

Research Paper :

Rainfall analysis for drought occurrences in Chiplun tahsil (MS)

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ABSTRACT

Rainfall distribution over India is highly erratic and uncertain both in time and space. Heavy rainfall for short period and some times continuous dry spell creates problems for crop growth. Therefore, it is necessary to study the rainfall analysis for developing farming system which may help to increase and stabilize agriculture production through better use of natural resources. The rainfall data of 15 years were collected from Minor Irrigation Department, Kapsal. Tal- Chiplun, dist. Ratnagiri. The study concluded as in seasonal week, a drought week which occurred as 29.43% followed by 48% week as abnormal week. The results of the monthly rainfall analysis showed that about 35.55% of total number of months was normal for 15 years period. This analysis will help for crop planning and for design of soil and water conservation structure for future need.

Key words : Abnormal rainfall, Crop planning, Drought, Rainfall analysis, Normal

Indian agriculture mainly depends on monsoon rain. Out of total cultivated area of our country, nearly 70 per cent of area is rain-fed which depends on characteristic of monsoon. Despite the progress, marginal and small farmers constituting 80% of agriculture income groups still depends on rain-fed farming (Das and Subhash, 2004). During rainy season about 70 % rainfall is received over Maharashtra state from south-west direction. During winter season, about 20% rain is received from north-east direction.

Konkan region is situated along Arabian sea shore on west-coast. It is divided into two parts *i.e.* southern Konkan and Northern Konkan. Chiplun region is placed in southern Konkan region. Average annual rainfall of konkan region is 3200 mm. Konkan tropical region with humidity varies from 50 to 80 % within the year. The important characteristics of rainfall influencing production of rain fed farming are number of rainy days, drought, normal and excessive rainfall for week, month and year. Meteorologically a day is considered dry when it receives rainfall less than 2.5 mm, while agriculturally a dry day receives rainfall less than 6.3 mm are of no use for plant growth, as they will not wet the soil enough to supply moisture around roots (Chowdhary, 1979).

Karate and Sena (2004) studied the application of rainfall analysis for planning soil and water conservation structures in semi-arid Gujarat. Researcher have made meteorological drought, agriculture drought based on rainfall data for different regions in India. Sharma *et al.* (1978) and Sharma and Verma (1983) analyzed the drought using the definition of drought month, drought

week and drought year for different regions as receiving actual rainfall equals to the 50% of the average rainfall.

METHODOLOGY

The daily rainfall data of 15 years (1993-2007) was recorded on rain gauge station located at Fanaswadi dam, 5 km away from Chiplun by Minor Irrigation Department Kapsal, Tal- Chiplun, Dist.- Ratnagiri (Maharashtra). The Chiplun is located 250 m above mean sea level at latitude 17°31'N and longitude 73°31' E. It is located at West Maharashtra of Konkan region coastal zone Arabian ocean. Therefore, humidity is generally high during June to October. It is generally more than 80% and least during winter. The average annual rainfall of Chiplun region is 3804 mm. The average maximum temperature is about 32°C and the average minimum temperature is 26°C for this region. There is not more temperature variation during daytime.

Analysis of rainfall data:

The weekly rainfall data were computed by adding daily rainfall data for each standard metrological week. Similarly, the daily rainfall in each month was added to compute the monthly rainfall in a particular year. Also the annual rainfall was computed by adding the monthly rainfall in that particular year.

The drought estimation was made by considering definition of different terms. Drought week/month was defined as receiving rainfall less than 50 % of the average weekly/monthly rainfall whereas normal week/month receiving rainfall in between 50 – 200% of average

rainfall. Abnormal week/month was defined as any week receiving rainfall more than twice the average weekly rainfall.

Sharma *et al.* (1978) had also defined yearly criteria for determination of drought years as any year receiving rainfall less than or equal to $X-SD$, Normal year is any year receiving rainfall in between the limits of $X-SD$ to $X+SD$ and abnormal year is the year receiving rainfall more than or equal to $X+SD$, where

X – Population mean I.E the mean yearly rainfall and

SD – Standard deviation with same unit as that of X .

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been summarized under following heads:

Weekly analysis of rainfall data:

The weekly rainfall data were analyzed to compute mean weekly rainfall, per cent drought, normal and abnormal weeks. The drought weeks were analyzed by using criteria as discussed earlier in methodology. The average maximum weekly rainfall was obtained in 26th M.W. (*i.e.* 329.2 mm). The maximum number of normal weeks obtained in 30th, 32th and 33rd M.W. (*i.e.* 11 times) out of 15 years rainfall data.

Table 1 shows that, meteorological weeks from 18th S.M. week to 44th S.M. weeks are major rainy weeks. As seen as in seasonal week, drought weeks occurred as 29.43% followed by 48% week as abnormal week. Same study was conducted by Uthape and Pertin (1998) for Rahuri region. It was found that, during 21 years period of rainfall data, 72.89 % weeks were drought, 13 % normal and 14.15 % abnormal weeks. Dhane *et al.* (2000) studied for Panvel region. It was found that average rainfall of different weeks have variation from 274.80 mm in 29th week to 52.98 mm in 38th week. The minimum number of drought weeks has occurred 6 times in week, while the maximum numbers of droughts were observed in 16th times in 23rd week during the 25 years rainfall data.

