

CLIMATIC VARIABILITY AND ITS IMPACT ON AGRICULTURAL OPERATIONS: A CASE STUDY OF RAJOURI DISTRICT

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ABSTRACT

The pattern and feature of agriculture in J&K state in general and Rajouri district in particular is not found to be coherent with rest of the Indian states because of its diverse climatic nature. The germination of seeds, growth and development require suitable temperature conditions. Each and every crop has the minimum, optimum and maximum temperature of its different stages of growth. Similarly, Rainfall is also the dominant and determining factor which controls the agricultural operations of an area. This paper aims to analyse the climatic variations in Rajouri district and their control on agricultural operations. For this, mean monthly temperature and rainfall conditions have been analyzed for twenty five years from 1980-81 to 2004-05 and monthly averaged values have been incorporated in the present study. Depending on the trend and pattern of temperature and rainfall the region is divided into four seasons. In general, the climate varies from semi-tropical in the southern part to temperate in the mountainous northern part of the district. The semi-tropical region receives monsoons whereas, the northern part prone to hailstorms experiences excessive rains. In consonance with these conditions, the farmers in the region have accordingly adopted the cropping pattern to suit the different seasons.

KEYWORDS : Climate, Temperature, Rainfall, Season, Agriculture, Crops

Climate is the average weather of a place over long span of time. Of all the physical factors, climate is the principal component that determines the agricultural land use patterns of region. Climate is a gamble of monsoonal phenomenon that directly influences the production of crops and land use pattern.

The suitable climate is essential for better yield, growth, production and reproduction (Vaidya, 1971). Crop production depends on climate to a much greater extent than on any other single factor of the environment, yet many crops are being grown traditionally in areas without any consideration to the fitness of climate. As a result, not only poor yields of the crops are obtained, but also much of the production potentials of the climates go unutilized (Moonis, 1980). Each and every crop has the minimum, optimum and maximum temperature of its different stages of growth. Rainfall is also the most determining factor which controls not only the overall agricultural landscape of a region but its operational characteristics as well (Khatri, 1990). It is the dominant single weather element influencing the intensity and location of farming systems and the farmer's choice of enterprise (Singh & Dhillon, 2004). Therefore, the background of climatic conditions (temperature and Rainfall) is essential for understanding the patterns of agricultural land use of the region.

Study Area

Rajouri district, the part of western Himalaya extends between 74°15' and 75°00' east longitude and 33°00' and 33°50' north latitude with an altitude of 600-3550 mts above mean sea level. The district is predominantly agrarian (rural in character) and industrially backward with 78 percent of its total population residing in villages.

The region has peculiar physical features where Dhuala Dhar range/Pir Panjal mountain range runs across the eastern part of it. The topography of the district varies widely from place to place. Of the seven blocks, Sunderbani, Nowshera and Kalakote blocks are mostly plain and fairly hot in summer. Whereas, Rajouri, Manjakote, Darhal, Budhal and part of Kalakote block consists of numerous hills and small valleys of meandering brooks. Kandi, literally means 'semi-arid land' lies in the south of the district. The climate varies from semi-tropical in the southern part comprising Nowshera, Sunderbani and Kalakote blocks to temperate in the mountainous northern part encompassing Rajouri, Manjakote, Darhal and Budhal blocks of the district. The sub tropical region receives monsoons, whereas, the northern part prone to hailstorms experiences excessive rains.

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Table 1: Mean Monthly Temperature (°C)

Months	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Minimum	5.2	6.2	9.7	15.4	19.3	22.4	21.3	21.6	20.5	14.3	10.2	7.4	14.4
Maximum	14.1	16.5	21.3	26.7	31.5	34.4	32.3	30.4	28.1	25.4	20.2	18.6	25.0
Average	10.5	11.8	15.5	21.1	25.4	28.4	26.7	26.0	24.3	19.1	15.2	13.0	19.1

Source: SKUAST Centre, Rajouri

OBJECTIVES

1. To uncover the mean monthly temperature conditions in the area.
2. To assess the average monthly rainfall pattern in the district.
3. To determine the impact of climatic variations on agricultural activities.

DATABASE AND METHODOLOGY

The interpretation of climate and agricultural aspect has been made with the help of both primary and secondary information. Data from primary sources have been collected through interviews with farmers, patwaries and sarparchs. Meteorological data pertains to temperature and rainfall has been collected from agricultural research institute SKAUST (Shera-e-Kashmir Agriculture University of Science and Technology) established at Tandwal, Rajouri.

