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Studies on rainfall pattern and length of growing period of Raipur district of Chhattisgarh plain agro-climatic zone

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Abstract

The current research entitled “Studies on rainfall pattern and length of growing period in Raipur district of Chhattisgarh plain Agro-climatic zone” was carried out to find out the rainfall pattern and length of the growing period of Raipur district of Chhattisgarh. For the study, block wise daily rainfall data of Raipur district and daily data of Temperature, Relative humidity, Wind speed, Sunshine duration and Evaporation data of Raipur station were collected from department of Agrometeorology IGKV Raipur for the period of 47 years (1971-2017). Potential evapotranspiration (PET) was derived using software “PET calculator v3.0” and “Weather cock” software was used to determine annual and weekly rainfall, rainy days and Length of growing period. The mean annual rainfall of 1091.5 mm with CV (22.2%) and 242.1 mm of SD was recorded. The mean annual rainy days of 69 days with CV (28.6%) and 12.6 days of SD were recorded. The annual rainfall and rainy days showed slightly increasing trend but not to the significant level. The length of growing period (LGP) of 112 days was recorded under deficit rainfall situation whereas, under normal rainfall situation LGP of 119 days was observed and under excess rainfall situation the LGP of 147 days was observed in Raipur district of Chhattisgarh plain Agroclimatic zone.

Keywords: Rainfall pattern, length, growing period, agro-climatic

Introduction

Rainfall is one of the important hydrological events, holds the greater significance in most of the agricultural and non-agricultural operations. The amount of rainfall varies with time and as well as with the geographical area and altitude in space. The information about the rainfall is very useful as it plays very crucial role in crop planning, cropping pattern and management practices as the rice is mainly grown in Chhattisgarh. It also helps in developing irrigation schedule and drainage plans of area. South-west monsoon (June-Sept) is main source of rainfall; July and August months got more than 75% of the annual precipitation over a large part of the country during this period (Krishnamurthy and Shukl (2007) ^[9]. Chhattisgarh extends from 80.15°E to 84.24°E longitude and 17.46°N to 24.50°N latitude with a area of approximately 13.5 million hectares. The climate of Chhattisgarh is described as dry sub-humid with an average annual rainfall of roughly 1188 mm, which is primarily contributed by the south-west monsoon of June-September receiving nearly 89 percent rainfall (Bhelawe *et al.* 2014). As changing climate and erratic distribution of rainfall and increased field water losses account for unreliability and shortage of water for crop production, here stress has been laid on regional climate change. Detailed rainfall analyses are crucial for optimum rainwater management at different levels, land and crop management, crop planning, etc. Knowledge of the rain onset date will assist to plan agricultural activities better, especially soil preparation and sowing. The study of total annual and seasonal rainfall and rainy days and there fluctuations have significant role in crop planning. To optimize the region's agricultural productivity, there is an urgent need to quantify total and seasonal rainfall variability as a first step to combat against the extreme impacts of constant dry spells/droughts and crop failure. Duration between the beginning and end of Agriculturally significant rainy season also known as the “length of growing period” (LGP) involves the period of soil moisture storage at the end of the rainy season. Consequently, the LGP depends not only on the distribution of rainfall, but also on the type of soil, depth of soil water,

retention characteristics of the soil, air temperatures and daylight hours. Similarly, if the potential evapotranspiration exceeds the likely rainfall, extra water resources need to be provided (Sathyamoorthy *et al.* 2017) [4]. This relates directly to precipitation. Considering all the facts, the assessment of rainfall data and the determination of LGP under excess, normal and deficit rainfall situation was carried for Raipur districts of Chhattisgarh plain agro- climatic zone of Chhattisgarh state.

Materials and Methods

Study Area

The study area is the Raipur district of Chhattisgarh plain Agro climatic zone. Chhattisgarh state came in to existence on 1st November, 2000, as result of bifurcation of the state of Madhya Pradesh. Chhattisgarh state, situated in Eastern India, is located between 17.46°N and 24.5° N latitudes and 84.15°E and 84.24°E longitudes. It is surrounded in the west by Madhya Pradesh and Maharashtra, in the north by Madhya Pradesh, in the east by Odisha and Jharkhand and in the south by Andhra Pradesh. The state has been divided into three agro climatic zones viz., Chhattisgarh plains, Bastar plateau and Northern hills region.

It covers total geographical area of about 13.5 million hectare.

