SWM season crop. Gross returns and net returns were higher with increased quantum of water applied under 60 mm pan value (Table 5).

Among management practices, cost of cultivation was not much varying except cycocel spray. Higher cost of cultivation was recorded with CCC spray in both the seasons. All other treatments were comparable. Gross and net returns were higher due to split application of potash. DCFW incorporation also gave higher gross and net returns. Economic returns was higher at scheduling of irrigation at 60 mm pan value, split application

of Kcl spray at peak flowering stage and incorporation of DCFW are useful.

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ANALYSIS OF RAINFALL DATA AND SUITABLE CROPPING SYSTEMS FOR TRICHY DISTRICT

C.R. CHINNAMUTHU and SP. PALANIAPPAN

Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore - 641 003.

ABSTRACT

The rainfall data pertaining to 40 years were analysed and contingent crop plan was developed for Trichy district. The annual mean rainfall was 742.02 mm. The distribution pattern of annual rainfall over the 40 years reveals that in 15 years, it was normal (37.5%) and in 10 years, it was deficit (25.0%). Excess rainfall was recorded in 13 years (32.5%). In two years, the rainfall was scanty (5.0%). Among the four seasons, North East monsoon contributes the highest quantity rainfall (47.2%) followed by South West monsoon (37.5%). The sowing rains of 20 mm and above were recorded in the third week of August through the end of the year. Based on the rainfall pattern, suitable crops are recommended for various soil types like red, black and salt affected soils.

KEYWORDS :   Rainfall, Cropping Systems, Trichy.

Rainfall is the ultimate source of moisture for human activities, more so for agriculture. Hence a knowledge on the probable dates of commencement, end of the rainy season and the duration of intermittent dry/wet spells are very useful for planning various agricultural operations. This will subsequently help to minimise the risk in crop production, and also to optimise the utilization of the limited resources like labour, fertiliser, herbicides and insecticides.

MATERIALS AND METHODS

Keeping the importance of rainfall, the daily rainfall data of Trichy centre pertaining to the years 1950 to 1989 (40 years) was collected. The data has been analysed through variability and probability methods (Kulandaivelu et al., 1979; Budhar and

Ramasamy, 1985). Mean, standard deviation and coefficient of variation were worked out for standard week, month, season and year. The conditional probability to find out the per cent chance to get the sowing rain was also worked out for different operations like summer ploughing, pre monsoon sowing of seeds, etc.

RESULTS AND DISCUSSION

Annual rainfall

The annual mean rainfall of Trichy centre was 742.0 mm. The highest rainfall of 1224.3 mm was recorded during 1983, while the lowest amount of 283.7 mm was observed in 1980. The annual rainfall has been classified into four categories viz., excess, normal, deficient and scanty (Table 1). The

Table 1. Annual mean rainfall and its classifications for Trichy Centre (1950-1989).

Year	Rainfall (mm)	Classification	Year	Rainfall (mm)	Classification
1950	451.90	Deficient	1970	860.70	Normal
1951	664.60	Normal	1971	643.50	Normal
1952	504.00	Deficient	1972	930.30	Excess
1953	895.50	Excess	1973	911.00	Excess
1954	676.00	Normal	1974	553.70	Deficient
1955	301.10	Scanty	1975	767.90	Normal
1956	953.40	Excess	1976	827.00	Normal
1957	406.70	Deficient	1977	1011.30	Excess
1958	664.90	Normal	1978	885.40	Normal
1959	681.70	Normal	1979	1175.90	Excess
1960	658.20	Normal	1980	283.70	Scanty
1961	916.70	Excess	1981	883.60	Normal
1962	753.30	Normal	1982	549.60	Deficient
1963	968.60	Excess	1983	1224.30	Excess
1964	765.00	Normal	1984	955.50	Excess
1965	684.40	Normal	1985	547.70	Deficient
1966	990.20	Excess	1986	647.80	Normal
1967	1108.90	Excess	1987	598.90	Deficient
1968	892.40	Excess	1988	564.00	Deficient
1969	452.20	Deficient	1989	454.10	Deficient

