Journal of Agrometeorology 2 (2) : 140-146 (December 2000)

Studies on rainfall pattern and groundnut productivity in Junagadh region

D. D. SAHU, B. M. PATOLIYA AND K. B. ASODARIA

Department of Agronomy, Gujarat Agricultural University, Junagadh - 362 001

ABSTRACT

The analysis of rainfall data for 32 years (1968-1999) of Junagadh, the main research station of South Saurashtra Agroclimatic Zone revealed that the normal monsoon rainfall is 834mm with 58% variability received in 33 rainy days with 29% variability. The monthly and weekly intra-monsoon variability ranged from 15.5 to 137.3 percent and 99.7 to 247.1 percent respectively. The frequency of mild (< 2.5 mm day^{-1}) and moderate (10-30 mm day^{-1}) rainy days were more but more amount of rains were received in a few number of very heavy (> 60 mm day^{-1}) rainy days. In drought years the total rainfall has significant effect on yield, whereas in wet years only weekly rainfall variation and rainy days have shown significant effect on yield of groundnut.

Key words : Rainfall variability, Probability, Rainy days, Groundnut.

Rainfall pattern is a location specific phenomenon. Amount, distribution, frequency and intensity are some of the important aspects of rainfall that have remarkable influence on crop growth and production in *kharif* season. In Saurashtra region of Gujarat, rainfall is scanty and erratic. More than 95% of annual rain occur during four months from June to September (Anon, 1997). Junagadh (21°31' N, 70°30' E, 61m above mean sea level), which is located at the foothills of Mount Girnar and in the middle of the South Saurashtra Agroclimatic Zone, has a typical climatic type of tropical semi-arid with high rainfall and high variability. In this paper, the rainfall data for 32 years (1968-99) of Junagadh was analyzed critically to reveal the rainfall pattern of the region where groundnut is predominantly grown in the monsoon season. The effect of rainfall on the groundnut productivity of the district is also analyzed and discussed.

MATERIALS AND METHODS

Daily rainfall data from June to September of recent past 32 years (1968-99) recorded at the Agrometeorological observatory of Gujarat Agricultural University, Junagadh Campus was used in the study. The variability, fluctuation and probability of rainfall on weekly, monthly

and annual (monsoon period only) basis were studied with the help of standard statistical parameters. The probability of rainfall was worked out using the method of cumulative distribution analysis (Thom, 1966). The daily rainfall amounts were grouped into different classes on the basis of intensity as mild (<2.5mm per day), light (5-10mm), moderate (10-30mm), heavy (30-60mm) and very heavy (> 60mm) to study their frequency of occurrence and amount of rainfall received in them.

The rainfall situation in each year was indexed by expressing the rainfall in terms of percentage departure from its mean, known as Monsoon Rainfall Index (MRI) and was calculated by using formula

$$MRI = [(Ri - Rm) / Rm] \times 100$$

Where,

Ri is the rainfall of the year (June to September)

Rm is the mean for 32 years.

A year is classified as wet or dry, when it is above (Rm + 1/2 SD) and below (Rm - SD) respectively, where Rm is the mean rainfall and SD is the standard deviation of the period. Accordingly, eight drought years (1969, 1972, 1974, 1985, 1987, 1991, 1993, and 1999) and five wet years (1979, 1980, 1983, 1988 and 1994) were identified.

RESULTS AND DISCUSSION

The statistics of monthly, weekly monsoon rainfall and rainy days along with monsoon rainfall index (MRI), total rainfall of monsoon period and the corresponding groundnut yield data are presented in Table 1.

The results indicate that the monsoon rainfall (June to September) in Junagadh region was highly variable ranging from 139 mm in 1987 to 2778 mm in 1983. The mean monsoon rainfall is 834 mm with a large standard deviation of 484 mm and high variability of 58 percent. This amount is received in 33 rainy days with a standard deviation of 10 days and variability of 29 percent.

The MRI ranged from -83.3 in 1987, the driest year to 233.1 in 1983, the wettest year of the region.

The variation of coefficient of variation on monthly basis (Table 1) ranged from 15.5 in 1975 to 137.3 % in 1988 and 1991, where as the coefficient of variation on weekly basis (Table 1) ranged from 101 in 1977 to 286 % in 1972. The corresponding yield data in these years, 1428 and 575, 1231 and 262 kg ha^{-1} clearly indicate that rainfall variability has great influence on the yield of groundnut. The years with more than 200 % weekly variability as well as low rainfall (< 600 mm) invariably recorded low yield of groundnut in the region.

