

Probability Study of Rainfall for Banaskantha District, North Gujarat Region

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ABSTRACT

The annual and monthly rainfall pattern of different stations of Banaskantha district were analysed. The year to year variability and variability in rainfall occurring during monsoon season alongwith other statistical parameters were worked out. Using simple probability percentage, the weekly probability of getting different amounts of rainfall for Deesa were computed for monsoon period. Moreover, the dryspells of different duration were also worked out and presented in this paper.

The study reveals that the sowing rains with more than 50% probability were available only in the first week of July whereas the onset of monsoon is in last week of June. Probability of getting 35 mm or more rain after 37th standard week was found to be zero in Deesa station of the district. (Received on 29th Nov. 1983)

INTRODUCTION

The climate of Banaskantha district in North-West Gujarat region forms the semi-arid to arid with insecure rainfall ranging from 392 to 901 mm. The climate of the district may be characterised by scanty and erratic rainfall. Most of the annual rainfall in the district occurs from the last week of June to mid September received from the South-West monsoon currents. The main cropping pattern in the district consists of cotton, *bajri*, *kharif* sorghum, *kharif* pulses like *tur*, *mung* and kidney bean (July to October). In *rabi* season wheat, groundnut, sesamum, isabgul, vegetables and potato are grown only in places where there are irrigation facilities. The soils are light and porous.

The agriculture of the district is a gamble on monsoon. Apart from scanty and uncertainty, the rainfall in the district is subject to considerable year to year fluctuations. For better understanding of climatic patterns, and crop planning, a detailed rainfall study is needed. Hence, a detailed analysis of rainfall data for the recent past 22 years (1959-80) of Deesa has been carried out in order to determine the agricultural potential of the district.

MATERIALS AND METHODS

The Banaskantha district situated geographically between 23°35' N-24°45' N latitude and 71°E-73° E longitude. It is the third biggest district in the state. The annual rainfall data of 11 rainfall stations representing 14 taluka

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places of the district for the period 1965 to 1979 were utilized in this study. Annual average rainfall and coefficient of variability were calculated. Using 22 years (1959-80) daily rainfall data for Deesa station onset and withdrawal of monsoon rains, yearly, monthly and weekly variability/distribution of rainfall, probability of different amounts of rainfall for the monsoon periods and occurrence of different durations of dry-spells were calculated and discussed. Occurrence of sowing rains (Raman, 1974) was also determined.

RESULTS AND DISCUSSION

Rainfall pattern in Banaskantha district :

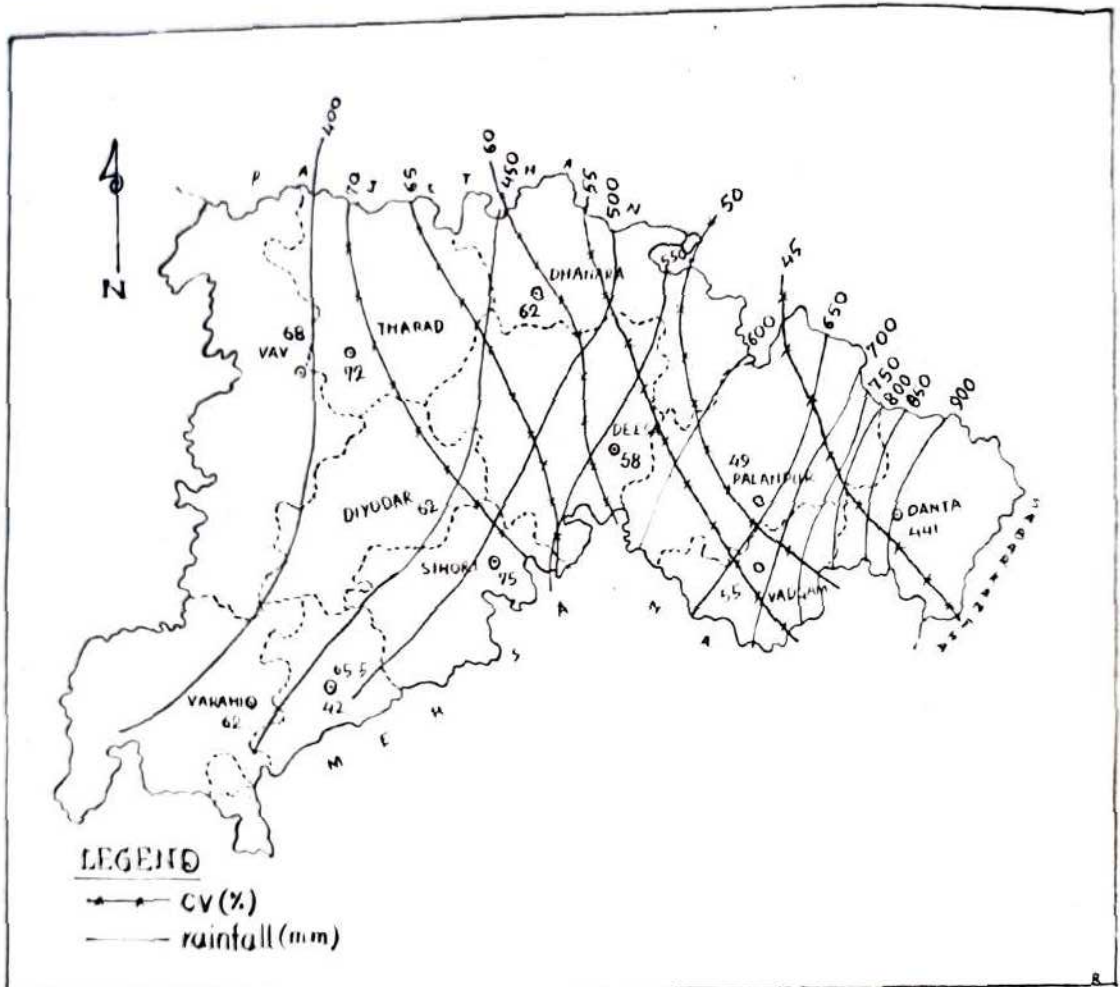
The mean annual rainfall of the district is 540 mm with the annual vari-

