Study on the rainfall climatology of Regional Research Station, Paiyur for crop planning

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Abstract : Regional Research Station, Paiyur is located in Krishnagiri taluk of Dharmapuri District and more than 80 per cent of the area is under dryland farming. The daily rainfall data for 28 years were analysed for its variability and probability. The mean annual rainfall was 918 mm with 32 per cent variability. The contribution from Winter, Summer, Southwest monsoon, Northeast monsoon periods to total rainfall was 1.3, 14.6, 49.8 and 34.3 per cent. Rains during May, July, August, September and October are more dependable. Each standard week from 29th to 46th receive a rainfall of more than 20 mm, indicating the crop growing period from July third week to November 2nd week

Keywords: Rainfall, Probability, Variability, Annual, Seasonal, Weekly, MAI.

Introduction

Rainfall pattern largely decides the cropping in dry farming tracts. Amount, distribution and intensity of rainfall mainly determine the choice of any particular crop and agronomic practices. Scientific study on the quantum and distribution of rainfall if made would enable the farming community to adjust or modify the cropping programme as well as the cultural operations to utilize the actual moisture available in the field for profitable crop production. Hence a study was undertaken at RRS, Paiyur to understand the rainfall climatology for crop planning purpose. Paiyur representing NorthWesten agroclimatic zone of TamilNadu was taken for the study.

Materials and Methods

Daily rainfall data for 28 years (1973 to 2000) from RRS. Paiyur which is located $12^0 21'$ N latitude. $78^0 18'$ E longitude with an altitude of 490 metre (MSL) were used for analysis of probability and variability. The data were aggregated to weekly, seasonal, and annual totals. Consequently the mean values were arrived at accordingly. The mean rainfall, standard deviation and coefficient of variation for annual, seasonal and weekly periods were worked out as reported by Kulandaivelu *et al.* (1979 and 1980) and Budhar and Ramasamy (1985). The annual rainfall received was classified based on the IMD specifications as Normal (particular year that received + or - 19 per cent of mean annual rainfall). Excess (year that received more than 19 per cent of mean annual rainfall) and Deficit (year that received less than 19 per cent of the mean annual rainfall). Initial probability for annual, seasonal, monthly and weekly periods were worked out by using the formula

$$IP = np/100$$

Where

n = No.of years of rainfall data

p = probability level required (50 per cent)

Conditional probability for weekly periods were analysed using the formula

$$CP = \overline{X} - X/SD$$

Where

$\overline{X}$ = mean rainfall of the particular week (mm)

X = anticipated rainfall for carrying out agricultural operations(mm).

SD = standard deviation of the week

Moisture availability index for monthly and weekly periods were analysed by the formula suggested by Hargreaves (1974).

Moisture availability index (MAI) = PD / PET

Where

PD = dependable monthly or weekly rainfall (mm)

PET = potential evapotranspiration of the particular month / week.

PD = np/ 100

Where

n = number of years taken for analysis

p = probability percentage eg. 50%

Table 1. Annual rainfall analysis and classification at Regional Research Station, Paiyur (1973 to 2000)

Sl.No.	Year	Annual rainfall (mm)	Classification
1	1973	734	Deficient
2	1974	770	Normal
3	1975	519	Deficient
4	1976	798	Normal
5	1977	986	Normal
6	1978	866	Normal
7	1979	1624	Excess
8	1980	727	Deficient
9	1981	1502	Excess
10	1982	515	Deficient
11	1983	948	Normal
12	1984	874	Normal
13	1985	682	Deficient
14	1986	864	Normal
15	1987	895	Normal
16	1988	778	Normal
17	1989	710	Deficient
18	1990	635	Deficient
19	1991	1324	Excess
20	1992	676	Deficient
21	1993	1204	Excess
22	1994	712	Deficient
23	1995	1204	Excess
24	1996	1370	Excess
25	1997	1231	Excess
26	1998	920	Normal
27	1999	718	Deficient
28	2000	1046	Normal

Annual mean rainfall = 918 mm
Annual standard deviation = 294
Annual coefficient variation = 32