Annual Mean Rainfall = 742.0 : Standard Deviation = 230.4 Coefficient of Variation = 31.1

Where Excess : +20% and above annual mean rainfall

Normal : + 19 to -19% of the annual mean rainfall

Deficient : -20 to -59% of the annual mean rainfall

Scanty : -60 and less of the annual mean rainfall

distribution pattern of annual rainfall over 40 years reveals that in 15 years it was normal (37.5%), in 10 years it was deficit (25.0%), in 13 years it was excess of the normal (32.5%) and in two years it was scanty (5.0%). The Coefficient of variation between years (31.07%) indicates a fairly high dependability in the recurrence of normal distribution.

Seasonal rainfall

Among the four seasons, North East monsoon (NEM) contributed the highest quantity rainfall of 349.9 mm (47.2% of total) followed by South West monsoon (SWM) to the extent of 278.3 mm (37.5% of total). The Summer and Winter contributed only 15.3 per cent to the total rainfall (Table 2).

The SWM as well as NEM were more dependable as indicated by their lower coefficient of variation of 39.5 and 41.2, respectively. Summer season recorded a CV of 70.5 per cent. The CV of Winter season (205.1%) shows that the rainfall received during this season is highly erratic and undependable.

Monthly rainfall

The highest rainfall (167.2 mm) was received in the month of October, contributing 22.6 per cent to total rainfall followed by September with 125.8 mm (Table 3). The lowest amount of rainfall (7.8

Table 2. Seasonal mean rainfall (mm), co-efficient of variation (CV%) 50% probability and per cent to total rainfall.

Season	Mean rainfall (mm)	CV%	50% probability	% Total rainfall
Winter	22.250	205.136	0.750	3.000
Summer	91.160	70.454	73.400	12.291
S.W.M.	278.330	39.454	291.000	37.528
N.E.M.	349.915	41.219	313.500	47.180

S.W.M. - South West Monsoon

N.E.M. - North East Monsoon

Table 3. Monthly mean rainfall (mm), coefficient of variation (CV%) and % rain to total rainfall.

Month	Mean rainfall (mm)	CV%	50% probability	% Rain
January	14.41	242.00	0.00	1.94
February	7.85	308.45	0.00	1.06
March	7.75	235.02	0.00	1.05
April	32.95	124.46	15.60	4.44
May	50.47	91.14	38.60	6.80
June	18.58	123.70	10.70	2.51
July	55.47	107.24	30.75	7.48
August	78.49	75.69	58.40	10.58
September	125.81	57.65	129.95	17.96
October	167.23	59.80	147.75	22.55
November	105.35	68.87	93.30	14.20
December	77.35	113.66	49.05	10.43

and 7.9 mm) was recorded during March and February respectively. Rainfall received during September (CV% 57.7), October (CV% 59.8), November (CV% 68.9) and August (CV% 75.7) is more reliable compared to the other months with a higher coefficient of variation (75.0%).

Weekly rainfall

The highest rainfall (40.0 mm) was recorded during the 42nd standard week. The analysis showed that there was a continuous wet spell of more than 10 mm of rainfall from the 27th standard week onwards i.e., from the first week of July through the end of December. From the first week of August (32nd week) onwards, the rainfall quantity increased linearly from 11.2 to 40.0 mm upto the third week of October and then it declines towards the end of the year (Table 4).

Rainfall probability

Many agricultural operations depend on the receipt of given amount of rainfall in a particular period. Probability analysis provides information on the quantity of rainfall to be received at a particular probability level at a particular period. For all agricultural purposes 50 per cent probability level is taken as the minimum assured rainfall that could be anticipated.

The initial probability for annual rainfall shows that there was a cent per cent chance to get a minimum rainfall of 283.7 mm. The annual rainfall at 75 and 50 per cent probabilities were 553.7 and

684.4 mm respectively. Among the four seasons, NEM recorded the highest rainfall (313.5 mm) at 50 per cent probability followed by SWM (291.0 mm) season. During summer and winter 73.4 and 0.8 mm could be expected once in two years, respectively.

