

Rainfall Analysis for Drought Estimation of Udaipur Region

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ABSTRACT

In regions where rainfall is erratic and frequent temporary drought conditions are expected within the monsoon season also, rainfall analysis for drought estimation is helpful for crop planning. In this paper normal, abnormal and drought months have been determined for the period of 1981-2005 of Udaipur region. Total 12 drought months were found during the rainy season in the duration of 1981-2005. Probability of occurrence of 6 drought months in a year was 96% and for 10 months was 4%.

The erratic trend, uneven distribution and uncertainty of rainfall in Udaipur region are responsible for creating moisture stress and crop failure. Even in a good monsoon year, a drought period of 19-25 days, which is common phenomenon in the region, affects crop yields. Jat et al. (2005a) had found that the failure of monsoon where more than two-third of the area was under rainfed cultivation and where irrigation system was poor and insufficient, often created critical fall in employment and constraints in the supply of food, fodder and drinking water for both human and animal. The information on drought is important in designing the storage capacity of reservoirs (Subramanian et al., 1984; Ray et al., 1987) and selection of suitable crops for the region. Incomplete gamma distribution was used by Jat et al. (2005b) to predict the minimum assured rainfall at different probability of exceedence in all weeks of the year in the Udaipur region. The objective of the study presented in this paper is to predict the magnitude and frequency of agricultural drought on monthly and yearly basis.

MATERIAL AND METHODS

Daily rainfall data recorded at Agricultural Meteorological Observatory, CTAE, Udaipur (24° 35'N Latitude, 73° 42'E Longitude and 582.17 m above MSL) for a period of 25 years (1981-2005) were used in the study. The daily data were converted into monthly rainfall values, which were analyzed for computation of drought months and drought season. The mean annual rainfall of the study region varies from 383 to 945 mm (1981-2005) of which 90% is received during south-west monsoon season (June to September). Frequency of drought months was worked out based on the methods suggested by Sharma et al., 1979. Average annual rainfall of Udaipur is 596 mm (1981-2005) and the standard

deviation is 188 mm. Therefore, any year receiving rainfall less than or equal to 408 mm was considered to be drought year, and the year receiving rainfall equal to or more than 784 mm was considered as abnormal year (wet year). Normal years were accounted between 408 mm to 784 mm of annual rainfall. Regarding monthly analysis, any month receiving rainfall less than half the average monthly rainfall was considered to be drought month. Any month receiving rainfall more than twice the average rainfall of the month was taken to be abnormal month. Normal months were taken between half and twice the value of average monthly rainfall.

RESULTS AND DISCUSSION

Analysis of data showed 20% of the years as drought years. Similarly, 12% of the years were abnormal years. Normal years accounted for 68% years receiving rainfall between 408 mm to 784 mm. There is a possibility of one drought year in a span of 5 years. From Fig. 1, it is seen that in 25 years, 12.7% of the total number of months were normal months.

Probability distribution of normal months in a year and the percentage of total years having the normal months are given in Table 1.

Table 1. Probability distribution of normal months in a year

No. of normal months in a year	Probability	% of total years having normal months
10	0.04	04
9	0.31	28
8	0.65	36
7	0.85	20
6	0.96	12