ANALYSIS OBSERVATION

Rajouri with diverse topography experienced variations in climatic conditions. In general, the climate of the district varies from semi-tropical in the southern part comprising Nowshera, Sunderbani and Kalakote to temperate in mountainous northern part encompassing the areas of Rajouri, Manjakote, Budhal and Darhal blocks of the district. The sub-tropical region receives monsoons, whereas, the northern part prone to hailstorms experiences rains. Thus, the temperature and rainfall conditions and their impact on agriculture varies both seasonally and regionally and accounts for the spatial variations in cropping patterns and yields. In consonance with these conditions, the farmers in the region have accordingly adopted the cropping pattern to suit the different seasons. Therefore, in order to have an impact analysis of climate on

agricultural/ farming activities, the study region is climatically divided into four seasons. The average monthly means of temperature and rainfall have been assessed for twenty five years from 1980-81 to 2004-05 and monthly averaged values have been incorporated in the present study. The climate is divided into following four seasons depending on the trend and pattern of temperature and rainfall and different agricultural operations are studied in each season.

SUMMER SEASON AND AGRICULTURAL ACTIVITIES

The intensification of hot waves enhances the temperature in the month of April which persists up to the end of July and grips almost every nook and corner of the region. The beginning of summer season provides relief and relaxation to the nomadic herders in the mountainous belt while the dwellers of lower plains feel uncomfortable and uneasy.

In summer season, the mean monthly temperature fluctuated between 25.4°C in May to 28.4°C in June (Table, 1). May recorded a rapid rise in temperature with the decrease of pressure. June is the hottest month of the year and recorded the highest mean monthly temperature (28.4°C) but is not as high as is recorded in other parts of the state which may exceed 40°C in the month of May and June. Thus, climatic conditions of the region are not as harsh as is found in other parts of the plain region.

The variations in average monthly maximum and minimum temperature in summer season showed high temperature in the month of June i.e 34.4°C and 22.4°C respectively. The lowest average monthly maximum and minimum temperature observed in the month of April where it recorded 26.7°C and 15.4°C respectively. In the month of September, the temperature starts declining due to shifting of solar radiations towards south.

Table 2: Average Monthly Rainfall (mm)

Months	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Rainfall	52.2	46.9	29.6	25.8	18.7	60.6	250.4	248.2	110.9	40.7	32.8	35.6	79.4

Source: SKUAST Centre, Rajouri

Table 3: Crop Calendar

Crop	Sowing	Harvesting	Marketing
Paddy	May- June	September- October	November-December
Maize	April- May	September- October	October- November
Wheat	October- November	April-May	May-June

Source: SKUAST Centre, Rajouri

This season is very unpleasant with uncomfortable and restless days and nights as the days are hot and nights are warm as a whole. The season is characterized with clear skies, very low humidity and high temperature. Besides, the high speedy wind or Andhi or Tufan is the remarkable phenomenon and is accompanied by huge clouds of dust in the sky which may result into light drizzles and thus modify the weather, making it pleasant for one or two days.

Though the summer is generally a dry season, some precipitation does take place in the form of pre-monsoon showers in the month of June and July. Maximum rainfall during this season is received in the month of July (250.4mm) and August (248.2mm) (Table, 2). The advent of summer monsoon brings complete change in the weather and level of mercury starts falling during the first week of July. As the season is characterized with heavy and intense rainfall so the continuous down pouring during the season causes severe damage by erosion, floods and landslides. Flooding may damage the crops like maize in August-September. Besides, a late withdrawal of monsoon season hampers the growth of kharif crops especially paddy and delays the sowing of rabi crops. Thus, the season is of great significance for farmer community because it advances and hampers the agricultural practices. In spite of the constraints of early or late arrival of monsoon in this area, it becomes a lifeline for farmers and on first onset; the people cultivate the kharif crops like maize, paddy etc.

AUTUMN SEASON AND AGRICULTURAL ACTIVITIES

The autumn season sets in with the retreat of

monsoon in mid September and continues upto the middle of November. This is the period when monsoon rains are just over, though cloudiness, high humidity and occasional showers still persists till the end of November. As such, minimum rainfall of this season is during November and is recorded as 32.8mm. Temperature drops down rapidly in September and continues upto November where average temperature remained around 15.2°C in the study region. Besides, in November, the mean maximum and minimum temperature read about 20.2°C and 10.2°C respectively.