Initial probability
100 % probability rainfall = 515 mm
75 % probability rainfall = 712 mm
50 % probability rainfall = 864 mm
30% probability rainfall = 948 mm
25 % probability rainfall = 1204 mm

Table 2. Seasonal rainfall analysis at Regional Research Station, Paiyur (1973-2000)

Season	Mean	CV%	50% Probability	% of rain to annual
Winter	12	283	0	1.3
Summer	134	52	118	14.6
SWM	457	41	451	49.8
NEM	315	54	285	34.3

Results and Discussion

Annual rainfall

The data on mean annual rainfall, coefficient of variation, probability and its classification are given in the Table 1. The mean annual rainfall was 918 mm with coefficient variation of 32 per cent. A rainfall amount of 515 mm would be expected with 100 % probability while 712 mm, 864 mm, 948 mm and 1204 mm of rainfall would be expected with 75 %, 50 %, 30 % and 25 % probability respectively. Out of 28 years of study, the rainfall was normal for 11 years and for another 10 years it was deficit and for the remaining seven years it was excess.

Seasonal rainfall

The data on mean, coefficient of variation, 50 per cent probability rain and percentage contribution of seasonal rainfall are presented in Table 2. Highest amount of 457 mm of rainfall was received in Southwest monsoon contributing to 49.8 per cent to total annual rainfall with coefficient of variation of 41 % indicating its dependability. For Northeast monsoon season, the rainfall received was 315 mm and thus contributing only 34.3. % to the total with coefficient of variation of 54 per cent. Summer rainfall also contributed substantially (134 mm), 14.6 per cent of the total with 52 per cent coefficient of variation, In winter, the rainfall was scanty with greater variation. Fifty per cent probability rainfall of 451 mm for southwest monsoon was very close to actual mean of 457mm indicating the dominance of Southwest monsoon season in this particular area. Similarly 50 per cent probability for summer (118 mm) and northeast monsoon (285 mm) were close to their respective mean seasonal rainfall.

Weekly rainfall

The weekly rainfall analysis was done for mean, CV %, MAI, 50 % probability and conditional probability of rainfall and the relevant data are presented in Table 3. Each standard week from 29 to 46 received rainfall more than 20 mm except 31st and 32nd standard weeks. It indicated that from July 3rd week onwards the crop season starts and extends upto November 2nd week. The highest mean rainfall of 58.4 mm was recorded in 40th standard week (Oct 1-7).The coefficient of variation analysis revealed that the dependability of rainfall is very high for the standard weeks from 33rd to 43rd which had the values less than 150 per cent.

Moisture availability Index (Table 3) is an yet another important criteria for fixing the crop growing period of particular zone. According to Hargreaves (1975) the following moisture deficit classifications suitable for application to all type of climates. 0.00 to 0.33 very deficit; 0.34 to 0.67 moderately deficit; 0.68 to 1.00 somewhat deficit; 1.00 to 1.33 adequate moisture; >1.34 excessive moisture. An adequate moisture availability index of 1.01 to 1.33 was observed for the standard weeks of 38, 39 and 40 (from 17th September to October 7th) and 44th standard week (29th October to 4th November). In this period, the crop growth does not suffer for want of moisture. Moisture deficit value of 0.68 to 1.00 was recorded in the standard weeks of 36, 37 (3rd September to 16th September) 42 and 43 (15th October to 28th October) and standard week 45(November 5th to 11th). In these weeks by adopting the agronomic management practices one could manage the moisture deficit situation. The rest of the periods especially the first half of the year i.e. from January to June even upto July the moisture availability is very deficit to moderately deficit where the annual crops could not be grown successfully and the perennial crops certainly require supplemental irrigation.

Fifty per cent probability of receiving rainfall was as high as 54.7mm in 39th standard week followed by 38th and 40th standards weeks with 41.3 and 41.7 mm of rainfall respectively. Hence the rainfalls during these three weeks are highly assured and crops should enjoy the benefit of rains during these weeks. The standard weeks 36 to 40, 43 and 44 received the rainfall of more than 25 mm which is sufficient for the standing crops.

