

A Study of Rainfall Characteristics of Dharwad in Relation to Cropping Programme

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(Received July, 1990)

ABSTRACT

Using the daily rainfall data of Dharwad for the latest forty-years (1950-89), its characteristic variations in the form of annual, seasonal, monthly and weekly periods have been studied. The frequency of annual normal rainfall at Dharwad from 1950 to 1989 shows a decreasing trend from decade to decade, whereas the deficiency in rainfall during the last two decades is on increase. Winter contributes least and summer contributes about nineteen per cent to annual rainfall. The South-West monsoon contributes sixty one per cent with forty rainy days, whereas North-East monsoon contributes just twenty per cent spread over ten rainy days. December had the highest coefficient of variation in rainfall and July had the least. The weekly analysis of rainfall has clearly shown that the most appropriate cropping season should be between 24th and 34th standard weeks, which corresponds to most assured rainfall period. Risks in rainfed farming can be minimised by adopting the findings of this study.

Agricultural production is intimately related to the harnessing of favourable weather conditions during every cropping season. It is an established fact that crop yield is the integral result of a number of mutually interacting physical and physiological processes that take place during the crop growth period. The prevailing weather conditions along with soil and water management practices constitute the physical part of the process; whereas, the physiological aspect deals with the seed from germination to reproduction. Water plays an important role in influencing the physiological process and

in most of the times, it conditions the growth of the plant depending upon its erratic behaviour. For proper planning of any crop, a better understanding of rainfall, which is the only source of moisture for rainfed farming is very essential. The various characteristics of rainfall - quantity, distribution, intensity etc., of a place are of paramount importance. Buddhar and Gopal-swamy (1987) have proposed the cropping pattern in Nedungal tract of Dharampuri district after studying the rainfall characteristics for 34 years. They (1988) have also analysed the climatology of Mettur taluk of Salem

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district for suggesting suitable cropping system for that area. In this paper, an attempt has been made to study the rainfall characteristics of transition zone of Dharwad and suggest a suitable cropping programme.

MATERIAL AND METHODS

The daily rainfall data of Main Research Station, University of Agricultural Sciences, Dharwad (Lat: 15°, 16' N; Long: 76°, 07' E; and Alt: 678 Metres) for forty years (1950-89) were collected from the agrometeorological observatory. The data were tabulated standard weekwise and monthwise. Following the standard definition of a rainy day, the number of rainy days were worked out. The results were statistically analysed for weekly, monthly, seasonal and annual rainfall quantities as per methods prescribed by Kulandaivelu *et al* (1980). The rainfall during kharif and rabi season alongwith the annual were classified as excess, normal, deficient and scanty, to know the existence of any periodicity in rainfall variation. This was accomplished on the basis of rainfall classification as suggested by India Meteorological Department.

RESULTS AND DISCUSSION

Annual and seasonal rainfall: The frequency distribution of excess, normal, deficient and scanty rainfall is given in Table 1. The overall annual rainfall average for the forty year period (1950-89) works out to 776.5 mm with sixty one rainy days. The coefficient of variation (CV) of annual rainfall is least (18.6) compared to all the four seasons of the year, and it is categori-

sed as normal. The highest annual rainfall received was 1119.7 mm over 71 rainy days in 1953 and the lowest 459.0 mm during 1976 spread over forty rainy days. The range of annual rainfall variation is 660.7 mm with number of rainy days equal to the number of days in the first month of every year. The intensity of annual rainfall is 21.3 mm per day which is similar to that of rabi season, and slightly higher than that of *kharif* season.

The first season consisting of January and February contributes almost nothing to the annual rainfall at Dharwad. The coefficient of variation (CV) of this season is 120.1, which is highest compared to the remaining three seasons of the year. Summer season has a mean rainfall of 146.1 mm over eleven rainy days, contributing about nineteen per cent to the annual rainfall. The CV for this season is 50.5. The highest rainfall recorded during summer season was 363.2 mm in 1958, whereas the lowest was just 3.3 mm in 1966. Considering the amount of rainfall and its variability, the summer rainfall is better suited for land preparation rather than for raising any crops. With some degree of risk, a short duration supplementary crop could be grown, whenever other climatic conditions are favourable.

The *kharif* cropping season or South-West monsoon season has a mean rainfall of 481.1 mm spread over forty rainy days, accounting for about sixty one per cent of the annual rainfall. Therefore, this is the principal cropping season of this area. Of all the

seasonal rainfalls, the CV of this season is the least (23.79) which makes this seasonal rainfall highly dependable. In 1959, the SW monsoon seasonal rainfall was highest (694.9 mm) with fiftythree rainy days and it was lowest in 1976 (231.3 mm) with twenty four rainy days. The range of rainfall variation is 463.6 mm, giving an average rainfall of about 16 mm per rainy day. One peculiarity of this seasonal rainfall is that, its quantity is continuously more than 400 mm for five to six years and then it declines for a couple of years and thereafter it again increases for the next five to six years. Since the rainfall of this season is more assured both in terms of quantity and the number of rainy days, it is very much suited for raising any desired crop.