Data Base

Daily data required for the study area was collected from the department of Agrometeorology IGKV Raipur and under this investigation 47 year (1971-2017) daily weather data are used.

Rainfall Analysis

The block wise daily rainfall data after checking data quality with the help of data filter, the block wise data are averaged and get the district wise daily rainfall data. This district wise daily rainfall data are used to calculate annual, monthly, weekly and seasonal rainfall with the help of Weather cock software.

Mean rainfall

The rainfall amount collected by a rain gauge in 24 hrs is known as daily rainfall (mm or cm) and the rainfall amount collected in a year is known as annual rainfall.

$$\text{Mean annual rainfall} = \frac{\text{Total rainfall}}{\text{Number of years}}$$

Standard Deviation (SD)

It is defined as the square root of the mean of the square of deviations of the rainfall value from the arithmetic mean of all such rainfall. It is a measure of variability or the scatter or the dispersion about the mean value. It is calculated by the following formula.

$$SD = \frac{\sqrt{\sum(X-\bar{X})^2}}{n}$$

Where, X= Rainfall frequency, $\bar{X}$ = Mean rainfall and n = Number of years

Coefficient of variation

Determination of rainfall variability through coefficient of variation (CV%) is simple. The CV can be obtained by dividing standard deviation by mean rainfall as indicated below.

$$CV\% = \frac{\sigma}{\mu} \times 100 \text{ or } \frac{SD}{\text{Mean}} \times 100$$

Where,

CV = Coefficient of variation

σ = Standard deviation (SD)

μ = Mean precipitation

CV is calculated to evaluate the variability of the rainfall. A higher value of CV is the indicator of larger variability and vice versa.

Excess, Normal and Deficit rainfall years

To determine the excess, normal and deficit rainfall years, firstly convert daily rainfall data into weekly annual rainfall and also calculate the rainfall per cent deviation by using the formula.

$$\text{Rainfall deviation \%} = \frac{\text{Actual rainfall} - \text{Normal rainfall}}{\text{Normal rainfall}} \times 100$$

On the basis of rainfall per cent deviation value, the particular year is categorized as excess, normal and deficit rainfall year. The year with annual rainfall percent deviation of – 20 to -59 is consider as a deficit rainfall years while the year having annual rainfall per cent deviation of -19 to + 19 is known as normal rainfall year and the year with annual rainfall per cent deviation of + 20 to + 59 consider as an excess rainfall years.

Following are the criteria for excess, normal and deficit rainfall years.

Categories	% Deviation
Large Deficit	> -59
Deficit	-20 to – 59
Normal	-19 to + 19
Excess	+20 to +59
Large Excess	> + 60

Potential Evapotranspiration

Potential evapotranspiration (PET) is defined as the maximum water loss through evaporation from wet soil and transpiration from a short cut grass, covering ground completely, under unlimited water supply. (Balasubramaniam and Geethalakshmi, 2003) [8]. The basic Weather variables required for PET calculation by using PET calculator v3.0 are TMAX, TMIN, RH, WS, SS and EVP.

The PET calculator gives the output for different seven methods of estimating PET by empirical equations. But, for the purpose of calculation of length of growing period (LGP) only the PET output given by Penman Monteith method Bapuji Rao *et al.* (2013) [1] is taken into consideration as this is a widely accepted method.

FAO Penman–Monteith Method

$$PET = \frac{0.408\Delta(Rn-G) + y \frac{900}{T+273} U_2 (ea-ed)}{\Delta + y(1+0.34U_2)}$$

Where,

PET = potential evapotranspiration [mm d-1] Rn = net radiation at crop surface (MJ m-2 d-1] G = soil heat flux (MJ m-2 d-1]

T = average temperature at 2 m height (°C)

U2 = windspeed measured at 2 m height [m s-1]

(ea-ed) = vapour pressure deficit for measurement at 2 m height [k Pa]

Δ = slope vapour pressure curve [k pa°C-1] γ = psychrometric constant [k pa°C-1]

900 = coefficient for the reference crop [l J-1 kg K d-1]

0.34 = wind coefficient for the reference crop [s m-1]

The various components of the above relation are derived as:

$$ed = e_0$$

(i) When solar radiation is available

$$R_n = 0.77 R_s - (a_c \frac{R_s}{R_{so}} + b_c) (a_1 + b_1 \sqrt{ed}) \sigma \frac{(T_{kx}^4 + T_{kn}^4)}{2}$$