Conditional probability of receiving 10 or 20 or 30 mm of rainfall in any particular week will be of very useful for efficient crop planning and proper management of field operations. The standard weeks 21,29,30,33 to 46 had 20 mm of rainfall with probability of more than 50 per cent. Similarly the standard weeks 34 to 40 (20th August to 7th Oct) and 43 to 46, (22nd Oct to 11th Nov) had 30mm of rainfall with a probability of more than 50 per cent. It indicated that there is continuous rainfall from August 3rd week to November 2nd week during Southwest monsoon and Northeast monsoon season.

Table 3. Weekly rainfall analysis at Regional Research Station, Paiyur (1973 - 2000).

Std. Week No.	Month and date	Mean rainfall (mm)	CV%	MAI	50% probability	Conditional probability		
						10 mm	20 mm	30 mm
1	Jan 1-7	0.4	396	0.00	0.0	-	-	-
2	8-14	1.6	259	0.00	0.0	2	-	-
3	15-21	1.1	399	0.00	0.0	3	-	-
4	22-28	0.0	-	0.00	0.0	-	-	-
5	29-4	0.0	-	0.00	0.0		-	-
6	Feb5-11	0.4	520	0.00	0.0	-	-	-
7	12-18	2.7	520	0.00	0.0	30	11	3
8	19-25	5.9	520	0.00	0.0	45	32	22
9	26-4	1.6	472	0.00	0.0	13	-	-
10	Mar5-11	2.4	490	0.00	0.0	26	7	-
11	12-18	4.1	255	0.00	0.0	28	6	-
12	19-25	2.7	267	0.00	0.0	16	-	-
13	26-1	2.8	333	0.00	0.0	21	3	-
14	Apr2-8	5.5	295	0.00	0.0	39	18	6
15	9-15	6.1	252	0.00	0.0	41	18	6
16	16-22	10.0	171	0.00	0.0	50	28	12
17	23-29	7.4	163	0.05	2.4	42	15	3
18	30-6	15.8	124	0.12	4.5	61	42	23
19	May7-13	14.3	154	0.19	7.1	58	40	24
20	14-20	16.3	126	0.29	10.5	62	43	25
21	21-27	26.1	119	0.56	20.5	70	58	45
22	28-3	19.2	105	0.48	17.6	68	48	29
23	Jun4- 10	21.1	145	0.15	6.3	64	51	39
24	11-17	11.5	240	0.00	0.0	52	38	25
25	18-24	2.7	152	0.00	0.0	4	-	-
26	25-1	7.3	212	0.00	0.0	43	21	7
27	Jul2-8	11.4	155	0.04	1.6	52	31	15
28	9-15	11.7	147	0.09	3.6	54	32	15
29	16-22	20.2	126	0.19	7.9	66	50	35
30	23-29	27.6	185	0.19	8.1	64	56	48
31	30-5	15.0	150	0.14	4.5	58	42	25
32	Aug6-12	14.8	154	0.20	6.5	58	41	25
33	13-19	24.6	119	0.48	15.4	69	53	43
34	20-26	51.0	133	0.49	15.8	73	68	62
35	27-2	36.8	163	0.22	7.1	67	61	54
36	Sep3-9	45.2	120	0.71	26.8	74	67	61
37	10-16	53.7	113	0.99	37.3	76	71	65
38	17-23	50.7	102	1.09	41.3	78	72	66
39	24-30	51.6	88	1.45	54.7	82	75	68
40	Oct 1-7	58.4	114	1.38	41.7	77	72	67
41	8-14	28.7	100	0.54	16.2	74	62	48
42	15-21	27.8	98	0.79	23.9	74	61	47
43	22-28	37.4	116	0.94	28.5	74	66	57
44	29-4	32.3	185	1.05	25.4	64	58	51
45	Nov5-11	34.8	156	0.64	15.4	68	61	54
46	12-18	35.6	153	0.40	9.6	68	61	54
47	19-25	13.8	146	0.23	5.6	57	38	21
48	26-2	10.4	275	0.04	1.0	50	37	25
49	Dec3-9	16.9	181	0.21	5.2	59	46	33
50	10-16	8.4	223	0.00	0.0	47	27	13
51	17-23	4.4	219	0.00	0.0	28	5	-
52	24-31	5.7	303	0.00	0.0	41	20	8

