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ANNUAL RAINFALL VARIABILITY IN EASTERN DISTRICTS OF UTTAR PRADESH

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Abstract: ***The Rainfall Variability is Mean deviation of 35 or above years rainfall data observation. The Mean of possible years or months low or high in per cent called variability.The degree to which rainfall amounts vary across an area or through time is an important characteristic of the climate of an area. This subject area in meteorology/climatology is called "Rainfall Variability." The rainfall variability excessed of 20% implies a great risk to forming.It has been observed that rainfall and rainy weather, particularly Post-harvest period of Kharif season crop activities that is harvesting,threshing hampers. The Eastern Uttar Pradesh extends between 230 45' N to 280 30' N latitudes and 810 45' E to 840 30' E longitudes over an area of 85,845 sq km with a total population of 79,742,097persons according to 2011 census. This, thus, covers 35.6 percent of the total geographical area and 40.07 percent of the total population of the state of Uttar Pradesh. the trends of rainfall in district over eastern Uttar Pradesh. The mean annual rainfall are very high mean annual rainfall and these District are situated in the southern part of the study area. The mean annual rainfall are found less than 500 mm rainfall in the study area only one district Koushambi situated in the for south West part of the study area. The Districts of very high variation are situated far West, far East, far north-eastern and Southern in the study area. The coefficient of variation from mean annual rainfall are found less than 30 mm rainfall in the study area only two districts- Bahraich and Varanasi situated in the for north- Western and southern part of the study area.***

Key Words: Rainfall Variability, data observation, variability, characteristic, meteorology/climatology.

Importance of water to plants is paramount for several reasons. Its consist a part of photosynthesis. Generally water is the most important part of a plant. It has 80 to 90% of the green weight of a plant. Rainfall is the most important source of soil and ground water.The rainfall variability is Mean deviation of 35 or above years rainfall data observation. The Mean of possible years or months low or high in per cent called variability.The degree to which rainfall amounts vary across an area or through time is an important characteristic of the climate of an area. This subject area in meteorology/climatology is called "Rainfall Variability." There are two types (or components) of rainfall variability, areal and temporal. The Areal variation of rainfall amounts at various locations across a region for a specific time interval (Time does not vary). The variation of rainfall amounts at a given location across a time interval (Area does not vary) .The low ratio of rainfall variability is the symbol of highly dependability and its high ratio of per cent irresponsible and irregular mode of rainfall. Although the changes of rainfall variation effect on every mode of life but its play an important role in agriculture for several reasons. The plant growth and development depends- upon a continuaous process of cell division, On the progressive initiation of tissues and organs primordial and on the differentiation and expansion of the component cells. Crop are greatly depend on whether particularly rainfall during the period of growth and particularly in the critical phase likes- germination, flowering, seed setting and maturing. The rainfall variability excessed of 20% implies a great risk to forming.It has been observed that rainfall and rainy weather, particularly Post-harvest period of Kharif season crop activities that is harvesting,threshing hampers. It has been also be noted that the rainfall deficiency are excess on the critical stages of the plant life hampers the supply of moisture, damage the plants, turning tillers as no production and reduced the Yield.The present research paper attempt has been made to examine the Annual rainfall variability in Eastern districtsof Uttar Pradesh.