Where

T_{kx} and T_{kn} is both set equal to mean hourly air temperature for hourly calculations. This is not employed in the present study as very few stations have the data on solar radiation

(ii) When only sunshine data are available:

$$R_n = 0.77(0.25 + 0.50 n/N + R_s) - 2.45 \times 10^{-9} \left(0.9 \frac{n}{N} + 0.1 \right) (0.34 - 0.14 \sqrt{ed}) (T_{kx}^4 + T_{kn}^4)$$

$$G = 0.38(T_{\text{day } i} - T_{\text{day } i-1})$$

Where,

T_{day i} = Mean daily air temperature

T_{day i-1} = mean daily air temperature of preceding day

(iii) Vapour Pressure Deficit (VPD)

Where,

$$VPD = (e_a - e_d) = \frac{e^0(T_{\text{max}}) + e^0(T_{\text{min}})}{2} - e_d$$

Where,

VPD = Vapour pressure deficit [kPa]

$e^0(T_{\text{max}})$ = saturation vapour pressure at T_{max} [kPa]

$e^0(T_{\text{min}})$ = saturation vapour pressure at T_{min} [kPa]

e_d = actual vapour pressure [kPa]

$$e_a = e^0(T) = 0.611 \exp \left(\frac{17.27 T}{T + 273.3} \right)$$

Where,

e_a = saturation vapour pressure [kPa]

$e^0(T)$ = saturation vapour pressure function [kPa]

T = air temperature [°C]

$ed = e_0$

(iv) Δ is slope of vapour pressure, computed on

$$\Delta = (e_a/T_m + 273)(6791/(T_m + 273) - 5.03)$$

Length of Growing Period (LGP)

The length of the growing period (LGP), as defined by the Agro-Ecological Zones project (FAO, 1978 report on the agro-ecological zones project) is the period during a year when precipitation exceeds half the potential evapotranspiration. In this study the length of growing period is calculated with the help of Weather cock software. All the weeks having rainfall equal to more than half of the potential evapotranspiration is known as length of growing period which includes Humid period; the period when rainfall is more than PET and Moist period; the period when rainfall is more than PET/2 but less than PET.

Results and Discussion

Annual Rainfall and rainy days

The average annual rainfall and rainy days of Raipur district of Chhattisgarh plain Agro-climatic zone is given in Table 1 and Fig 1. The average annual rainfall of 1091.5 mm and the average annual rainy days of 70 days are recorded respectively (Chaudhary et al. 2015) [7]. The highest annual rainfall was recorded in the year of 2013 (1728.7 mm) followed by 1980 (1651.2 mm) and 2003 (1462 mm). Whereas, the lowest annual rainfall was recorded in the year of 2000 (648.4 mm) followed by 2008 (693.1) and 1988 (732.3) with the annual mean rainfall of 1091.5 mm and standard deviation (SD) of 242.1 mm and coefficient of variation (CV) of 22.2 per cent. Bhuarya et al. 2014 and Bhelawe et al. 2016 [2] also reported similar results as the result obtained in this research work. The highest annual rainy days was recorded in the year of 1990 (112 days) followed by 2014 (100) and 2007 (94) whereas, the lowest annual rainy days are recorded in the year of 1974, 1979 and 2002 (47 days) followed by 1972, 2000 and 2008 (54 days) and 1976, 2006 and 2015 (56 days) with mean of 70 days and standard deviation (SD) of 15 days and coefficient of variance (CV) of 21.3 per cent, respectively. Deficit, normal and excess rainfall years of the district were also worked out, the year with annual rainfall per cent deviation of (-20 to -59) are categorized under deficit rainfall year, the year with annual rainfall per cent deviation of (-19 to +19) are categorized under normal rainfall year and the year with annual rainfall per cent deviation of (+ 19 to + 59) grouped under excess rainfall year. The Raipur district has 9 deficit rainfall years i.e. 1974, 1979, 1981, 1982, 1988, 2000, 2002, 2004 and 2008 and 8 excess rainfall years i.e. 1971, 1980, 1994, 2003, 2005, 2011, 2012, and 2013 and rest 30 years were found normal rainfall years among the 47 years of rainfall data analysis. Chaudhary et al. (2015) [7] also studied and reported similar pattern of rainfall in some of the district of Chhattisgarh.