Agricultural implications :
Existing cropping pattern

Groundnut is the most important crop being cultivated in this area. Sowing is done from June 15 to July 15 and harvesting is done in October. The crops like redgram, lablab and castor are being grown as intercrops. Long duration sorghum, ragi and short duration samai are the next important crops that are being grown from July 15th to August 15th. Rainfed cotton is being cultivated to some extent and sowing is done during August second fortnight. The second season crop of horsegram is invariably cultivated during Northeast monsoon season after harvest of first season crops of groundnut and samai. Besides above annual crops, mango is planted to a considerable extent under drylands.

Proposed cropping system

Based on the critical analysis of rainfall the risk free weeks for crops are 29th to 46th week and the rainfall amount received during the weeks being more than 20mm, besides adequate moisture availability index of 1.01 to 1.33 was observed for the standard weeks of 38, 39 and 40 (from 17th September to October 7th) and 44th standard week (29th October to 4th November) will be useful to the crops (groundnut, samai, ragi and horsegram) sown during Southwest monsoon and Northwestern monsoon. With the onset of South west monsoon during 2nd and 3rd week of July, groundnut bunch varieties such as JL24, TMV2, TMV7 and Pollachi red maturing in 105 days could be suggested to fetch higher income. Besides gypsum application, coir pith compost application and random tie ridging and compartmental bunding can be followed for good yields and moisture conservation during the standard weeks of 36, 37 (3rd September to 16th September) 42 and 43 (15th October to 28th October) and standard week 45 (November 5th to 11th) with moisture deficit value of 0.68 to 1.00. After the harvest of groundnut, cowpea or horsegram can be sown. Budhar and Gopalasamy (1987), Gopalasamy and Narayanan (1985) found that sowing cowpea during the month of September was more remunerative and for late sowing horsegram was more suitable.

In case of delayed on set of southwest monsoon short duration sorghum (Paiyur2, CO26, CO28) and ragi could be sown with the intercrops of redgram, lablab and castor with a view to increase the cropping intensity and income. Growing of short duration medium staple cotton like SVPR3 and MCU7 against medium duration varieties (MCU 5 and LRA5166) could be also a viable alternative as the market price for cotton is more or less stable as compared to other commercial and cereal crops.

References

Budhar, M.N. and Ramasamy, R. (1985). Influence of rainfall on cropping systems in drylands of pennagaram taluk of Dharmapuri district. *Madras Agri. J.* 72: 213-217.

Budhar, M.N. and Gopalasamy, N. (1987). Rainfall analysis and cropping Nedungal tract of Dharmapuri District. *Madras Agri. J.* 74: 220-225.

Gopalasamy, N. and Narayanan, A. (1985). Improved production technologies for North east monsoon pulses in drylands. Regional workshop on crop production constraints and solutions. Regional Research Station, Paiyur P: 17

Hargreaves,G.H. (1974). Precipitation dependability and potential for agricultural production in North east Brazil. EMBRAPA and UTAH state Univ. pub. No.711-1-159

Hargreaves, G.H. (1975). Water requirement manual for irrigated crops and rainfed agriculture. EMBRAPA and Utah State University publication No.75-DI 58, pp: 40.

Kulandaivelu, R.R., Kumpuchetty, N., Rajendran, P. and Morachan, Y.B. (1979). Rainfall pattern and cropping system in Kinathukkadavu block, Coimbatore district. *Madras Agri. J.* 66: 520-525.

Kulandaivelu, R., Kumpuchetty, N. and Morachan, Y.B. (1980). Rainfall pattern and cropping system in Coimbatore. *Madras Agri. J.* 67: 171-176.