The yield pattern has closely followed the total monsoon rainfall pattern in the region (Fig 3). The correlation coefficients between the yield and the other rainfall features (total rainfall, CVM %, CVW %, MRI and total rainy days) calculated for each categories of years and for the whole period are shown in Table 2. It is interesting to find that all the rainfall features except the monthly variability significantly influenced the yield of

Table 1: Statistics of monsoon rainfall, rainy days and yield of groundnut in Junagadh region

Year	Monthly rainfall		Weekly rainfall		Rainy days			Total rainfall (mm)	MRI	Yield (kg ha^{-1})
	SD mm	CV %	SD mm	CV %	Total	SD	CV %			
1	2	3	4	5	6	7	8	9	10	11
1968	143.2	81.7	82	200	26	3.7	56.8	701	-16.0	887
1969	197.7	133.8	72	208	24	5.6	9.3.3	591	-29.1	838
1970	218.2	90.2	67	118	42	7.4	0.6	968	16.1	1319
1971	46.2	18.5	100	175	30	2.9	38.5	997	19.5	1464
1972	90.8	124.8	49	286	15	4.3	116.0	291	-65.1	262
1973	192.9	84.9	77	151	41	3.3	32.2	909	9.0	1220
1974	39.6	40.1	38	166	20	1.4	28.3	394	-52.8	427
1975	24.2	15.5	36	100	44	2.2	19.6	625	-25.1	1428
1976	151.5	73.7	51	111	44	4.6	41.3	822	-1.4	1355
1977	131.7	63.1	46	101	45	6.5	58.2	835	0.1	1231
1978	58.2	34.6	58	147	32	2.9	36.8	672	-19.4	1466
1979	333.7	103.6	141	186	32	5.0	62.1	1288	54.4	941
1980	425.1	102.0	164	167	38	4.0	42.5	1668	100.0	1257
1981	283.6	114.4	114	195	32	4.2	53.0	992	18.9	1048
1982	172.5	104.9	52	135	33	8.3	100.1	658	-21.1	691
1983	526.7	75.8	333	204	50	4.5	36.1	2778	233.1	784
1984	101.0	39.2	83	137	33	6.0	73.0	1032	23.7	1152
1985	74.8	93.8	25	135	35	7.7	87.7	319	-61.7	330
1986	241.6	129.7	98	240	24	4.2	70.7	745	-10.7	1411
1987	21.0	60.4	11	139	11	1.0	34.8	139	-83.3	132
1988	477.5	137.3	120	147	51	9.9	77.5	1391	66.8	1763
1989	129.2	66.6	61	135	36	5.3	59.5	776	-7.0	1314
1990	206.6	124.3	97	247	32	5.0	62.1	665	-20.3	943
1991	174.4	137.3	47	157	30	5.2	69.3	508	-39.1	575
1992	134.8	64.9	62	127	31	4.0	52.0	831	-0.4	1163
1993	72.8	79.6	39	180	19	4.0	83.1	366	-56.1	442
1994	300.8	109.3	85	122	48	6.7	55.7	1188	42.4	1594
1995	272.0	134.0	96	206	36	6.7	74.3	812	-2.6	920
1996	165.4	92.1	65	155	30	6.0	79.6	718	-13.9	1758
1997	74.6	36.7	55	120	35	1.3	14.4	813	-2.52	1858
1998	150.3	72.0	76	156	35	4.0	45.1	835	0.1	1990
1999	90.0	99.4	44	206	26	5.3	80.9	362	-56.6	——

Table 2 : Correlation coefficients between rainfall parameters and groundnut productivity

Rainfall parameters	For whole period	Normal years	Drought years	Wet years
Total rainfall (mm)	0.600*	0.236	0.897*	0.154
Monthly variability %	-0.273	-0.516	-0.474	0.149
Weekly variability %	-0.432*	-0.316	-0.555	-0.529
MRI	0.601*	0.239	0.897*	0.156
Rainy days	0.613*	0.038	0.712	0.778*