ability of 56 per cent (Table-1). Of the talukas, Danta taluka situated in the

TABLE 1

Talukawise average annual rainfall of Banaskantha district (1965 to 1979).

Name of taluka	Annual average rainfall (mm)	S.D. (mm)	C.V. %
1. Danta	901.1	397.3	44.1
2. Vadgam	672.8	369.4	54.9
3. Palanpur	645.1	317.6	49.2
4. Deesa	569.6	332.8	58.4
5. Dhanera	458.6	282.9	61.7
6. Tharad	416.7	301.8	72.4
7. Vav	392.2	267.5	68.2
8. Diyodar	440.4	274.8	62.4
9. Kankrej	527.4	396.5	75.2
10. Radhanpur	473.5	310.2	65.5
11. Varahi	440.2	274.8	62.4
Average	539.8	300.8	55.7



eastern part of the district, recorded the highest annual rainfall (901 mm) and Vav in the north-western part of district the lowest (392 mm). Deesa, in the middle of the district recorded 570 mm of annual rainfall (Fig. 1). The annual rainfall of the Deesa station ranged from 113.6 mm in 1974 to 1457.7 mm in 1975 in the last 22 years (Table 7).

Onset and withdrawal of monsoon rains in Deesa :

It is generally believed that the onset of South-West monsoon means arrival of sowing rains. Many a time due to insufficient rains at the beginning, the sowing is delayed. The simple probability of commencement and withdrawal of monsoon rains for Deesa has been

TABLE 2

Onset and withdrawal of monsoon at Deesa.

Onset of monsoon		Withdrawal of monsoon	
Period	% Probability	Period	% Probability
Before May	4	Before 31st Aug.	9
1-10 June	32	1-10 September	23
11-20 June	14	11-20 September	23
21-30 June	41	21-30 September	32
Beyond June	9	Beyond Sept.	13

calculated. The maximum probability of getting monsoon rains is 41% during 21st-30th June and the withdrawal of the monsoon occurs in the month of

September with maximum probability of 32% from 21st-30th September (Table 2).

Yearly and monthly rainfall distribution in Deesa :

The maximum and minimum monsoon rainfall amounts vary from 81.6 mm in 1974 to 1414.7 mm in 1977 and the rainy days from 9 in 1968 to 48 in 1959 (Table 3). The ratio of highest to lowest rainfall is 11 : 1.

TABLE 4

Monthly rainfall and rainy days distribution for Deesa Station.