The cool nights and warm days are the main characteristics of the season. In this season, the skies generally remain clear, the duration of sunshine long and little precipitation recorded. The amount of rain, though very small, is of unique importance for the cultivators because the success of both kharif and rabi crops depends upon the rain as this season marks a transition between Kharif and rabi crops, the former being harvested in September-October and later are sown in October-November (Table, 3).

SPRING SEASON AND AGRICULTURAL ACTIVITIES

This season generally prevails from mid March to mid May in the region. At the advent of March, the weather starts improving and temperature starts moving up steadily due to usual shifting of solar radiations towards north. The average monthly temperature ranged between 15.5°C in March to 25.4°C in May, as a result of which the nights are cooler in the season. In April, the mean monthly temperature may shoots up abruptly and reached upto 25.4°C with 31.5°C maximum and 19.3°C minimum temperature in the

month of May.

Rainfall is meager and major portion of this falls in earlier part of the season. During this season, the maximum amount of average rainfall is received in the month of March i.e. 29.6mm that suddenly decreased in April and recorded a minimum average of 18.7mm in the month of May. The amount of rainfall, though very small, is of exceptional importance for the farmers because it helps in increasing the soil moisture that enhances the rate of germination.

In spring season, with the steady rise in temperature, lush green grass develops and leaves starts appearing on the fruit and non fruit bearing plants which not only give rise to fruits but also add fragrance to the fresh air. The seeds of vegetables began to germinate in the fields. The snow starts melting but snowing may take place even in March in the upper reaches of the district. This is actually the season from where agricultural year begins. Ploughing of Paddy fields and sowing of rice nurseries commences in the early parts of May. Other allied activities like horticulture, sericulture and apiculture are performed in this season. The season also provides a ray of hope to nomadic peoples.

WINTER SEASON AND AGRICULTURAL ACTIVITIES

Due to the apparent movement of sun towards south, the temperature began to fall in the month of November and invites cold winter season which sets fully by mid-December and prolongs upto the month of March. The average winter temperature in this region oscillated between 10.5°C in January to 15.2°C in November. January is the coldest month of the year when mercury touches down as low as 5°C or -7°C in the upper reaches of the region. The temperature starts to declining in November and continued upto January and the average for the March is placed at 15.5°C.

The region receives practically low rain during this season due to the existence of dry winds blowing from the west. This meager rainfall may be attributed to the western disturbance or temperate cyclones. The regime of rainfall showed that winter rainfall fluctuated between

32.8mm in November to 52.5 mm in January. In these months, the total rainfall does not exceed 15 percent of the total rainfall of the year. This small amount of rainfall is highly beneficial to rabi crops, due to very low rate of evaporation during the season. The winter rainfall generally occurs as light showers. Sometimes these showers become sharp and are occasionally accompanied by hailstorms which cause severe damage to field crops. Occurrence of heavy snow is very common feature in the month of January especially in the upper reaches. This month is also marked by heavy dew and intense frost which adversely affects the ripening of winter crops like wheat, pulses etc. Besides, fog during extreme chilly days and haze are the common phenomenon of the season. Agricultural activities remained standstill because of inclined weather conditions.

SUGGESTION

Nearly 65percent area lies in tropical and semi-tropical region while rest of the area lies in temperate zone and remains under snow for more than six months. The crops which are economically viable, ecologically sound and socially compatible be grown in these areas.

CONCLUSION

To conclude, the temperature and rainfall conditions and their impact on agriculture varies both seasonally and regionally. June is the hottest month of the year and recorded the highest mean monthly temperature (28.4°C) but the climatic conditions of the region are not as harsh as is found in other parts of the plain region. The late withdrawal of monsoon season hampers the growth of kharif crops especially paddy and delays the sowing of rabi crops. Thus, the season is of great significance for farmer community because it advances and hampers the agricultural practices. In spite of the constraints of early or late arrival of monsoon in this area, it becomes a lifeline for farmers and on first onset; the people cultivate the kharif crops like maize, paddy etc. The amount of rain, though very small, is of unique importance for the cultivators because the success of both kharif and rabi crops depends upon the rain as this season marks a transition between Kharif and rabi crops, the former being harvested in September-October and later are sown in October-November. In spring season, with the steady rise in temperature, lush green grass

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