September and October months recorded more than 125 mm of rainfall with 50 per cent probability level followed by November (93.3 mm) and August (58.4 mm) (Table 2). The remaining months recorded less than 50 mm rainfall.

Receipt of sowing rain

Knowledge on the receipt of sowing rain would be of great use in taking up dry seeding in advance. This facilitates advanced sowings to utilise early showers. The quantity of sowing rain may vary depending upon the soil type. Well drained sandy soil may require higher amount of rainfall as compared to sandy loam or clay loam soils. In areas with heavy soil types 20 mm rainfall is sufficient to facilitate the germination of dry sown seeds.

The weekly mean rainfall data (Table 4) reveals that the sowing rains of 20 mm and above were recorded from the third week of August (34th week) to the end of the year. The per cent chance (conditional probability) to get 20 mm at different weeks during these periods varies from 67.0 to 76.4 per cent (Table 4). These periods fall during SWM and NEM seasons. So dry sowing of seeds could be taken up at any time starting from the second week of August.

In Summer, during the last week of April to third week of May the rainfall was 10 mm and above with more than 50 per cent conditional probability. This summer shower could be effectively utilised for summer ploughing.

Length of growing season

The moisture availability index (MAI) based on 50 per cent probability of rainfall was calculated (Hargreaves, 1975).

The value of MAI is equal or greater than 0.25 indicated the adequate moisture availability for the crop needs. The data reveals that 34 through 47th standard week excluding 36th week recorded the

Table 4. Weekly mean rainfall (mm), Co-effecient of variation (CV%) moisture availabilit index (MAI) and conditional probability to get 10,20 and 30 mm rainfall.

Std week	Mean rainfall	CV%	MAI	Conditional probability to get		
				10 mm	20 mm	30 mm
1	3.41	392.50	0.00	31.21	10.75	2.33
2	7.36	391.69	0.00	46.41	33.00	21.48
3	3.49	347.90	0.00	29.46	8.69	1.46
4	0.15	379.50	0.00	0.00	0.00	0.00
5	0.89	364.54	0.00	0.26	0.00	0.00
6	1.68	614.40	0.00	21.19	3.84	0.31
7	1.76	522.26	0.00	18.67	2.39	0.11
8	3.51	361.39	0.00	30.50	9.68	1.83
9	0.70	372.15	0.00	0.00	0.00	0.00
10	2.87	359.13	0.00	24.51	4.85	0.43
11	1.37	385.43	0.00	5.05	0.00	0.00
12	0.30	339.24	0.00	0.00	0.00	0.00
13	2.51	551.16	0.00	29.46	10.38	2.33
14	5.82	256.62	0.00	38.97	17.11	5.26
15	7.33	229.11	0.00	46.61	22.66	8.85
16	7.85	233.01	0.00	45.22	25.46	11.31
17	11.95	194.46	0.00	53.39	36.32	21.77
18	9.71	214.65	0.00	49.60	31.21	16.60
19	10.12	163.85	0.00	50.00	27.43	11.51
20	14.04	135.11	0.11	57.93	37.83	20.05
21	10.28	198.03	0.03	50.40	31.56	16.60
22	6.31	194.52	0.01	38.21	13.35	2.68
23	5.13	236.82	0.00	34.46	11.12	2.02
24	6.75	176.42	0.00	39.36	13.35	2.56
25	4.26	258.55	0.00	30.15	7.64	0.96
26	2.43	195.23	0.00	5.59	0.00	0.00
27	10.71	218.97	0.00	51.20	34.46	20.61
28	17.88	176.47	0.02	59.48	47.21	35.20
29	13.84	194.62	0.00	55.57	41.29	27.43
30	13.04	241.42	0.00	53.98	41.68	29.46
31	7.40	239.24	0.00	44.04	23.89	26.11
32	11.18	222.80	0.02	51.99	36.32	22.36
33	11.55	208.04	0.01	52.39	36.32	22.06
34	22.38	124.52	0.28	67.00	53.59	39.36
35	25.98	102.16	0.45	72.57	58.71	44.04
36	25.07	144.51	0.10	66.28	55.57	44.43
37	32.83	108.40	0.50	73.89	64.06	51.60
38	37.34	103.62	0.58	76.11	67.36	57.14
39	30.57	114.62	0.36	72.24	61.79	50.40
40	33.57	97.99	1.04	76.42	65.91	54.38
41	30.21	99.84	0.79	74.86	63.31	50.00
42	39.96	132.79	0.57	71.23	64.80	57.14
43	28.89	129.97	0.62	69.15	59.10	48.80
44	34.60	134.99	0.54	70.19	62.17	53.98
45	33.31	99.34	0.86	75.80	65.54	53.98
46	25.96	125.65	0.52	68.79	57.14	45.22
47	28.25	143.42	0.15	67.36	57.53	48.40
48	17.83	175.36	0.20	59.48	47.21	34.83
49	33.56	168.27	0.28	66.28	59.10	52.39
50	12.73	162.67	0.09	55.17	36.32	20.33
51	17.46	293.24	0.08	55.96	48.01	40.52
52	13.60	214.75	0.02	54.78	41.68	28.77