Table 1: Annual rainfall, rainy days and per cent deviation at Raipur District

Year	RF (mm)	Deviation (%)	Category	RD	Deviation (%)
1971	1434.4	31.4	Excess	79	12.9
1972	1089.3	-0.2	Normal	54	-22.9
1973	1284.1	17.6	Normal	71	1.4
1974	859.7	-21.2	Deficit	47	-32.9
1975	1287.6	18	Normal	72	2.9
1976	1036.6	-5	Normal	56	-20.0
1977	1231.8	12.8	Normal	59	-15.7

1978	1122.2	2.8	Normal	74	5.7
1979	744.4	-31.8	Deficit	47	-32.9
1980	1651.2	51.3	Excess	66	-5.7
1981	841.3	-22.9	Deficit	61	-12.9
1982	737.2	-32.5	Deficit	57	-18.6
1983	999.8	-8.4	Normal	79	12.9
1984	937.5	-14.1	Normal	64	-8.6
1985	1216.8	11.5	Normal	60	-14.3
1986	1216.8	11.5	Normal	90	28.6
1987	1025.1	-6.1	Normal	89	27.1
1988	732.3	-32.9	Deficit	68	-2.9
1989	977.7	-10.4	Normal	76	8.6
1990	1182	8.3	Normal	112	60.0
1991	1051.8	-3.6	Normal	86	22.9
1992	993.1	-9	Normal	69	-1.4
1993	1189.1	8.9	Normal	72	2.9
1994	1383	26.7	Excess	80	14.3
1995	1167.5	7	Normal	74	5.7
1996	1079.7	-1.1	Normal	69	-1.4
1997	1018.4	-6.7	Normal	88	25.7
1998	1078.5	-1.2	Normal	86	22.9
1999	941.5	-13.7	Normal	81	15.7
2000	648.4	-40.6	Deficit	54	-22.9
2001	931.3	-14.7	Normal	60	-14.3
2002	784.2	-28.2	Deficit	47	-32.9
2003	1462.7	34	Excess	86	22.9
2004	795.4	-27.1	Deficit	58	-17.1
2005	1422.7	30.3	Excess	60	-14.3
2006	1112.5	1.9	Normal	56	-20.0
2007	1149.9	5.3	Normal	94	34.3
2008	693.1	-36.5	Deficit	54	-22.9
2009	1081.9	-0.9	Normal	57	-18.6
2010	1092.2	0.1	Normal	66	-5.7
2011	1361.4	24.7	Excess	85	21.4
2012	1382.6	26.7	Excess	80	14.3
2013	1728.7	58.4	Excess	89	27.1
2014	1181.1	8.2	Normal	100	42.9
2015	958.6	-12.2	Normal	56	-20.0
2016	1121.1	2.7	Normal	63	-10.0
2017	885.6	-18.9	Normal	60	-14.3
Mean	1091.5			70	
SD	242.1			15	
CV (%)	22.2			21.3

Fig 1: Trend of annual rainfall and rainy days at Raipur district

Trend analysis of annual rainfall and rainy days

Time trend equation of annual rainfall and rainy days from the long term data has been worked out. Table 2 showed non-

significant increasing trend of annual rainfall and rainy days in Raipur district (Jain and Kumar 2012) ^[6].

Table 2: Trend of annual rainfall and rainy days in Raipur district of Chhattisgarh plain Agro- climatic zone.

Parameter	Data base	Time trend equation	R2
Annual rainfall	1971 – 2017	$Y = 0.5141x + 1079.2$	0.0008
Rainy days	1971 – 2017	$Y = 0.143x + 67.014$	0.017

Length of growing period

The “length of growing period” (LGP) as defined by the Agro-Ecological Zones project (FAO, 1978-81) is the period (in days) during a year when precipitation (P) exceeds half the potential evapotranspiration (PET). The Raipur district has great variation in length of growing period (LGP) in the entire three situation (Deficit, Normal and Excess) rainfall situation. Data on the length of growing period (LGP) are presented in Table 3 and represented in Fig 2 a, b and c. The data revealed that the starting SMW of LGP is the same in both deficit and normal rainfall situation, i.e. 24th SMW, whereas, it starts from the 23rd SMW under excess rainfall situation, but in all three rainfall situations LGP ends at 39th, 40th and 43rd SMWs. Thus, the duration of length of growing period are 112, 119 and 147 days under deficit, normal and excess rainfall conditions, respectively. Sathyamoorthy *et al.* (2017) ^[4] characterized similar pattern of length of growing period over North Western Zone of Tamil Nadu. Ramachandran *et*

al. (2014) also reported similar pattern of length of growing period in Andhra Pradesh using NDVI variations.