Months	Amount (mm)	Days	% distribution of rainfall
January	3.2	0.3	0.5
February	1.4	0.1	0.2
March	5.6	0.1	0.9
April	0.0	0.0	0.0
May	1.8	0.2	0.3
June	62.2	3.2	10.0
July	231.5	9.1	37.3
August	179.4	8.0	28.9
September	107.8	4.0	17.4
October	11.3	0.6	1.8
November	14.5	0.7	2.3
December	1.5	0.1	0.3
	620.2	26.4	

The annual rainfall, rainy days, monsoon rainfall and per cent distribution of rainfall are computed for Deesa and presented in the table 4. The mean annual rainfall for the station is 620 mm received in 26 rainy days (more than 2.5 mm/day). The coefficient of

TABLE 3

Details comparison of extremes of rainfall with normal.

Rainfall	Normal	S.D.	C.V.	Extremes of annual rainfall					
				Highest			Lowest		
				Amount (mm)	Year	% of Normal	Amount (mm)	Year	% of Normal
Amount (mm)	620	334	54	1414.7	1977	228	81.6	1974	130
Rainy days	26	11	41	48	1959	185	9	1968	35

variation is 54 per cent. The data indicated that among rainy months, July recorded the highest amount of rainfall (231.5 mm) in 9 rainy days followed by August (179.4 mm). April is completely the rainless month. However, agriculturally significant rains at 50% level of probability commence in the beginning of July and withdraw in early September (Biswas and Basarkar, 1978).

Rainfall distribution of monsoonal weeks :

Weekly rainfall data are more useful than monthly, seasonal and annual rainfall for various cropping operations like seeding, interculturing and growth studies of different crops. Hence, the thorough study of weekly rainfall of Deesa station has been made. As most of the rains are received from June to September i.e. 22nd to 42nd meteorological week in the district, the extensive study has been limited to these periods only.

The data of table 5 indicate that the mean rainfall exceeded 50.0 mm in standard weeks 27, 28, 31, 35 and 36 whereas it exceeded 35 mm in standard weeks 27, 28, 29, 30, 31, 33, 35, 36 and 37. The period in which the weekly mean rainfall is 7 mm or more covers the period from 25th to 37th standard weeks (18 June to 16 September) indicating the normal period for growing of dryland crops. The total number of weeks containing an average rainfall of 21 mm or above (@ 3 mm/day) for the station is 13 weeks from 25th to 37th weeks. Biswas (1980) observed that a crop of 14-16 weeks duration can be raised in rainfed condition. The highest mean weekly rainfall of 64.0 mm is observed in case of 27th week (2-8 July).

The coefficient of variation is an indirect measure of occurrence of depen-

dable rainfall. In general, it is accepted that weeks with the value of C.V. upto 150 per cent are dependable and the same with 100 per cent or less are highly

TABLE 5

Weekly mean rainfall, S.D. and C.V. for Deesa station.

Meteorological week with No., and Month	Average rainfall	S.D. (mm)	C.V. (%)
22 May	2.4	5.0	212
23 June	3.1	7.8	251
24	6.4	17.3	272
25	21.6	28.0	130
26	27.4	63.2	231
27 July	64.0	58.9	92
28	56.6	77.2	136
29	36.8	37.6	102
30	48.5	97.6	201
31	52.8	55.6	105
32 August	28.6	41.1	144
33	44.5	53.6	120
34	32.6	56.0	172
35	54.2	80.1	148
36 September	49.9	63.5	127
37	38.5	101.8	264
38	4.0	8.4	210
39	6.1	10.8	176
40 October	2.6	6.8	262
41	1.6	5.4	335
42	1.9	5.3	278

dependable. According to the estimate, the standard weeks 26, 30, 34 and 38 cannot be depended for rains while during standard weeks 25, 27, 28, 29, 31, 32, 33 and 35 rains can be expected. Adequate and assured rainfall during the 27 to 29th week enhance the prospects of germination and establishment of *kharif* crops in dryland area if land preparation and sowing of seeds are done in the 26th/27th standard week.

Probability of getting different amounts of rainfall :

Table 6 gives an account of per cent probability of getting different amounts of rainfall. Rains more than 50 mm and

TABLE 6

Per cent chance of getting different amount of rainfall for Deesa.