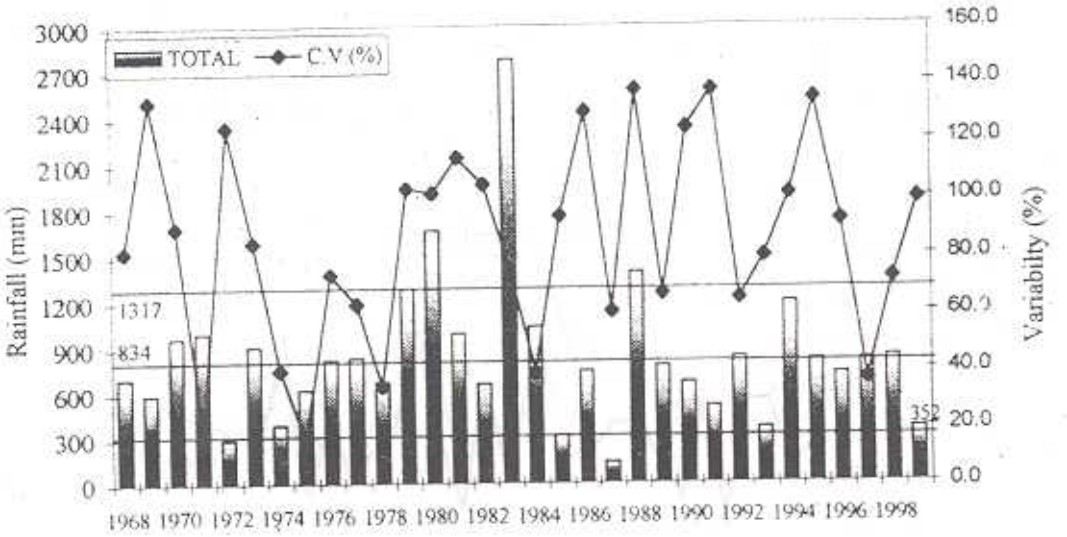

Fig.1 : Monsoon rainfall and intramonsoonal variablity of rainfall at Junagadh

Table 3 : Statistics and probability of weekly rainfall in Junagadh region

Month	Week No.	Mean	SD (mm)	CV %	Probability %		
					50	40	30
June	23	16.7	32.2	192.9	0.1	0.5	7.5
	24	34.4	55.1	160.3	3.1	14.0	37.8
	25	91.6	251.6	274.7	12.7	21.8	57.8
	26	62.5	125.3	200.6	12.5	22.0	38.8
July	27	67.8	95.9	141.4	32.0	58.2	77.6
	28	85.7	111.4	129.9	39.5	55.8	97.4
	29	104.5	121.2	116.1	73.4	114.5	137.6
	30	55.7	74.2	133.3	30.0	51.9	78.2
	31	56.1	78.9	140.6	22.0	42.8	70.5
August	32	57.5	94.7	164.8	19.3	31.8	41.9
	33	39.9	75.1	188.1	19.0	28.9	33.0
	34	20.6	29.1	141.5	12.0	20.8	24.0
	35	41.8	72.6	173.5	15.2	22.1	32.5
September	36	29.8	41.2	138.3	10.9	20.9	37.2
	37	23.7	48.6	205.3	3.0	10.0	14.5
	38	20.2	42.4	209.8	4.6	10.5	17.0
	39	18.4	20.1	109.0	14.4	21.2	27.4
Season		826.0	483.1	58.5	323.6	547.7	830.7

groundnut when long period rainfall was considered. In drought years the total rainfall has significant effect on yield, whereas in wet years only weekly rainfall variation and rainy days have significant effect on yield of groundnut.

The statistics and probabilities of weekly rainfall in Junagadh region are presented in Table 3. The results indicate that the mean rainfall appeared to be sufficient to meet the requirement of the crop but the variability and standard deviation values for the weeks in the rainy season are too high to be depended on the total amount of rainfall. The probability of getting the average weekly or seasonal rainfall, which can be considered safe for crop growth, is quite low (30%). With rainfall received at 40 percent probability, it is risky to raise the crop and with rainfall at 50 percent the growth of a crop is impossible without life saving irrigation.

The intensity of rainy days indicate the distribution of rainfall. The frequency of occurrence of rainfall intensity classes in different months were obtained and depicted in Fig. 4(a,b). The results indicate that the frequency of mild, light, moderate, heavy and very heavy rainy days are the highest in the month of July whereas the frequency of scanty rainy days are the highest in the month of August in the region. The amount of rainfall received through mild and scanty rainy days is highest in the month of August whereas it is highest through light, moderate, heavy and very heavy rain days in the month of July.