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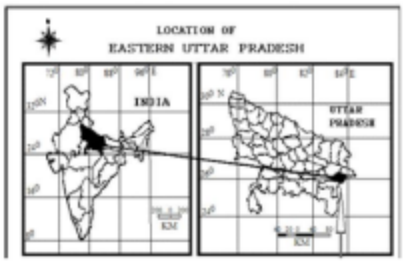
AREA PROFILE: The Eastern Uttar Pradesh extends between 230 45' N to 280 30' N latitudes and 810 45' E to 840 30' E longitudes over an area of 85,845 sq km with a total population of 79,742,097persons according to 2011 census. This, thus, covers 35.6 percent of the total geographical area and 40.07 percent of the total population of the state of Uttar Pradesh. it's has been Nepal on its north, Champaran, Saran, Bhojpur and Palamau districts of Bihar on its East. Sarguja, Sindhi, Rewa District of Madhya Pradesh on its south and Lakhimpur, Sitapur, Barabanki, Fatehpur and Banda districts of Uttar Pradesh on its West.The agricultural region of Eastern Uttar Pradesh comprises Prayagraj, Shrawasti, Balrampur,Santkabir Nagar,Sidharthnagar, Maharajganj, Kushinagar, Ambedkarnagar, Amethi, Kaushambi, SantRavidas Nagar, Bahraich, Ballia,Basti, Deoria, Ayodhaya, Ghazipur, Gonda, Gorakhpur, Jaunpur, Mirzapur, Sonbhadra, Chandouli, Mau, Pratapgarh,Sultanpur, Varanasi districts. The study area as a part of vast Ganga plain and lies in the well-known climatic region which is famous for its variation. The annual rainfall average 958.6mm. About 88.23% of the annual rainfall is generally accounted for by the four summer months-June to September. Fig.No-01.



OBJECTIVES :

1. To estimate the Annual Rainfall Variability at macro and micro levels in the Study Area.
2. To Identifythe minimum and Maximum risk covering Area.
3. To prepare maps charts and diagrams for observation correlation and Co-efficient of variationfor the policy formations.

PERSENT STAGE OF KNOWLEDGE : Understanding spatiotemporal rainfall patterns has been directly implicated to combating extreme poverty and hunger through agricultural enhancement and natural resource management. The amount of soil-water available to crops depends on rainfall onset, length, and cessation which influence the success/failure of a cropping season. It thus emerges that, understanding climatic parameters, rainfall in particular, can aid in developing optimal strattegies of improving the socioeconomic well-being of smallholder farmers. This is particularly important in sub-Saharan Africa (SSA) where agricultural productivity is principally rain-fed yet highly variable. Drier parts of Kenya's central highlands, eastern Kenya, continue to experience high unpredictable rainfall patterns, persistent dry-spells/droughts coupled with high evapotranspiration (2000-2300?mm?year?1). Generally, the total amount of rainwater is enough; however, it has been reported to be poorly redistributed over time with 25% of the annual rain often falling within a couple of rainstorms; as a result crops suffer from water stress, often leading to complete crop failure. Recha et al. noted that most studies do not provide information on the much-needed character of within-season variability despite its critical influence on soil-water distribution and productivity.

Weather crop relationship is complex and much work would be have to be done to arrive at dependable relationships in quantitative form between these factors and area of crops. Such studies are being actively pursued in many countries. In the USA crop area studies are made using regression technique, both linear and curvilinear. In addition to weather factors technological trend in used both its linear and quadratic forms. In USSR crop Area forecasts using curvilinear techniques.Besides, weather parameters, soil moisture,stage of Crop development, soil type and evapo- transpiration are also considered.Boyko has studies in 1955 on climate, eco-climatic, hydrological

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influence on vegetation.Breazeale and Georgehas studies in 1953 impact of atmospheric humidity on roots growths. Gardener in 1955,Klugesin 1958, andwhitheck in 1932 are study on climate and plants.

There has been continued interest in understanding rainfall's seasonal patterns by evaluation of its variables including rainfall amount, rainy days, lengths of growing seasons, and dry-spell frequencies. Studies by Sivakumar, Seleshi and Zanke, and Tilahun noted high variations in annual and seasonal rainfall totals and rainy days in Ethiopia and Sudano-Sahelian regions. Studies on rainfall patterns in the region have been based principally on annual averages, thus missing on within-season rainfall characteristics. However, understanding the average amount of rain per rainy day and the mean duration between successive rain events aids in understanding long-term variability and patterns. Nonetheless, meteorological stations in the region which are sole sources of climatic data are only limited to single locations spatially. In sub-Saharan Africa, the predominant setbacks in analysinghydrometeorological events are occasioned by lacking, inadequate, or inconsistent meteorological data. Like in most other places, the rainfall data within in the drier parts of Embu county and the neighbouring stations are scarce with missing data making their utilization quite intricate.