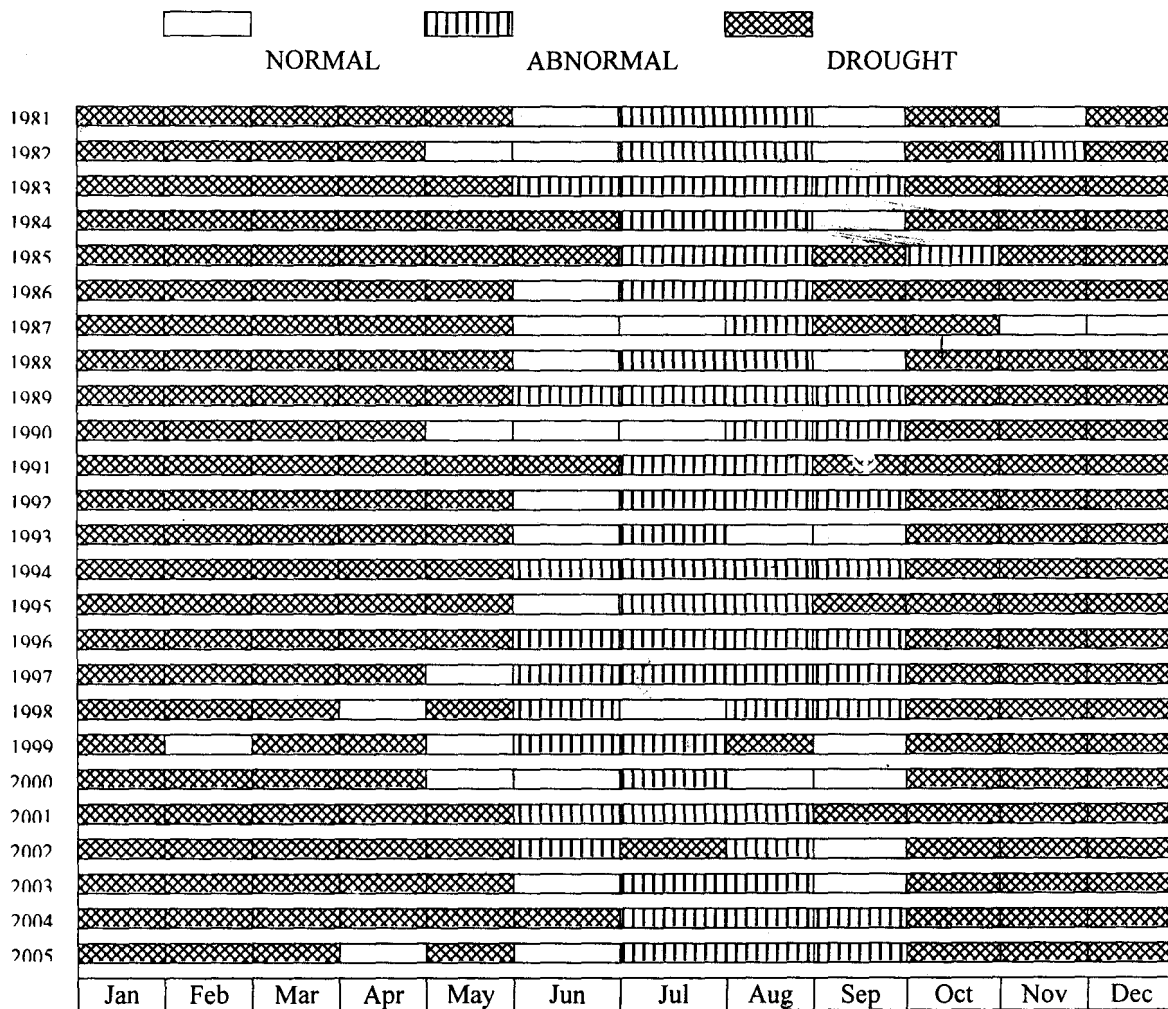


Fig. 1. Normal, abnormal and drought months (1981-2005) at Udaipur

For the monsoon period, i.e. from June to September, 26% of the months were normal, whereas, for other period the normalcy was hardly 6%. About 62% months were abnormal during the monsoon season whereas, about 1% was abnormal during rest of the year. In all 21.34% of the months were abnormal during whole of the year. Probability of particular number of months being abnormal and the percent distribution of a given number of abnormal months are given in Table 2.

About 66% of total months during the 25 years were drought months. Probability distribution of drought months in a year is given in Table 3 and month-wise drought in Table 4.

It could also be established that about 12% of the total months during monsoon period were drought months with distributions of 16, 4, 4 and 24 per cent in the months of June, July, August and September, respectively (Table 4).

During the rabi season (October to February) about 29.6% of months experienced drought. In the absence of irrigation facility, there is likelihood of crop failure in general conditions or the yields of crops are very low.

There is possibility of mitigating the drought during the monsoon crops and to help farmer in taking *rabi* crops.

Table 2. Probability distribution of abnormal months in a year

No. of abnormal months in a year	Probability	% of total years having abnormal months
4	0.19	20
3	0.46	28
2	0.85	40
1	0.96	12

Table 3. Probability distribution of drought months in a year

No. of drought months in a year	Probability	% of total years having drought months
10	0.04	04
9	0.31	28
8	0.65	36
7	0.85	20
6	0.96	12

Table 4. Month-wise drought distribution

Month	% of indicated months under drought	% of total years having drought months
Jan	13.97	100
Feb	13.41	96
Mar	13.97	100
Apr	12.85	92
May	11.17	80
Jun	2.23	16
Jul	0.56	4
Aug	0.56	4
Sep	3.35	24
Oct	1.68	12
Nov	12.85	92
Dec	13.41	96

The surplus water during the monsoon can be utilized by constructing water harvesting ponds. Figure 2 shows water surplus (during monsoon) and deficit for the years (1981-2005) with average annual rainfall of 596 mm.

A surplus of 304 mm shows the possibility of mitigating the drought till the month of December and January, and facilitate supplemental irrigation for *rabi* crops. Hence, water harvesting through embankment cum dugout pond or stop dams on the ephemeral streams are the need of the region to overcome the problem of drought.

CONCLUSIONS

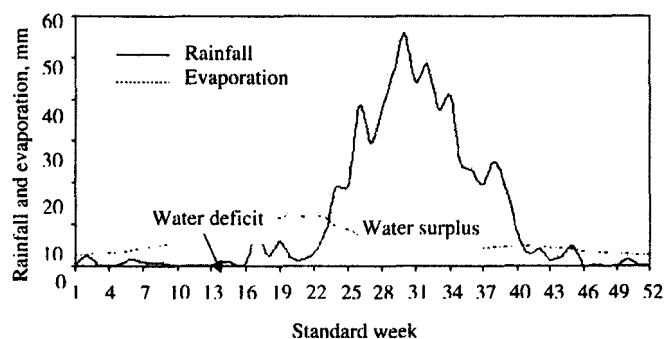
The study indicated that for Udaipur region the probability of occurrence of 6 drought months in a year was 96% and for 10 months was 4%.

ACKNOWLEDGEMENT

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**Fig. 2. Water balance at Udaipur**

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