Short communication

Rainfall analysis for drought estimation of Kota region

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The erratic trend, uneven distribution and uncertainty of rainfall in Kota 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) observed that the failure of monsoon in an area, where more than two-third of the area under cultivation is rainfed and where irrigation system is poor and insufficient, often creates critical fall in employment, food, fodder and drinking water for both humans and animals. The information on probability of drought is important in designing the storage capacity of reservoirs (Subramaniam *et al.*, 1984; Ray *et al.*, 1987) and selection of suitable crops for the region (Jat *et al.,* 2005a). 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 whole year in the Udaipur region. The objective of this study is to predict the magnitude and frequency of drought on monthly and yearly basis.

The daily rainfall data recorded at Central Soil & Water Conservation Research & Training Institute, Research Station, Kota (25° 11' N Latitude, 75° 51' E Longitude and 256.9 m above MSL) for a period of 35 years (1970-2004) were used in the study. The daily data were converted into monthly and annual rainfall and were used for computation of drought months and drought seasons. The annual rainfall varied from 300 (2003) to 1504 (1996) mm (during 1970-2004) of which 91 per cent was 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 Kota is 726 mm with a standard deviation of 256 mm. Therefore, any year receiving rainfall less than or equal to 470 mm was considered to be drought year, and the year receiving rainfall equal to or more than 982 mm was considered as abnormal or wet year. Normal years were accounted between 470 mm to 982 mm. Regarding monthly analysis, any month receiving rainfall less than half the average monthly rainfall was considered to be drought month. A month receiving rainfall more than twice the average monthly rainfall was taken to be abnormal month. Normal months were taken between half and twice the value of average monthly rainfall.

Table 1 : Probability distribution of normal months in a year

Number of normal months in a year	Probability	% of total years having normal months
5	0.03	2.86
4	0.22	20.00
3	0.50	28.57
2	0.75	25.71
1	0.97	22.86

Table 2: Probability distribution of abnormal months in a year

Number of abnormal months in a year	Probability	% of total years having abnormal months
4	0.11	11.43
3	0.39	28.57
2	0.69	31.43
1	0.97	28.57

Table 3: Probability distribution of drought months in a year

Number of drought months in a year	Probability	% of total years having drought months
10	0.08	08.57
9	0.33	25.71
8	0.78	45.71
7	0.94	17.14
6	0.97	02.86

