

DROUGHT ANALYSIS FOR UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND (INDIA)

S.V. Sonakar¹

Ex- Post Graduate Student, Department of Irrigation & Drainage Engineering
College of Technology, G.B. Pant University of Agriculture & Technology
Pantnagar – 263145 (Udham Singh Nagar), Uttarakhand, India

Vinod Kumar²

Professor, Department of Irrigation & Drainage Engineering
College of Technology, G.B. Pant University of Agriculture & Technology
Pantnagar – 263145 (Udham Singh Nagar), Uttarakhand, India

A.S. Tomar³

Assistant Professor, Department of Irrigation & Drainage Engineering
College of Technology, G.B. Pant University of Agriculture & Technology
Pantnagar – 263145 (Udham Singh Nagar), Uttarakhand, India

ABSTRACT

The present study was taken up for Udham Singh Nagar district of Uttarakhand to analyse the rainfall pattern in respect of drought conditions. The weekly rainfall data of 25 years (1988-2012) were analysed for weekly, monthly, seasonal, and annual behaviour of the rainfall in the study area. The rainfall analysis indicated that the maximum amount of rainfall was observed to be 158.58 mm in the 33rd week followed by 106.76 mm in the 28th week. The minimum amount of rainfall was observed to be 0.86 mm in the 43rd week followed by 0.87 mm in the 47th week. The average monthly rainfall was observed to be minimum (5.2 mm) during the month of November and maximum (492.10 mm) during the month of July. The total annual rainfall was irregular in nature with the minimum total of 930.8mm in 2009 and maximum total of 3123.4mm in 2000. The average annual rainfall was found to be 1579.52 mm. During the period of 25 years that the maximum occurrence of drought was observed (24 times) during 46th standard week (month of November) and the 28th standard week (month of July) was found to be least draught week, with draught occurrence only one time. Excess/ surplus amount of rainfall was available in the 1st and 39th standard weeks (January and September month) with 6 occurrences during the period of 25 years. The month of November was observed to be highest prone to drought with 17 occurrences and the month of July is least prone to draught with two occurrences. It is interesting to note that though the month of November is prone to draught, it is also prone to excess rainfall, 7 occurrences out of 25. The month of July was observed to have normal rainfall generally, 23 occurrences. It was also observed that maximum contribution (86.92%) to annual rainfall (1579.52 mm) comes from seasonal rainfall (1372.93 mm, observed during June – September).

Keywords : Rainfall analysis, drought investigation, meteorological week, rainfall contribution.

Introduction

Rainfall is the most important natural hydrologic event and is a unique phenomenon varying both in space and time, the rainfall distribution is very uneven and it not only varied considerably from place to place but also fluctuates from year to year. The rainfall is one of the most important and governing factor in the planning and operation strategies of any agricultural programme for any given area. As such, proper and specific information about the rainfall pattern over a period for a particular place is quite essential for proper and optimal planning of requisite irrigation system and cropping pattern.

MATERIALS AND METHODS

The rainfall data were collected for a period of 25 years (1988-2012) from the meteorological observatory located at the Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar. The weekly rainfall data were converted into 52 standard meteorological weeks. In each year 7 days were counted in 52 meteorological weeks and in case of leap year 8 days were counted in 9th meteorological week. The data were analyzed for the i) Weekly, monthly and annual rainfall and ii) Drought investigation, identification of normal, drought and surplus weeks. The data were analysed for their weekly monthly and yearly behaviour. Accordingly, the data were analysed in years, months and standard meteorological weeks and the averages of the same were worked out for weekly rainfall.

Weekly rainfall data were used to classify the drought, normal and surplus rainfall weeks as per the following criteria:

Drought month: according to Sharma *et.al.* [1] any month receiving rainfall less than or equal to 50% of the average monthly rainfall is termed as drought month,

Drought season: according to Ramdas [2] if actual rainfall is deficient by more than twice the mean deviation of the season, the season is termed as drought season,

Drought year: Dharet *al.* [3] defined that meteorologically a year will be deficient drought year if actual rainfall is deficient by 20 to 50 percent and if the deficiency is more than 60 percent then it will be scanty drought year.