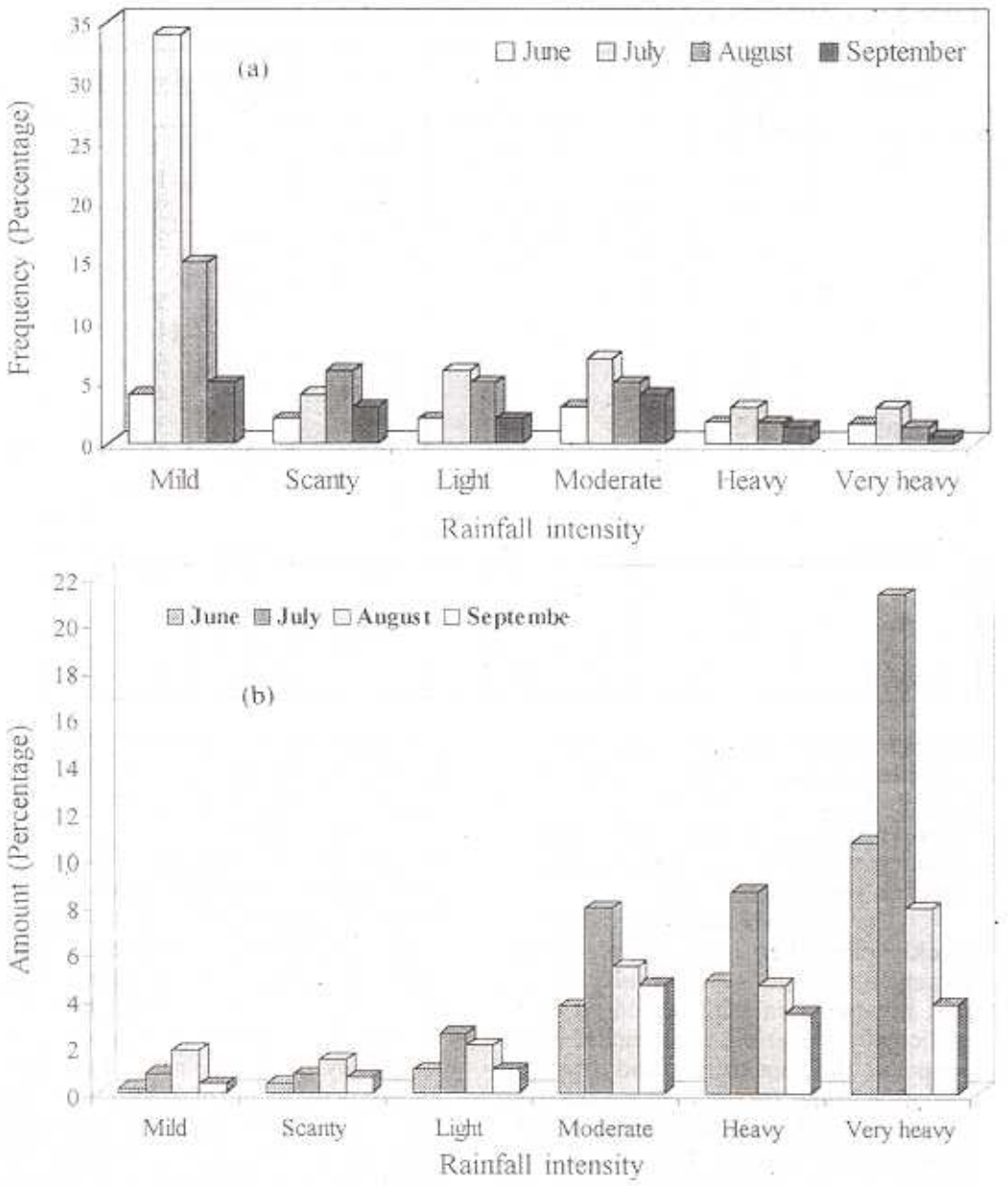

Fig.4 : Frequency of (a) rainy days and (b) rainfall amounts during monsoon months under different rainfall intensities.

REFERENCES

Anonymous, 1997. Agroclimatic Atlas of Gujarat. Department of Agricultural Meteorology, B. A. College of Agriculture, GAU, Anand.

Thom, H.C.S. 1966. Some methods of climatological Analysis. WMO Tech. Note No. 81. 53pp.