MAI of greater than 0.25 (Table 4). So the length of growing season (which will support the growth of crop without any moisture stress) is 12 weeks (middle of August to middle of November) which falls during the north east monsoon season. Crops sown during the month of August will successfully complete its life cycle with higher yields.

Existing cropping pattern

In red soils, with the receipt of first shower, groundnut crop is sown and harvested between July and October (SWM). In some parts, groundnut crop is intercropped with cowpea. After the harvest of the groundnut, sorghum / varagu is sown during November and harvested in January. In black soils, sorghum / cotton is cultivated between July and October followed by varagu during November-January by utilising the NEM rains.

Contingent crop plan

The rainfall received from August to December without any long break helps to take up two crops successfully. The contingent crop plan suggested for different types of soils are furnished below.

Red soil

For red soil, based on the rainfall prediction, the following crops and varieties are suggested. From July-August to October-November, five rows of groundnut intercropped with on-row of cowpea can be taken up, with the following varieties.

Groundnut : Co 1, Co 2, JL 24, VR 2.
Cowpea : Co 4.

After the harvest of groundnut and cowpea, sorghum can be intercropped with red gram or castor during November-December.

Sorghum : Co 26.
Red gram : Co 5.
Castor : TMV 4.

Black soil

In black soil, after the receipt of the initial showers in August, sowing of any one of the following crops can be taken up. There are three different options available for the black soil conditions.

1. Sole cowpea can be sown in July-August. After the harvest of cowpea, cotton can be intercropped with black gram in October-November.

2. Ragi can be sown with sunflower as border crop in July- August. In September-October, cotton - black gram or sorghum-cowpea intercropping system can be adopted.

3. Sole crop of varagu can be raised in July-August, followed by horse gram or sesamum in September-October.

Cowpea : Co 4 and Paiyur 1
Cotton : LRA 5166
Black gram : Co 5
Ragi : Trichy 1, K 7
Sunflower : Co 1
Sorghum : Co 26
Varagu : K 1, Co 1
Horse gram : Co 1
Sesamum : Co 1 / TMV 3

Salt affected soils

In soils with high salt content, ragi can be raised with sunflower as border crop or pearl millet can be sown in July- August, followed by cotton or sorghum in October-November. The varieties suitable for the salt affected areas are:

Ragi : Trichy 1
Sunflower : Co 1
Cotton : LRA 5166
Sorghum : Co 25 / Co 26
Pearlmillet : WCC 75, X 5

Green manure crop

After summer ploughing in April - May, green manure crop like daincha and kolinji can be raised using the summer showers.

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