According to IMD, normal (particular year that received ± 19 percent of mean annual rainfall), excess (year that received more than 19 percent of mean annual rainfall) and deficit (year that received less than 19 percent of mean annual rainfall). According to National Commission of Agriculture [4], agricultural drought is an occasion when the rainfall in the week is half of the normal rainfall. If there are four such consecutive weeks in rainy season, the area may be classified as drought affected. According to Irrigation Commission [5], if the frequency is more than 20 percent, the area should be declared as drought prone area.

RESULTS AND DISCUSSION

I. Rainfall Analysis

(a) Weekly rainfall

The weekly analysis of rainfall of 25 years' data of study area is shown in Fig 1. It may be observed from Fig 1 that, the weekly rainfall of minimum total of 0.86 mm in 43rd standard week with maximum total of 158.58 mm in 33rd standard week. The average weekly rainfall was found to be 30.56 mm.

(b) Monthly rainfall

The monthly rainfall data of 25 years is shown in Fig. 2. From Fig. 2 it can be observed that the total monthly rainfall with minimum total of 5.20 mm in November and maximum total of 492.10 mm in July. The average monthly rainfall was found to be 131.60 mm.

(c) Seasonal, off seasonal and annual rainfall

The seasonal, off seasonal and annual rainfall of 25 years is shown in Fig. 3 and Fig. 4. As shown in Fig.3, the peak value of annual rainfall was observed the year 2000, followed by 1999, 2008, 2011, 2003 and 2010, whereas, drought situation was observed during the year 1992, followed by 1993, 1991, 2009 and 2006 for which annual rainfall were less than mean annual rainfall of 1579.52 mm. From Fig. 4; it can be observed that the total annual rainfall of this period was irregular in nature with minimum total of 930.80 mm in 2009 and maximum total of 3123.40 mm in 2000. The average annual rainfall was found to be 1579.52 mm.

II. Drought Analysis

(a) Drought, normal and surplus weeks

On the basis of definition, rainfall for a week to be normal, surplus and drought and the week wise distribution of weeks to be drought, surplus and normal. It can be seen from Fig. 5 that about 103.33 percent, 56 percent and 274 percent of the total number of weeks were normal, surplus and drought, respectively, during the period of 25 years' (1988-2012). It was observed from weekly drought analysis (Fig. 5) that maximum drought occurred during 46th standard week (24 times during 25 years) and minimum drought occurred during 28th standard week. The 1st and 39th standard week were observed to be the surplus weeks maximum times (6 times during 25 years), whereas, 26th standard week never received surplus rainfall. The 28th standard week received normal rainfall almost always (24 times out of 25 events).