Table 4: Months wise drought distribution

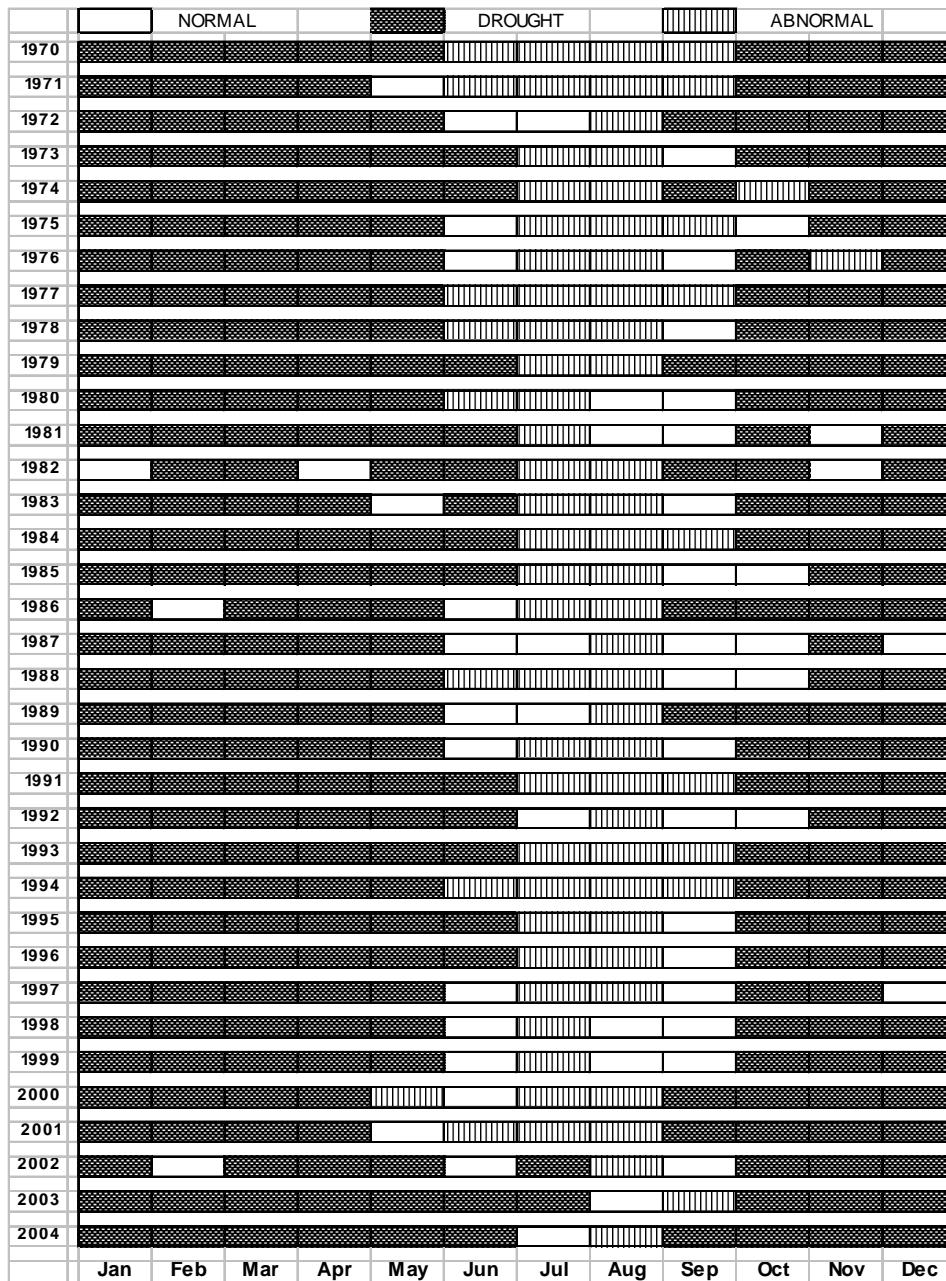| Month	% of total drought months falling in the given month	% of total years having drought months
Jan	11.85	97.14
Feb	11.50	94.29
Mar	12.20	100.00
Apr	11.85	97.14
May	10.80	88.57
Jun	5.23	42.86
Jul	0.70	5.71
Aug	0.00	0.00
Scp	3.14	25.71
Oct	10.10	82.86
Nov	11.15	91.43
Dec	11.50	94.29

Fig. 1 : Normal, abnormal and drought months during 1970-2004 at Kota

Analysis of data showed 17 per cent of the years to be drought years, 20 per cent to be abnormal years and normal years accounted for 63 per cent receiving rainfall between 470 mm to 982 mm. There is a possibility of one drought year in a span of 6 years. From Fig. 1, it could be seen that in 35 years, 12 per cent of the total number of months were normal and 69 per cent months were drought and 19 per cent were abnormal months.

Probability distribution of normal months in a year and the percentage of total years having the normal, abnormal and drought months are given in Table 1, 2 and 3 respectively. For the monsoon period, i.e. from June to September, 28 per cent of the months were normal, whereas, for other period the normalcy was hardly six per cent. About 54 per cent months were abnormal during the monsoon season whereas, less than one per cent was abnormal during rest of the year. In all nine per cent of the months were abnormal during whole of the year. About 68 % of total months during the 35 years were drought months. Probability distribution of monthly drought is given in Table 4.

It could also be established that about 19 per cent of the total months during monsoon period were drought months with percentage distribution of 43, 6, 0 and 26 per cent in the months of June, July, August and September respectively (Table 4). During the *rabi season* (October to February) about 91 per cent of months are drought. If no other source of irrigation is available, 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 season and to help farmer in taking *Rabi* crops. The surplus during the monsoon can be utilized by water harvesting ponds.

ACKNOWLEDGEMENT

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