Analysis of monthly rainfall data:

The normal, abnormal and drought months were analyzed on the basis of definitions explained in the methodology. The rainfall for a monthly data to be a drought, abnormal or normal with the average rainfall has been shown in Table 2. The average maximum monthly rainfall was about 1253.70 mm in the month of July. The average monthly rainfall was 317 mm. It was seen that

Table 1 : Weekly average rainfall and criteria for drought, normal and abnormal weeks

Meteorological week no.	Average weekly rainfall (mm)	Number of weeks		
		Drought weeks	Normal weeks	Abnormal weeks
18	2.82	13	0	2
19	2.2	13	0	2
20	12.33	12	1	2
21	10.73	12	0	3
22	43.93	10	3	2
23	109.73	8	4	3
24	225.4	4	10	1
25	261.4	5	9	1
26	329.2	3	10	2
27	275	4	10	1
28	291.53	4	10	1
29	239.53	6	7	2
30	329.13	3	11	1
31	263.93	3	10	2
32	275.6	3	11	1
33	125.13	3	11	1
34	184.86	3	10	2
35	229.72	5	9	1
36	118.34	5	9	1
37	79.33	6	7	2
38	87.73	3	9	3
39	114.86	5	8	2
40	68.93	7	5	3
41	57.93	7	6	2
42	28.93	8	4	3
43	17.86	10	1	4
44	7	12	1	2
45	5.13	14	0	1
46	0.86	14	0	1
47	0.33	14	0	1
48	0	15	0	0
49	4.86	14	0	1
Total weeks		248	176	56

arrival of monsoon mainly end of May and withdrawal of monsoon at late October but mainly rainy season was from June to September. From the month January to April, there was no occurrence of rainfall, *i.e.* so all the months termed as a drought months. The results of the rainfall analysis showed that about 35.55% of total numbers of month were normal for 15 years period. It can be seen from Table 2 that about 93 % of normal month occurred during monsoon season *i.e.* June to September whereas two times in September and one time in June and August, drought was occurred. It was also seen that 59 % total number of months was drought month during 15 years period. Most drought occurred from January to April as

Table 2 : Number of month to be drought, normal, abnormal in 15 years period				
Sr. No.	Average rainfall (mm)	Number of times the month as		
		Drought	Normal	Abnormal
January	-	15	-	-
February	-	15	-	-
March	-	15	-	-
April	-	15	-	-
May	37.76	10	1	4
June	911.53	1	14	-
July	1253.66	-	15	-
August	928.26	1	14	-
September	481.27	2	13	-
October	180.40	6	7	2
November	6.60	13	-	2
December	4.86	14	-	1
Total		107	64	9

that time there was nearly no rainfall whereas month July was not suffered from drought in 15 years period. Abnormal months was occurred in the month of May with average rainfall 37.76 mm. Only 5 % of total number of months were abnormal in 15 years period. During the seasonal period, no abnormal month occurred.

Analysis of yearly rainfall data:

The average annual rainfall for Chiplun region was 3804.36 mm and value of S.D. were found to be 537.72. The drought, normal and abnormal years was determined by criteria as discussed earlier. Therefore, any year receiving rainfall less than or equal to 3266.64 mm will be drought year. Distribution of annual rainfall is shown in Fig. 1. Thus, as per the above definitions, 20% years (*i.e.* 2001, 2002 and 2004) were drought years. Any year receiving rainfall equal to or greater than 4342.07 mm will be abnormal. Thus, 13.33% of total years for the

period studied. The years receiving rainfall in between 3266.64 to 4342.07 mm will be normal years. Thus, remaining 66.67% of years (1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2003 and 2007) are the normal years for the period studied.

Conclusion:

The crop planning is suggested based on 70% rainfall along with onset of effective monsoon and drought, normal and abnormal periods. This requirement completed by rainy season and excess water may chance to store water for growing *Rabi* season crops.

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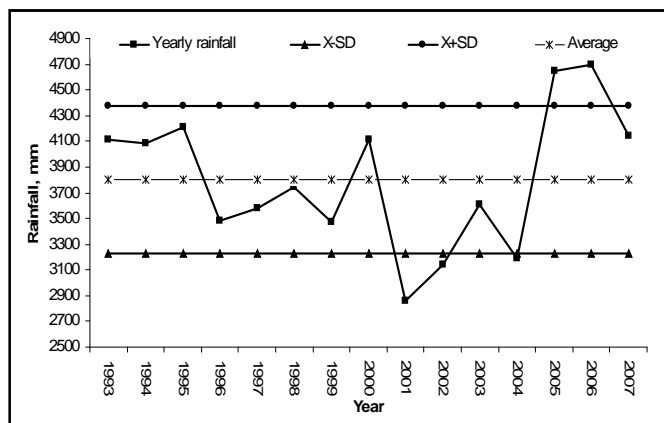


Fig. 1 : Schematic diagram of drought, normal and abnormal year in 15 years period

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