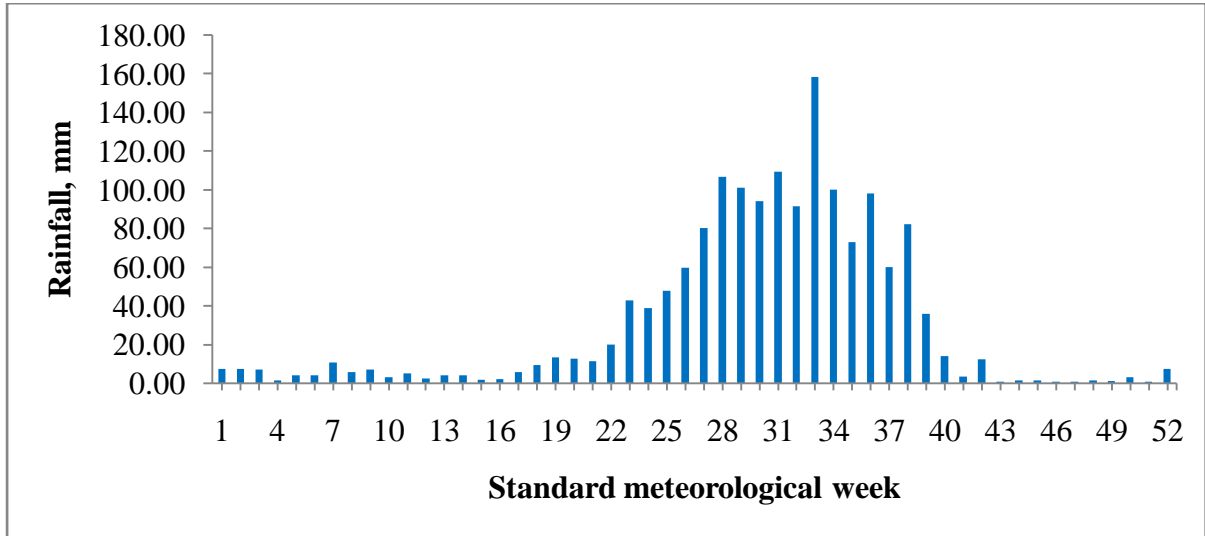


Fig 1: Mean weekly rainfall distribution.

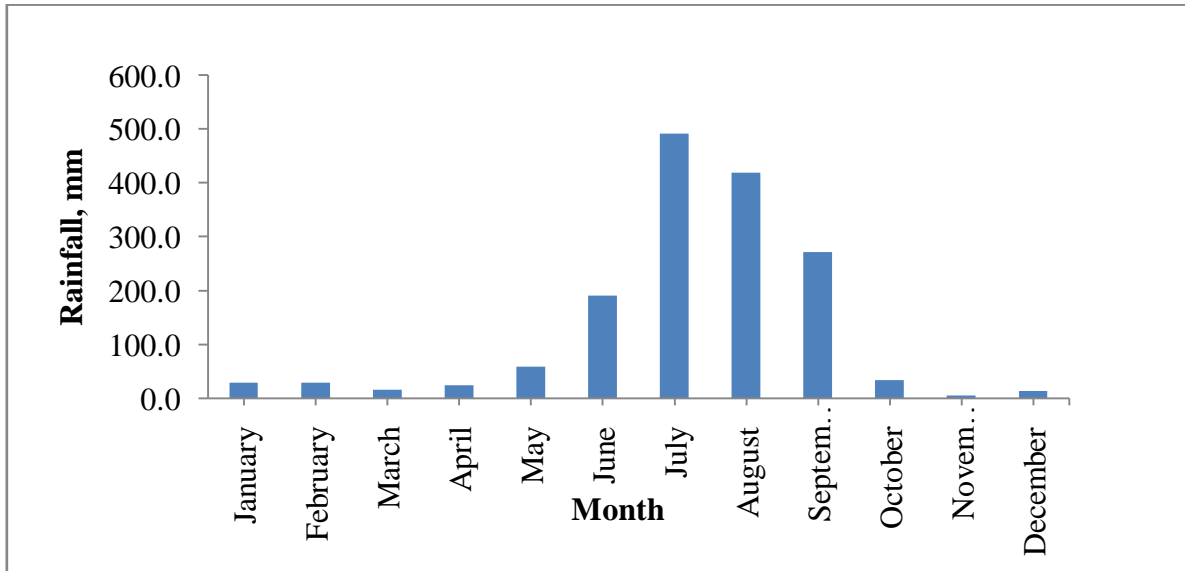


Fig 2: Mean monthly rainfall distribution.