Table 1 indicates that the prevalence of normal rainfall is always 50 per cent

or more during *kharif* season, compared to the other categories of excess, deficient and scanty rainfall. It also shows a feeble trend of decrease in frequency of occurrence of normal rainfall from decade to decade. The rainfall deficiency was highest in the third decade (1970-79) to the extent of 40 per cent as against no deficiency in the first decade. It is peculiar to note that the rainfall was not scanty during any of the four decades considered in this study.

The rabi cropping season or North-East monsoon season is another important crop growing season of this region. The mean seasonal rainfall is 157.4 mm with ten mean rainy days, contributing about twenty per cent to the annual rainfall. The coefficient of variation is 55.8, slightly higher than that during summer season. The highest rainfall of this season is 428.0 mm recorded in

Table 1. Frequency distribution of excess, normal, deficient and scanty rainfall years at Dharwad from 1950 to 1989

Decade	Kharif season				Rabi season				Annual			
	E	N	D	S	E	N	D	S	E	N	D	S
1st decade (1950-59)	2	8	—	—	4	4	2	—	2	8	—	—
2nd decade (1960-69)	2	6	2	—	4	3	3	—	1	9	—	—
3rd decade (1970-79)	1	5	4	—	1	2	6	1	1	7	2	—
4th decade (1980-89)	3	5	2	—	—	1	5	4	—	6	4	—
Total	8	24	8	—	9	10	16	5	4	30	6	—

E - Excess; N - Normal; D - Deficient and S - Scanty.

1957 and the least 21.3 mm received during 1988. Even though the amount of rainfall and the number of rainy days are more or less same for summer and North East monsoon seasons, with higher CV during North-East monsoons, the rainfall of only latter is used for raising rabi crops, for the main reason that the accumulated moisture in the soil due to both the monsoons could be profitably used.

As in *kharif* season, rabi also exhibits a decreasing trend in normal rainfall (Table 1). The frequency of occurrence decreased gradually from 4 in the first decade to 3 in the second, 2 in the third and just one in the last decade. This is an alarming trend and should be of great concern. Added to this the frequency of deficient rainfall is increasing, and this has to be seriously studied for planning of future cropping programme of this area. The rainfall in this season is almost scanty during the third and fourth decades, reaching a negative deviation of 40 per cent during the decade 1980-89. Considering the probability of deficient rainfall, rabi season does not have the assured rainfall as much as that of *kharif*; besides, the distribution is very erratic and uncertain. Therefore, the planning of rabi crop should be done very cautiously and carefully.

Monthly rainfall : Table 2 shows the mean monthly rainfall, rainy days in a month, percentage contribution of monthly rainfall towards annual and coefficients of variations. The CV of January rainfall is highest (139.3), but that of February is interestingly less

by more than (Table 2) half. The months of March, April and May which form summer season are found to have increasing rainfall from month to month, varying from 8.0 mm in March to 84.4 mm in May. In May, in spite of high rainfall and more number of rainy days, the rainfall is not that reliable because of high CV (73.2). Moreover, because of high temperatures normally prevailing, the major portion of water gets evaporated without making itself available for crops.

The rainfall for the next four months of June to September, though also on the increase, attains a peak value (155.1 mm) in July and then decreases upto September. The CV for July is lowest (47.5) for the year and its contribution to annual rainfall is highest amounting to twenty per cent. The number of rainy days are also maximum (14) during this month. The highest monthly rainfall during the four decades is 330.9 in June 183, 369.0 in July 1961, 271.0 in August 1969 and 231.0 in September 1974.

The North East monsoon season comprising October, November and December, witnesses another peak in October (120.0 mm) with seven rainy days. The contribution of October rainfall to the annual is next only to that of July accounting for 16 per cent. The rainfall pattern of Dharwad is therefore, bi-modal. It is of interest to note at this juncture, that though sometimes July peak fluctuates between June and August, the October peak is almost constant. The highest monthly rainfall for the four decades are 398.0

Table 2. Mean monthly rainfall, coefficient of variation and rainy days at Dharwad (1950-89)

Months	Rainfall in (mm)	Rainy days	C. V.	Percentage contribution to annual rainfall
January	0.7	—	139.3	0.09
February	0.6	—	65.4	0.08
March	8.0	1	148.4	1.03
April	51.8	4	59.6	6.70
May	84.4	6	73.2	10.90
June	106.8	8	58.7	13.80
July	155.1	14	47.5	20.00
August	107.3	11	53.8	13.80
September	104.6	7	54.5	13.50
October	120.0	7	66.5	15.50
November	31.4	2	126.3	4.00
December	5.8	1	318.6	0.60
Total	776.5	61	18.6	—

mm in October 1953, 168.5 mm in November 1966 and 52.1 mm in December 1962.