In India data collected under the All India coordinates crop weather scheme, introduced in 1945 has been statatically analysed using the techniques of regression. Fisher's response curve, fitting of probability distribution of meterological factors and Ezekief'scurvilinear techniques. The study has brought out of relatively large dependence of crop growth and yield on rainfall and its distribution in various phases compared to the other meterological parameters. The Indian Institute of Agricultural Research, New Delhi, has carried out linear regression analysis with area as a dependent variable. Total rainfall during the five growth phase of crops-flowering and grain formation period is more important and effective as comprised to rainfall in other period. Jasbir Singh, Vijay Kumar and Gupta in 1993, Williamson in 1925 has been study on rainfall and area of crop. Choubey, Sanjeevin 2011 has made the study on crop area relationship. The present study- Impact of rainfall variability on Area of Paddy in Eastern Uttar Pradesh the is sequence of theseresearchs and an attempt to minimize the risk factors of production of Paddy in study area.

DATA BASE AND METHODOLOGY : The study is based on secondary data obtained from Indian Meteorological Department (IMD) Pune and Indian Agricultural statistics, New Delhi. The districts wise rainfall data provided by IMD for the last thirty years (1991-2020) On the basis of provided data for the past years and it's percentage where workout in the districts under reference and present in tables. The tables made by the estimating Mean and co-efficient of variation. The correlation and co-efficient of variation(CV) are calculated using following formula-

$$C.V. = \frac{S.D.}{M} \times 100$$

Where -

C.V. = Co-efficient of Variation

S.D. = Standard Deviation

M = Mean

For the correlation - $r = \frac{\Sigma dx\, dy}{N\sigma \times \sigma y}$

DETAIL STUDY: Mean Annual Rainfall ; Table 1 gives the rainfall statistics for the Eastern districts of Uttar Pradesh for the Annual Rainfall. show the spatial pattern of these statistics. There are Four types of Mean annual rainfalls recorded-First is Very High Annual Rainfall (900>), second is High Annual Rainfall (700-900), third is Medium Annual Rainfall (500-700) and fourth is Low Annual Rainfall (<500). Fig.2 shows the trends of rainfall in district over eastern Uttar Pradesh.

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Table 1

Mean Annual Rainfall and Its coefficient of variation

DISTRICTS	ANNUAL MEAN	Column6 CV
ALLAHABAD	800.1	63
AMBEDKAR NGR	873.5	94
AZAMGARH	854.1	83
BAHRAICH	1101.5	18
BALLIA	694.2	70
BALRAMPUR	994.7	75
BASTI	871.3	96
CHANDAULI	639.9	131
DEORIA	932.4	39
FAIZABAD	845.4	69
GHAZIPUR	793.4	80
GONDA	886.2	71
GORAKHPUR	1245.3	45
JAUNPUR	703.2	102
KAUSHAMBI	494.9	160
KHUSHINAGAR	570.7	150
MAU	793.6	111
MAHARAJGANJ	978.9	91
MIRZAPUR	921.7	39
PRATAPGARH	748.9	77
S.KABIR NGR	1065.3	93
SIDDHARTHNA.	1001.5	58
SULTANPUR	747.2	51
SONBHADRA	928.7	70
VARANASI	881.3	27
SANT R NAGAR	744	133
SHRAVASTI	845.4	111

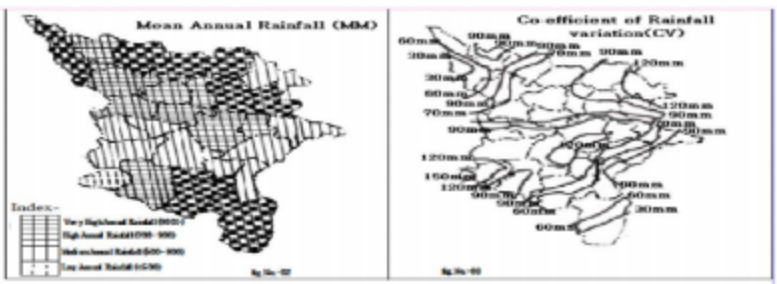
Source-IMD.calculeted from years of 1999-2019.