Humid and moist period

The beginning SMW of the humid period (the period when rainfall is more than PET) in both deficit and normal rainfall situation are the same, i.e. 25th SMW, but it differs in the excess rainfall situation and starts at 24th SMW and the ending SMW of humid period in all the three situation are same and ends at 38th SMW. It can be clearly seen from Table 3, that there is only 1 week of moist period (the period when rainfall is more than half of the PET) in all the three situation deficit, normal as well as excess rainfall situation at the beginning of humid period, while under deficit rainfall situation there is only 1 week of moist period and under normal rainfall situation there are 2 weeks of moist period while under excess rainfall situation exceptionally 5 weeks of moist period was found after the humid period.

Table 3: LGP under Deficit, Normal and Excess Rainfall situation at Raipur

	Deficit				Normal				Excess			
	RF(mm)	PET	PET/2	P>PET/2	RF(mm)	PET	PET/2	P>PET/2	RF(mm)	PET	PET/2	P>PET/2
1	0.0	16.5	8.3	-8.3	3.0	16.5	8.3	-5.3	3.4	16.5	8.3	-4.8
2	1.9	17.3	8.6	-6.7	4.3	17.3	8.6	-4.3	0.9	17.3	8.6	-7.8
3	2.6	18.9	9.5	-6.9	1.2	18.9	9.5	-8.3	0.3	18.9	9.5	-9.2
4	4.2	19.4	9.7	-5.5	0.8	19.4	9.7	-9.0	5.0	19.4	9.7	-4.7
5	2.2	21.0	10.5	-8.3	0.9	21.0	10.5	-9.6	10.1	21.0	10.5	-0.4
6	3.9	22.9	11.5	-7.6	3.8	22.9	11.5	-7.7	0.8	22.9	11.5	-10.6
7	1.8	25.0	12.5	-10.7	4.4	25.0	12.5	-8.1	1.5	25.0	12.5	-11.0
8	1.2	27.1	13.6	-12.4	0.9	27.1	13.6	-12.7	2.3	27.1	13.6	-11.3
9	1.9	33.9	17.0	-15.1	2.3	33.9	17.0	-14.6	1.5	33.9	17.0	-15.5
10	0.2	30.8	15.4	-15.2	8.0	30.8	15.4	-7.4	4.7	30.8	15.4	-10.7
11	1.5	33.2	16.6	-15.1	2.4	33.2	16.6	-14.2	2.2	33.2	16.6	-14.4
12	2.8	36.7	18.3	-15.5	3.3	36.7	18.3	-15.0	0.2	36.7	18.3	-18.1
13	0.7	39.1	19.5	-18.9	2.3	39.1	19.5	-17.3	0.1	39.1	19.5	-19.4
14	0.4	41.9	20.9	-20.6	4.0	41.9	20.9	-16.9	4.3	41.9	20.9	-16.7
15	0.6	44.6	22.3	-21.6	1.8	44.6	22.3	-20.5	1.9	44.6	22.3	-20.4
16	0.8	47.8	23.9	-23.1	2.3	47.8	23.9	-21.6	8.5	47.8	23.9	-15.4
17	0.7	50.7	25.4	-24.7	2.5	50.7	25.4	-22.8	1.1	50.7	25.4	-24.2
18	2.4	53.5	26.7	-24.4	4.5	53.5	26.7	-22.2	1.3	53.5	26.7	-25.4
19	1.6	52.3	26.2	-24.6	3.5	52.3	26.2	-22.7	3.2	52.3	26.2	-23.0
20	4.7	55.6	27.8	-23.1	4.5	55.6	27.8	-23.3	3.9	55.6	27.8	-23.9
21	0.3	55.1	27.6	-27.2	2.9	55.1	27.6	-24.7	7.1	55.1	27.6	-20.5
22	1.8	55.3	27.7	-25.9	3.2	55.3	27.7	-24.5	13.7	55.3	27.7	-14.0
23	8.2	52.5	26.2	-18.1	11.7	52.5	26.2	-14.5	45.7	52.5	26.2	19.5
24	40.9	44.1	22.1	18.8	35.9	44.1	22.1	13.9	68.3	44.1	22.1	46.3
25	52.3	34.0	17.0	35.3	53.4	34.0	17.0	36.4	77.6	34.0	17.0	60.6
26	42.2	32.2	16.1	26.1	72.9	32.2	16.1	56.8	62.8	32.2	16.1	46.7
27	41.8	29.3	14.6	27.1	67.4	29.3	14.6	52.8	96.7	29.3	14.6	82.1
28	56.4	25.6	12.8	43.6	81.0	25.6	12.8	68.2	87.3	25.6	12.8	74.5
29	42.0	23.2	11.6	30.4	87.6	23.2	11.6	76.0	101.2	23.2	11.6	89.6
30	38.1	24.1	12.1	26.0	67.1	24.1	12.1	55.0	98.2	24.1	12.1	86.1
31	46.8	23.9	11.9	34.9	65.3	23.9	11.9	53.4	121.6	23.9	11.9	109.6
32	98.2	23.1	11.6	86.7	56.7	23.1	11.6	45.2	62.9	23.1	11.6	51.4
33	66.3	22.7	11.4	54.9	83.9	22.7	11.4	72.5	91.9	22.7	11.4	80.5
34	34.3	23.8	11.9	22.4	53.8	23.8	11.9	41.9	53.8	23.8	11.9	42.0