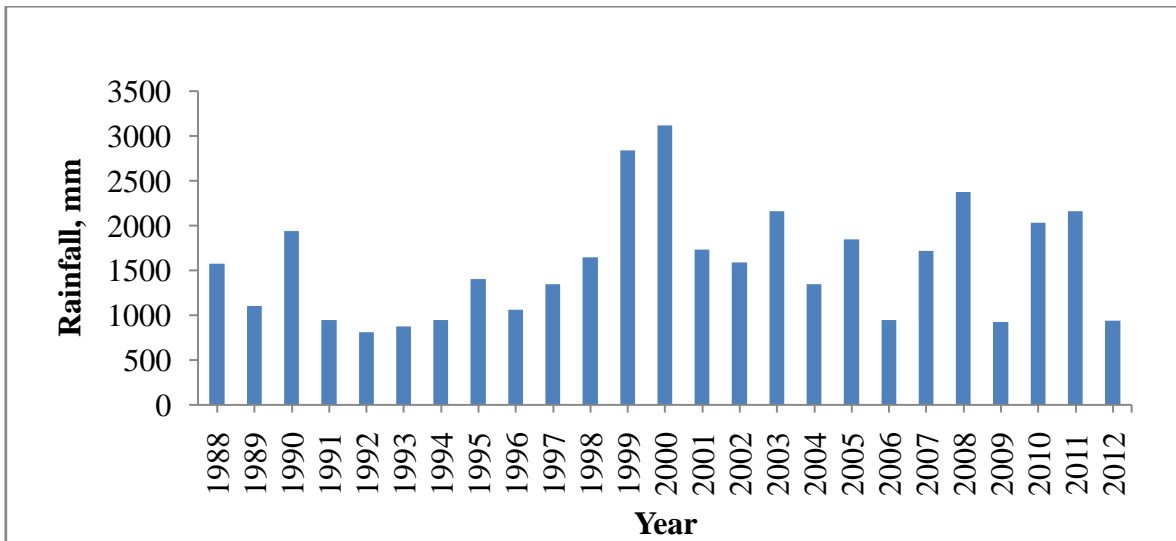


Fig 3: Annual rainfall distribution.

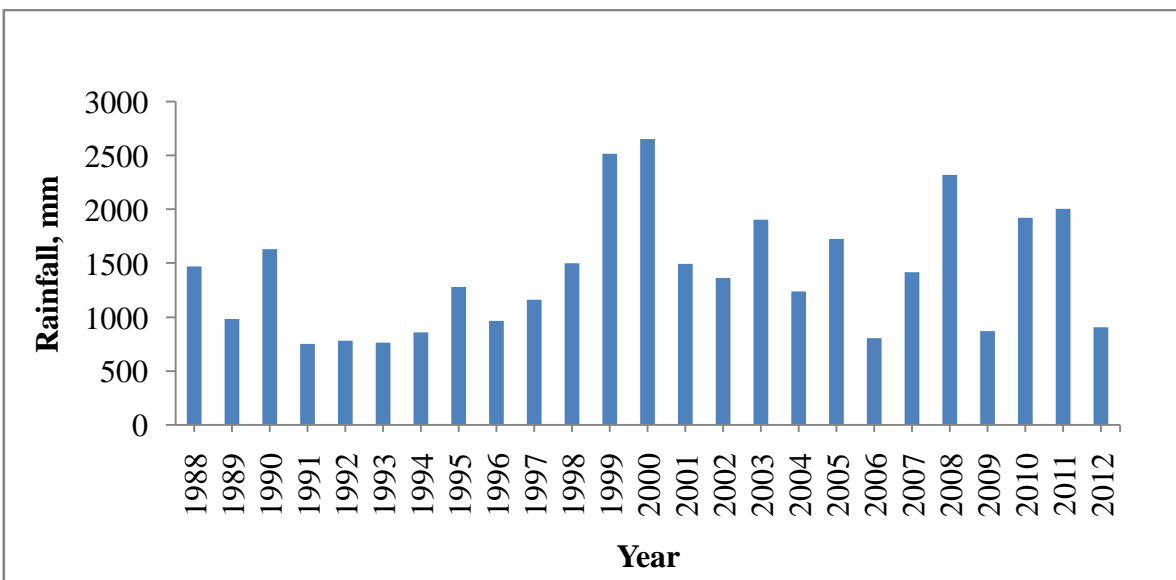


Fig 4: Seasonal rainfall distribution.