Meteorological week No. & date	Any rain	7 mm	14 mm	21 mm	28 mm	35 mm	More than 50 mm	More than average	No rain
22 May —28-3	32	18	5	5	0	0	0	23	68
23 June —4-10	23	14	9	5	5	0	0	18	77
24 —11-17	32	18	14	9	9	5	5	18	68
25 —18-24	55	50	50	36	36	18	18	36	46
26 —25-1	68	36	32	32	23	14	14	23	32
27 July —2-8	91	77	77	73	68	64	50	41	9
28 —9-15	82	68	68	50	45	41	32	41	18
29 —16-22	77	68	68	50	45	41	32	41	23
30 —23-29	77	59	50	45	45	36	23	23	23
31 —30-5	91	64	64	55	50	45	41	41	9
32 Aug. —6-12	95	73	36	27	27	23	18	27	2
33 —13-19	77	64	50	41	41	41	32	32	23
34 —20-26	73	55	41	32	32	27	23	27	27
35 —27-2	68	64	59	55	41	41	27	23	32
36 Sep. —3-5	64	59	55	55	55	50	45	45	36
37 —10-16	50	41	32	27	23	18	14	18	50
38 —17-23	36	14	9	9	5	0	0	23	64
39 —24-30	32	27	23	14	9	0	0	27	68
40 Oct. —1-7	14	14	14	5	0	0	0	14	86
41 —8-14	9	9	9	5	0	0	0	9	91
42 —15-21	23	5	5	5	0	0	0	23	77
43 —22-28	14	9	9	9	9	5	5	9	86

more than average rainfall can be considered as the assured rainfall for the station. At 25 per cent level of probability the period of receiving more than 50 mm of rainfall ranged from 27th week (2-8, July) to 36th week (3-9, Sept.). However, the period for getting 14 mm of rain extended upto 39th week (24-30 Sept.).

Analysis of dryspells :

Considering the local environment and soil, a consecutive period of 2 weeks with rainfall less than 15 mm as a dry spell, (Raman, 1974) the analysis of

dryspells for 2 weeks, 3 weeks and more than 3 week periods were worked out. (Table 7). It has been observed that 64% of the years had at least one dryspell, in 14% of the years occurred two dryspells and 22% of the years did not encounter any dry spells in a season. Out of 22 years it was observed for Deesa that 50% of the years experienced 2 weeks dryspell, 33% of the years experienced 3 weeks dryspells, whereas in 9% of the years, more than 3 weeks dryspells. The occurrence of dryspell during 32-34th week was found to be common in the area.

TABLE 7

Analysis of dry spells in weeks for 22 years (1959-1980) for Deesa.

Year	No. of dryspells	Length of dryspells in meteorological weeks			Total rainfall	Remarks
		2 weeks	3 weeks	more than 3 weeks		
1959	2	32-33	23-25	—	1036.3	
1960	No spell	—	—	—	302.9	The rain had occurred for a short period 25th to 32nd weeks
1961	No spell	—	—	—	969.7	
1962	1	30-31	—	—	271.7	The rain ceased from 34th week.
1963	1	—	28-30	—	538.3	—
1964	1	25-26	—	—	455.3	The rain was ceased from 36th week.
1965	1	32-33	—	—	397.5	The rain ceased from 36th week.
1966	2	—	26-28	32-35	489.5	—
1967	No spell	—	—	—	868.7	—
1968	1	29-30	—	—	346.2	The rain ceased from 32nd week.
1969	1	30-31	—	—	261.2	The rain ceased with after 33rd week.
1970	1	—	28-30	—	971.6	—
1971	1	—	32-34	—	376.9	—
1972	1	—	—	29-32	366.4	The rain ceased after 34th week.
1973	1	25-26	—	—	939.3	—
1974	1	29-30	—	—	113.6	The rain ceased after 31st week.
1975	2	26-27 & 30-31	—	—	1099.5	—
1976	No spell	—	—	—	658.1	—
1977	1	33-34	—	—	1457.7	—
1978	No spell	—	—	—	702.9	Rain ceased after 35th week.
1979	1	—	26-28	—	516.4	Rain ceased after 33rd week.
1980	1	—	28-30	—	505.3	Rain ceased after 31st week.

Conclusion :

The rainfall areas vary from the lowest in the North-Western part to the highest in the Eastern part of the district. It was also found that the early cessation of monsoon was very common in the locality. To overcome water stress during the initial stages of rainfed crops the sowing operations can be started from 26th week. On the basis of the rainfall pattern the potential crop season is from the beginning of July to end of September. Intra-seasonal problems due to break of rainfall is of less significance as compared to the onset of

sowing rains and withdrawal of rains in the district.

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