zone-IV (TR1- Transition Zone I), Zone- V (TR2- Transition Zone II), Zone- VI (Western Maharashtra Scarcity Zone), etc.

Zone III- Western Ghat Zone

Western Ghat Zone includes the hilly area of Western Ghat especially western part of Igatpuri and Nashik tehsil. About 102.73 sq. km. (1.06 %) area belongs to Zone III. The average temperature of an area ranging between 300C to 400C and average rainfall ranges between 3000 to 6000 mm. The region is characterized by light laterite and reddish brown soil is acidic, and low in phosphorus. Zone III-Western Ghat Zone is ideal for Rice, Ragi and Jowar cultivation. Mango, Cashew nut, Jackfruit and Jamun are the major fruit crops also grown in this region.

Zone IV- TR1- Transition Zone I

TR1- Transition Zone I includes the central-western part of Nashik and Igatpuri tehsil and western part of Dindori tehsil. About 1292.28 sq. km. (13.38 %) area belongs to Zone IV. The average temperature and average rainfall ranges between 280 C to 350 C and 700 mm to 2500 mm respectively. The region is characterized by reddish brown to black soil and it is rich in nitrogen but poor in phosphorous and potash. Zone IV- TR1- Transition Zone-I is ideal for Rice crop cultivation. Mango, Guava and Grapes are the major fruit crops also grown in this region.



Zone V- TR2- 'Transition Zone II

Zone V TR2- Transition Zone II includes the Central- Eastern part of Dindori tehsil, Central part of Nashik tehsil, North-East and Eastern part of Igatpuri tehsil, Western part of Chandvad and Sinnar tehsil. About 1571.97 sq. km. (16.28 %) area belongs to Zone V. The average temperature and average rainfall ranges between 30°C to 40°C and 700 mm to 1200 mm respectively. The region is characterized by greyish black soil and alkaline in nature. It has fair content of Nitrogen, Potash and Potassium. Zone V- TR2 Transition Zone II is suitable for Jowar, Bajra, Groundnut, Wheat and Sugarcane crops cultivation. Mango, Guava and Grapes are the major fruits crops of the region.

Zone VI- SC- Western Maharashtra Scarcity Zone

Western Maharashtra Scarcity Zone includes South Eastern part of Dindori tehsil, Eastern part of Nashik tehsil, West and North Western part of Sinnar tehsil, Central part of Chandvad tehsil, Northern part of Sangamner and Nevasa tehsil and entire part of Yeola, Kopargaon, Shrirampur, Vijapur, Gangapur tehsils of the study area. About 6691.43 sq. km. (69.28 %) area belongs to Zone VI. The average temperature and average rainfall ranges between 30°C to 42°C and 500 mm to 750 mm respectively. The region is characterized by Clay soil which is poor in Nitrogen. It has low content of phosphate and well supplied in potash. Zone VI- SC- Western Maharashtra Scarcity Zone is suitable for Jowar, Bajra, Groundnut, Wheat and Sugarcane crops cultivation. Mango, Guava, Grapes and Chikoo are the major fruits crops of this region.

Crop Planning

Agricultural land has been facing various challenges. The effective Crop planning of an area is controlled by numerous problems such as methods of irrigation, water management, land distribution, climate variability and climate changes, lack of knowledge, human and other resources. The effective Crop planning helps to utilize the minimum resources to get the maximum profit through agricultural practices. Agriculture plays an important role to maintain our physical environment. By using bio-fertilizer and green manure we can improve fertility of soil without any harm to land. The main aim of the crop planning is to improve the profit and productivity of land with low input cost and use of available resources (S. Saranya and T. Amudha, 2016).

This paper gives general ideas of Crop Planning which are applicable to solve this problem. The study area belongs to hot and dry climate except South-West Monsoon Season. There is a water deficiency throughout the year. So there must be applying the proper methods in agricultural point of view. In the hilly area of Igatpuri and Nashik tehsils Agro forestry recommends that there is water deficiency and erosional activity also takes place over there during rainy days. Farmers take Rice cultivation presently; if a prior provision of water they can grow crops in the field in large amount. The soil of the areas has agricultural potentiality to grow various crops. Table 2: Agro-Climatic Zone with suitable Crop planning methods

Agro-Climatic Zone	Including Tehsil	Potential Cropping Pattern	Water Conservation Methods	Soil Conservation Methods	Methods of Irrigation
Western Ghat Zone	Igatpuri and Nashik	Maize, Pulses, Wheat, Bajra, Soybean, Fruit and Nuts	Nala Bunding, Check dams, Percolation tanks, Continuous Contour Trenches (CCT), Water Storage Tank	Biological Bund, Crop Rotation, Strip Cropping, Ploughing, Land Levelling	Drip Irrigation, Flooded Irrigation, Furrow Irrigation, Terrace Irrigation,
TR1- Transition Zone I	Nashik, Igatpuri and Dindori	Soybean, Maize, Wheat, Jowar, Bajra, Fruit and Nuts	Nala Bunding, Check dams, Percolation tanks	Biological Bund, Crop Rotation, Mulching, Shelter belts, Use of Animal Manure	Drip Irrigation, Flooded Irrigation, Furrow Irrigation, Sprinkler Irrigation,
TR2- Transition Zone II	Dindori, Nashik, North-East and Igatpuri, Chandvad and Sinnar	Maize, Sugarcane, Soybean, Fruit and Nuts	Farm Bund, Farm Pond, Percolation Tank	Biological Fencing, Mulching, Use of Soil Organism, Crop Rotation, Intercropping and Crop Diversification	Furrow Irrigation, Drip Irrigation, Sprinkler Irrigation
SC- Western Maharashtra Scarcity Zone	Dindori, Nashik, Sinnar, Chandvad, Sangamner, Nevasa, Yeola, Kopargaon, Shrirampur, Vaijapur, Gangapur	Vegetables, Flowers, Cotton, Fruit and Nuts	Farm Pond, Water Storage Tank, Percolation Tank, Farm Bunds	Biological Fencing, Crop Rotation, Mulching, Shelter belts, Use of Animal Manure, Crop Diversification and Intercropping	Sprinkler Irrigation, Drip Irrigation, Centre Pivot Irrigation, Furrow Irrigation

There are numerous methods that we can apply to solve crop planning issues. The above mentioned Water and Soil conservation methods may lead to change this scenario like Nala Bunding, Construction of check dams, percolation tanks, Biological Bunds, Land Levelling, use of modern irrigation techniques, etc. Modern irrigation techniques like Drip irrigation and Sprinkler irrigation saves water. Water and Soil Conservation methods can help to restrict surface runoff, soil erosion, and can improve groundwater level. At the low land area like Yeola, Sinnar, Chandvad, Gangapur and Vaijapur tehsils a canal network may improve the agricultural productivity. The soil is ideal for Vegetables, Flowers, Fruit and nuts. Now day's farmers construct the farm ponds to overcome on water

deficiency especially in summer days.

Conclusion:

The Climate of an area influences the each and every natural and man-made entity of human being, hence agricultural practices mainly influenced by climatic condition and agricultural resources of an area. That's why it became essential to overcome on this sensitive condition a proper planning must be applied in that way. The study area has four Agro- Climatic Zone which having their own criteria. At ground root mostly farmers do not follow the climatic condition at the time of agricultural practices. So that in many cases agricultural loss is also over there. Hence a proper planning can help to decrease the agricultural loss. If provide irrigation facility in water scarcity region or at the time of dry season it leads to increase the agricultural production. To maximize the agricultural production now in present era use of modernizing techniques in agricultural land also increased which influenced agricultural practices.

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