Very High Annual Rainfall (900 >) : It can be seen that Gorakhpur receives the highest rainfall (1245mm) over other districts during all the Annual season. respectively. mean annual Rainfall received over Bahraich (1101.5mm), Sant Kabir Nagar (1065.3mm), Siddharth Nagar (1001..5mm), also very high.All of these District are sichuated in northern part of the study area. Balrampur(994.7mm), Deoria(1245mm), Maharajganj (1245mm), are sichuated in northern part of the study area. Mirzapur(921.7mm), and Sonbhadra(928.7mm) are also found very high mean annual rainfall and these District are situated in the southern part of the study area.

High Annual Rainfall (700-900) : Going through table no.1 It can be seen that The mean annual rainfall are found between 700 mm to 900 mm rainfall in the districts of Ambedkar Nagar, Allahabad, Azamgarh, Basti, Faizabad, Gazipur, Gonda, Jaunpur, Mau, Pratapgarh, Sultanpur, Varanasi, Sant Ravidas Nagar and Shravasti districts.These districts are mostly situated in the nearer part of the very high mean annual rainfall area.

Medium Annual Rainfall (500-700) : Going through table no.1 It can be seen that The mean annual rainfall are found between 500 mm to 700 mm rainfall in the districts of Ballia, Kushinagar and Chandauli districts.These districts are mostly situated in the for East, south and northern part of the study area.

Low Annual Rainfall (< 500) : Going through table no.1 It can be seen that The mean annual rainfall are found less than 500 mm rainfall in the study area only one district Koushambi (494.9mm) situated in the for south West part of the study area.



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Very High Variation of Rainfall (120mm>) : Very high variation in the rainfall are found in the area where the coefficient of variation is above 120mm. Going to the table number 1 of the coefficient variation in rainfall over districts Kaushambi (160mm) Kushinagar (150mm) Sant Ravidas Nagar(133mm) and Chandauli (131mm). The Districts of very high variation are situated far West, far East, far north-eastern and Southern in the study area.

High Variation of Annual Rainfall (90mm-120mm) : Going through table no.1 It can be seen that The coefficient of variation in rainfall over districts are found between 90mm to 120mm High Variation of Annual Rainfall in the districts of Mau, shravasti, Sant Kabir Nagar, Maharajganj, Basti and Ambedkar Nagar.These districts are mostly situated in the nearer part of the very high coefficient of variation in rainfall in the study area.

Medium Variation of Annual Rainfall (60mm-90mm) : Going through table no.1 It can be seen that The Medium coefficient of variation in rainfall are found between 60mm to 90 mm rainfall in the districts of Allahabad, Azamgarh, Ballia, Balrampur, Faizabad, Ghazipur, Gonda and Pratapgarh.These districts are mostly situated in the for East, south and northern part of the study area.

Low Variation of Annual Rainfall (30mm-60mm) : Going through table no.1 It can be seen that The coefficient of variation in rainfall are found between 30mm to 60 mm rainfall in the districts of Deoria, Gorakhpur, Mirzapur, Siddharth Nagar and Sultanpur. Thay are situated in the part of Nothern, southern and Western part of the study area.

Very Low Variation of Annual Rainfall (<30mm) : Going through table no.1 It can be seen that The coefficient of variation from mean annual rainfall are found less than 30 mm rainfall in the study area only two districts- Bahraich and Varanasi situated in the for north- Western and southern part of the study area. Fig.3 shows the trends in district rainfall over eastern Uttar Pradesh.

Conclusion- Going through table no.1 and Fig.2, 3 shows the trends of rainfall in district over eastern Uttar Pradesh. The mean annual rainfall are very high mean annual rainfall and these District are situated in the southern part of the study area. The mean annual rainfall are found less than 500 mm rainfall in the study area only one district Koushambi situated in the for south West part of the study area. The Districts of very high variation are situated far West, far East, far north-eastern and Southern in the study area. The coefficient of variation from mean annual rainfall are found less than 30 mm rainfall in the study area only two districts- Bahraich and Varanasi situated in the for north- Western and southern part of the study area.

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