Weekly rainfall : It is clear from Table 3 that rainfall is almost nil upto 14th week and the probability of getting atleast 10mm of rainfall exceeds fifty per cent only from the 18th week onwards. Since, the probability values of more than sixty per cent are only considered as reliable, the real cropping season could start from 24th week and continue upto 34th week, with an assured rainfall for a period of about twelve weeks.

As per the present package of practices (Anonymous, 1988), *kharif* ground-

nut is recommended for cultivation between 20th to 37th week for bunch variety and between 24th to 44th week for spreading variety. *Kharif* jowar is preferred to be taken up between 26th to 41st week covering a period of 15 weeks. The third important crop, cotton, has been suggested to be grown between 30th week to 6th week of next year. In the light of present study, as far as groundnut is concerned, both the bunch and spreading varieties perfectly fit into the duration of assured rainfall period as described above. But the sowing of *kharif* jowar as late as 26th week (25th June to 1st July) may need some modification. The sowing may be preponed by at least

two or three weeks, by which time the conditions would have already become favourable for starting of agricultural operations.

After a small gap of about three weeks (35 to 37), the weekly rainfall again starts rising from 38th to 42nd week, a duration of about five weeks which could be suitably used for raising *rabi* crop. After 43rd week, even

though rainfall continues, it is most uncertain. It is an observed fact that whenever rainfall is received towards the end of the year, it comes mainly from cyclones, whose origin and passage over the land are very erratic. The rainfall is very undependable during first seventeen weeks as also last ten weeks of every year. Therefore, the cropping programme should be formulated in such assured conditions as to

Table 3. Standard weekwise mean rainfall, rainy days and the percentage probability of getting atleast 10 mm rainfall at Dharwad

Standard week number	Month	Dates	Rainfall in mm	Rainy days	Probability
1	2	3	4	5	6
1	January	1-7	0.2	—	1
2		8-14	0.7	—	1
3		15-21	0.3	—	1
4		22-28	0.0	—	0
5	February	29-4	0.4	—	3
6		5-11	0.6	—	1
7		12-18	0.0	—	0
8		19-25	0.2	—	0
9	March	26-4	0.4	—	1
10		5-11	0.5	—	1
11		12-18	0.5	—	3
12		19-25	3.6	1	10
13	April	26-1	2.9	—	10
14		2-8	8.3	—	27
15		9-15	9.3	1	26
16		16-22	12.4	1	34
17	May	23-29	16.4	2	45
18		30-6	19.9	1	51
19		7-13	12.1	1	48
20		14-20	21.3	2	52
21		21-27	19.5	1	45
22		28-3	23.8	1	47

Table 3 continued

1	2	3	4	5	6
23	June	4-10	26.3	1	56
24		11-17	24.3	2	62
25		18-24	21.6	2	60
26		25-1	25.1	3	68
27	July	2-8	36.1	4	71
28		9-15	38.3	3	78
29		16-22	35.0	3	79
30		23-29	39.1	3	84
31	August	30-5	28.7	3	82
32		6-12	25.3	3	78
33		13-19	21.8	3	70
34		20-26	23.4	2	69
35	September	27-2	16.9	1	47
36		3-9	20.3	1	42
37		10-16	15.6	1	45
38		17-23	35.1	2	68
39	October	24-30	36.3	2	75
40		1-7	29.1	2	72
41		8-14	28.6	2	71
42		15-21	21.3	2	64
43	November	22-28	18.2	1	42
44		29-4	16.0	1	36
45		5-11	21.0	1	29
46		12-18	7.4	1	23
47	December	19-25	3.6	1	17
48		26-2	3.1	-	12
49		3-9	2.4	-	6
50		10-16	1.3	-	8
51		17-23	1.5	-	8
52		24-31	0.5	-	3
Total			776.5	61	

utilise the assured rainfall period of May to October or standard weeks 18 to 45.

The *kharif* crops which are sown in June will be benefitted by the peak of the rain in July (27-29 week) because

it will help in the vegetative growth and in the early reproductive phase. As the crops will be in the maturity phase, the trough of the rain in September (35-37 week) will not have much impact on productivity of crops.

REFERENCES

- Anonymous, 1988, Package of practices for high yields for Region-I, Zones 1 and 2. Univ. Agril. Sci., Dharwad and Department of Agriculture, Govt. of Karnataka.
- Buddhar, M. N. and Gopalaswamy, N., 1987, Rainfall analysis and cropping in Nedungal tract of Dharampuri district. *Madras Agric. J.*, 74 : 220-225.
- Buddhar, M. N. and Gopalaswamy, N., 1988, Rainfall, climatology and cropping systems for Nettur taluk of Salem district. *Madras Agric. J.*, 75 : 418-422.
- Kulandaivelu, R., Kempuchetty, N., Rajendran, P. and Morachan, Y. B., 1979, Rainfall pattern and cropping system in Kinathukadavu block, Coimbatore district. *Madras Agric. J.*, 66 : 520-525.