35	30.0	23.1	11.5	18.4	65.0	23.1	11.5	53.4	92.4	23.1	11.5	80.8
36	20.7	23.8	11.9	8.8	48.4	23.8	11.9	36.6	95.0	23.8	11.9	83.1
37	23.5	25.0	12.5	11.0	52.2	25.0	12.5	39.7	74.3	25.0	12.5	61.8
38	30.2	26.0	13.0	17.2	30.2	26.0	13.0	17.2	75.3	26.0	13.0	62.3
39	15.4	27.5	13.7	1.6	25.2	27.5	13.7	11.4	12.9	27.5	13.7	-0.8
40	6.9	26.7	13.4	-6.4	14.7	26.7	13.4	1.3	25.9	26.7	13.4	12.6
41	1.6	26.2	13.1	-11.5	12.3	26.2	13.1	-0.8	13.2	26.2	13.1	0.1
42	4.0	25.4	12.7	-8.7	5.4	25.4	12.7	-7.3	27.0	25.4	12.7	14.3
43	9.0	23.5	11.7	-2.8	8.1	23.5	11.7	-3.7	13.1	23.5	11.7	1.4
44	0.5	22.0	11.0	-10.5	3.9	22.0	11.0	-7.1	2.0	22.0	11.0	-9.0
45	0.1	21.5	10.7	-10.7	6.1	21.5	10.7	-4.7	0.2	21.5	10.7	-10.5
46	1.0	20.4	10.2	-9.2	2.4	20.4	10.2	-7.8	0.0	20.4	10.2	-10.2
47	5.0	19.2	9.6	-4.6	2.2	19.2	9.6	-7.4	0.0	19.2	9.6	-9.6
48	6.0	18.2	9.1	-3.1	1.6	18.2	9.1	-7.5	0.0	18.2	9.1	-9.1
49	0.0	17.2	8.6	-8.6	4.3	17.2	8.6	-4.4	0.0	17.2	8.6	-8.6
50	0.0	17.1	8.5	-8.5	1.4	17.1	8.5	-7.1	0.3	17.1	8.5	-8.3
51	0.1	16.5	8.2	-8.1	0.8	16.5	8.2	-7.5	0.0	16.5	8.2	-8.2
52	0.0	18.6	9.3	-9.3	0.8	18.6	9.3	-8.5	1.2	18.6	9.3	-8.1
	759.6	1554.9			1088.1	1554.9			1478.4	1554.9

A.

B.

C.

Fig 2 a, b and c: Length of growing period under deficit, normal and excess rainfall situation in Raipur district

Conclusion

Based on the 47 years of rainfall analysis and the results obtained it can be concluded that the rainfall and rainy days showed slightly increasing trend but not to the significant level. Out of 47 years of data analysis 30 (64%) years were found normal rainfall years, while 9 (19%) years were found as deficit, whereas 8 (17%) years were found excess rainfall years. None of the years were found large excess or large deficit rainfall years. Considering the duration of length of growing period, when precipitation (P) exceeds half the potential evapotranspiration (PET) 112, 119 and 147 days were found as length of growing period under deficit, normal and excess rainfall conditions, respectively. Thus, under deficit rainfall condition short duration rice, under normal rainfall condition medium duration rice and under excess rainfall condition long duration rice or medium duration rice followed by short duration early season rabi crop can be grown under rainfed condition.

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