(b) Drought, normal and surplus months

On the basis of definition, the rainfall for a month to be normal, surplus and drought and the month wise distribution of months to be drought, surplus and normal are given in the Table 1. It can be shown from Table 1 and Fig 6, that about 44.33 percent, 15.33 and 40.33 percent of total number of months were observed as normal, surplus and drought months, respectively during the period of 25 years (1988-2012). it was also observed that maximum number of drought occurs in the month of November (17 times out of 25 events) and minimum number of drought were observed in the month of July (2 times during 25 years). The month of August receives normal rains almost always (23 times during 25 years).

(c) Drought, normal and surplus years

The yearly drought analysis is shown in Fig 8. The analysis shows that during the 25 years, the normal annual rains are observed 9 times, whereas, 7 years receives surplus rains and 9 years receives rains less than the normal rains. This indicates that almost an equal distribution of drought, surplus and normal rainfall in the region.

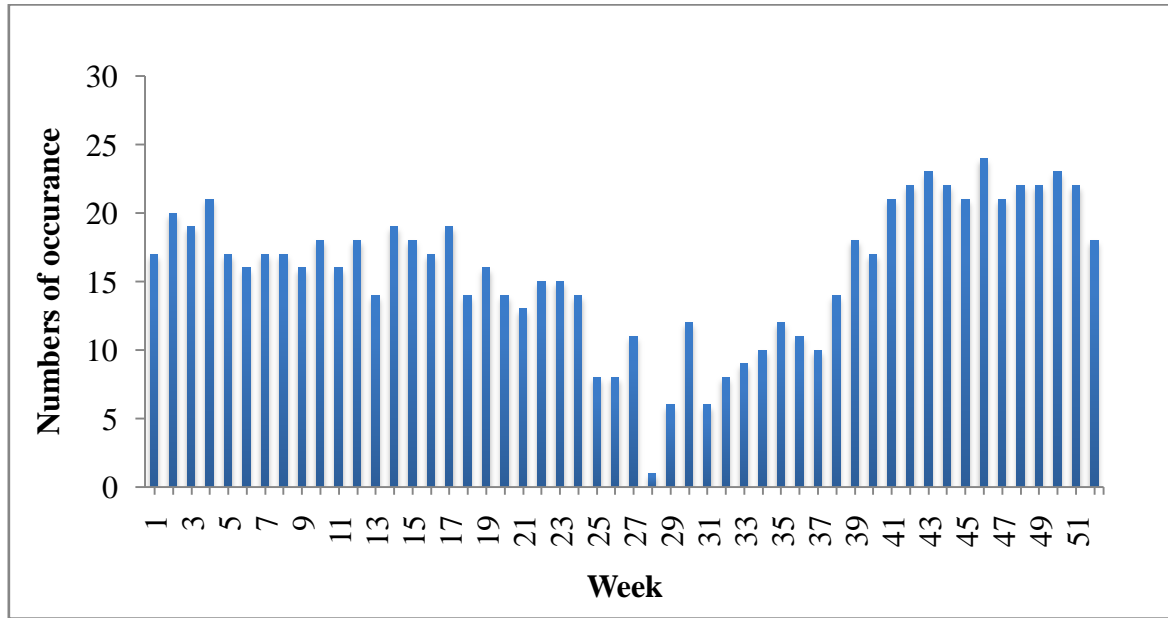


Fig 5: Weekly drought occurrence

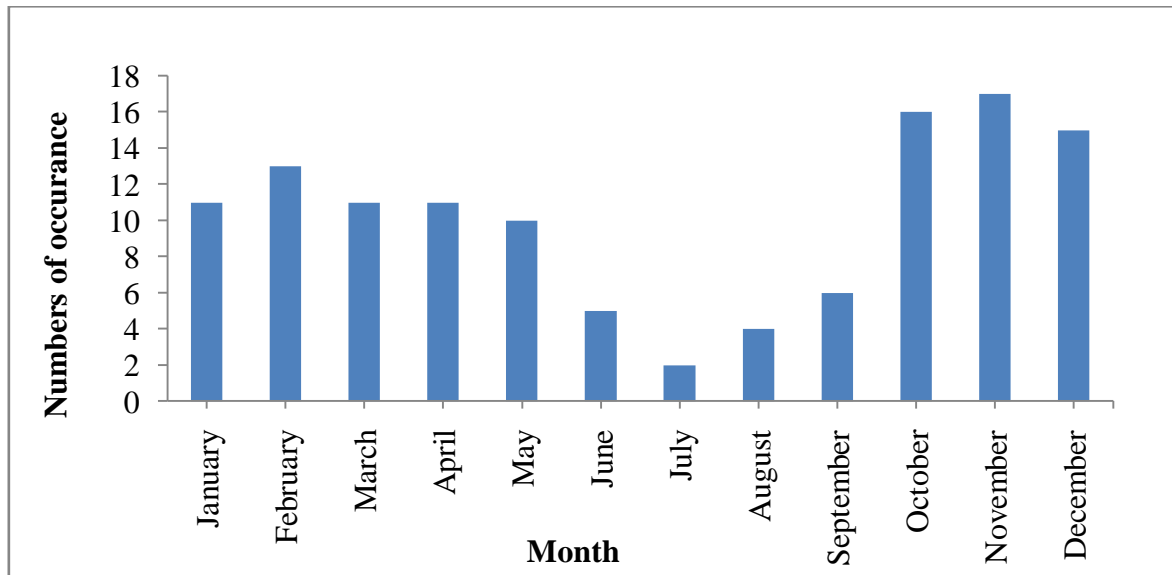


Fig 6: Monthly drought occurrence

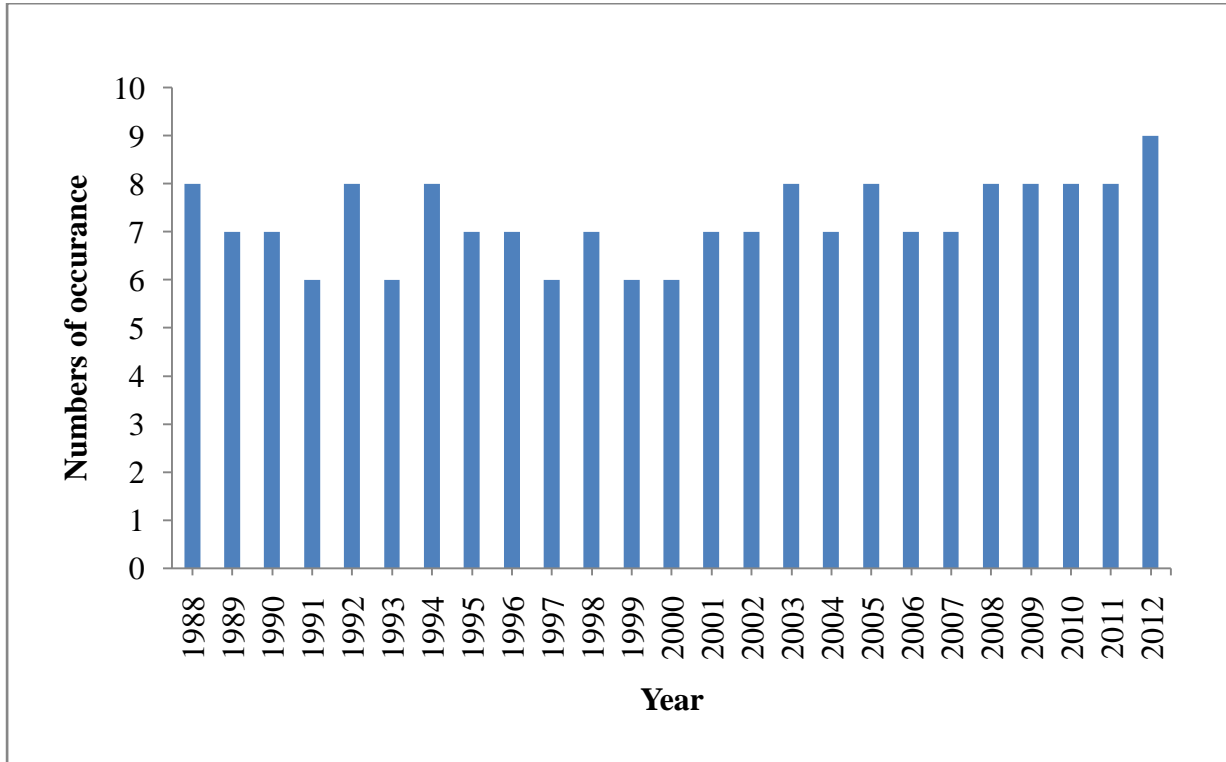


Fig 7: Distribution of drought months

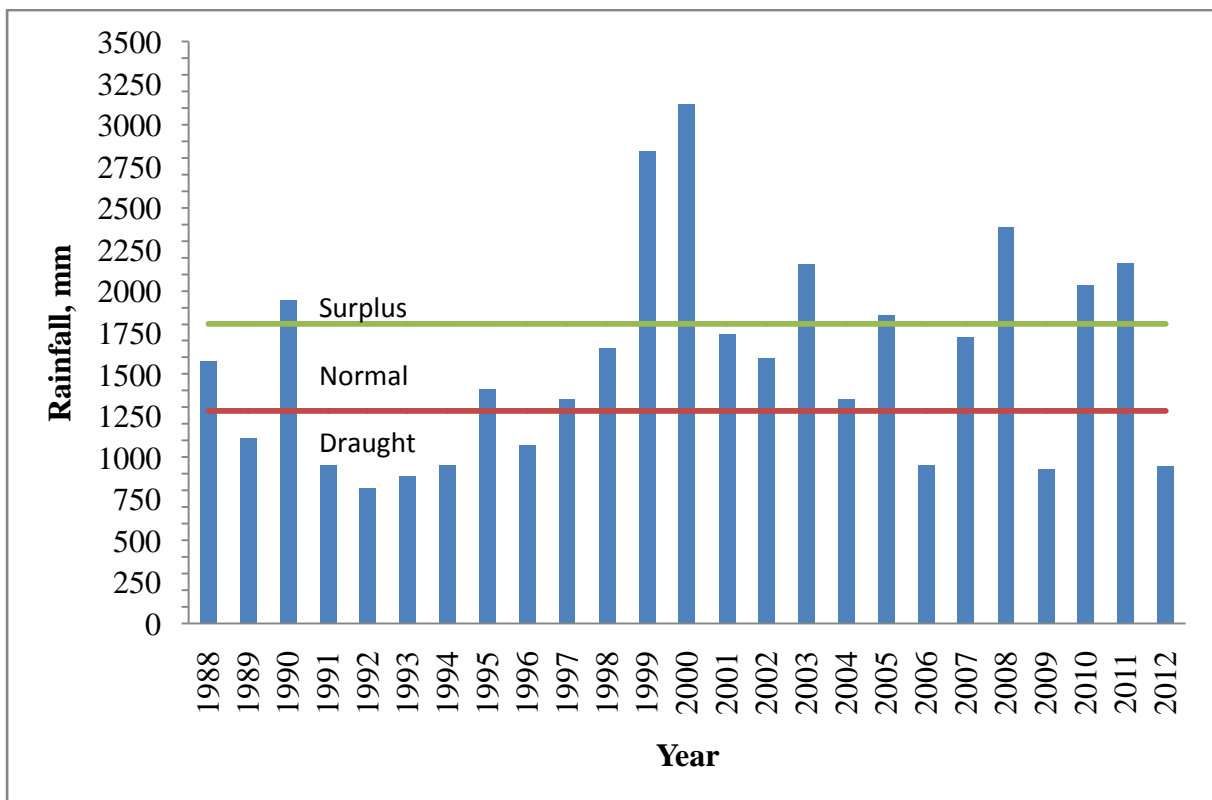


Fig 8: Annual rainfall distribution with drought classification

Table 1: Monthly distribution of number of drought, surplus and normal weeks.

Month	Values of rainfall (mm)			Total numbers of week		
	Drought week	Surplus week	Normal week	Drought	Surplus	Normal
January	14.31	57.24	14.31-57.24	11	6	8
February	14.20	56.80	14.2-56.80	13	3	9
March	7.76	31.08	7.76-31.08	11	5	9
April	12.08	48.32	12.08-48.32	11	3	11
May	29.23	116.94	29.23-116.94	10	4	11
June	95.07	380.28	95.07-380.28	5	3	17
July	246.03	984.14	246.03-984.14	2	0	23
August	209.66	838.66	209.66-838.66	4	1	20
September	135.69	542.78	135.69-542.78	6	3	16
October	16.51	33.02	16.51-33.02	16	5	4
November	2.60	5.20	2.6-5.20	17	7	1
December	6.59	13.18	6.59-13.18	15	6	4
Total				121	46	133

CONCLUSIONS

The weekly rainfall analysis indicated that the maximum amount of rainfall was observed to be 158.58 mm in the 33rd week followed by 106.76 mm in the 28th week. The minimum amount of rainfall was observed to be 0.86 mm in the 43rd week followed by 0.87 mm in the 47th week. The monthly rainfall analysis indicated that the average monthly rainfall was observed to be minimum (5.2 mm) during the month of November and maximum (492.10 mm) during the month of July. The average monthly rainfall was found to be 131.6 mm. In the seasonal, off seasonal and annual rainfall analysis it was observed that the total annual rainfall was irregular in nature with the minimum total of 930.8mm in 2009 and maximum total of 3123.4mm in 2000. The average annual rainfall was found to be 1579.52 mm.

The weekly rainfall analysis indicated that during the period of 25 years that the maximum occurrence of drought was observed (24 times) during 46th standard week (month of November) and the 28th standard week (month of July) was found to be least draught week, with draught occurrence only one time. Excess/ surplus amount of rainfall was available in the 1st and 39th standard weeks (January and September month) with 6 occurrence during the period of 25 years. The month of November was observed to be highest prone to drought with 17 occurrence and the month of July is least prone to draught with two occurrence. It is interesting to note that though the month of November is prone to draught, it is also prone to excess rainfall, 7 occurrence out of 25. The month of July was observed to have normal rainfall generally, 23 occurrences. It was also observed that maximum contribution (86.92%) to annual rainfall (1579.52 mm) comes from seasonal rainfall (1372.93 mm, observed during June – September).

References

- [1] Sharma, H.C., Chauhan, H.S. and Ram, S. 1979. Probability analysis of rainfall for crop planning. *Journal of Agricultural Engineering*, 16(3); 87-94.
- [2] Ramdas, L.A. 1960. Crop and weather in India, ICAR, p. 127, New Delhi.
- [3] Dhar, D.N., Rakheha, P.R. and Kulkarni, A.K. 1979. Rainfall study of severe drought years of India, *Drought*, (1):314, New Delhi.
- [4] National Commission on Agriculture. 1976. Report & Progress. Ministry of Agriculture & Irrigation, GOI. New Delhi. Part-1
- [5] National Commission Report. 1972. Ministry of Irrigation & Power, GOI. New Delhi Vol-1.