

Droughts in the monsoon months of June to December at Coimbatore and their agricultural significance*

by

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Synopsis: The agricultural significance of droughts in the monsoon months of June to December at Coimbatore is brought out in this paper.

Introduction: In the monsoon months of June to December two monsoon seasons are included. They are the South-west Monsoon season (June to September) and North-east Monsoon season (October to December). The possibility of one of these two monsoons being favourable when the other one fails is not entirely ruled out (3). But the North-east Monsoon period is more well-defined and dependable for rains than that of the South-west Monsoon (1).

In the year 1963 sufficient soaking rains of the order of 1.50" were not received on any three or four consecutive days in the period 13th July to 23rd August in the South-west Monsoon season to take up the 'Adi' pattam sowing of dry land *cholam* crop. Similarly in the month of October in the North-east Monsoon season in 1963 sufficient rains were not received to sow dry land *Karunganni* Cotton crop. The net result was that the area under these two major dry land crops in and round about Coimbatore was considerably low in 1963, particularly in the case of *cholam* crop.

To know as to whether similar agricultural failure of rains in the critical periods of both the monsoon seasons has occurred previously at Coimbatore, the daily rainfall data, collected in the Observatory, located at the Agricultural College and Research Institute in the period 1907 to 1963 (57 years) were compiled and critically examined with special reference to the occurrence of droughty weeks in general and spells of continuously droughty weeks of four and above in particular. If the rainfall in a week is equal to half the normal rainfall or less, then that week is considered as a week of 'drought'. Drought has great agricultural significance when it lasts for four or more consecutive weeks (2).

Methods: (i) The South-west Monsoon period of June to September was divided into seventeen weeks, covering the period from 1st June to 27th September. Likewise the North-east Monsoon period of October to December was divided into thirteen weeks from 1st October to 30th December. The weekly rainfall data were compiled, separately for each monsoon period. The total and mean rainfall for each week were worked out. If in a week the rainfall happens to be either equal to or less than half of its mean value, then it is considered as a week of 'drought'.

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* Received on 2-7-1964.

(ii) The total number of droughty weeks in each monsoon period was computed for each year. These total droughty weeks were correlated with the rainfall of each monsoon period.

(iii) The continuous spells of droughty weeks of four and above, as done by Mallik, and Govindaswamy, (2) were compiled separately for each monsoon period. If the spell of droughty weather is in the first four to seven weeks, then in that year it is presumed that the onset of the South-west Monsoon was a delayed one. Similarly if the spell of droughty weather is in the last four to seven weeks (12 weeks only in 1934), then that year is classified under the group of abrupt cessation. The years in which the continuous droughty weeks come in-between have been considered as years of weak development of the monsoon. The details, compiled on these lines, together with rainfall and departure of rainfall from mean are given in Table I for the South-west Monsoon period of June to September.

(iv) The details regarding the North-east Monsoon period of October to December, compiled on the same lines as for the South-west Monsoon period, are presented in Table II. In regard to this monsoon continuous spell of droughty weeks in the first four weeks was considered as an indication of the delayed onset of the monsoon. In the group of abrupt cessation of monsoon years with the last four to eight weeks of continuously droughty weather were included. The years with continuously droughty weeks coming in between were grouped under weak development of the monsoon.

(v) The total number of continuous droughty weeks were computed with details of the years of their occurrence and their rainfall. Correlations were worked out between these factors separately for each monsoon period.

(vi) Agriculturally 13th July to 23rd August is the important period in the South-west Monsoon season. In this period, if the rains are favourable, the 'Adi' pattam sowing of dry *chulam* crop is taken up. If the rains in this period are not of the order of 1.50" and above on three or four consecutive days, the sowing of dry land *chulam* crop is not taken up and the South-west Monsoon is considered as agriculturally unfavourable. Likewise the month of October is the important period in the North-east Monsoon season. It is in the month of October that the sowing of dry land *Karunganni* cotton crop are extensively attended to. So if the rains in October in any year are highly sub-normal, then in that year the North-east Monsoon is considered as agriculturally unfavourable. So for the total rainfall in the period 13th July to 23rd August and in the month of October standard deviations were worked out separately. The subnormality of rainfall in these two important periods is decided if the rainfall is either equal to or less than the value of mean minus half the standard deviation. The details of the sub-normal years for the two monsoon seasons are incorporated in Table III.

Discussion: (i) The total number of droughty weeks in the South-west Monsoon season ranged from 5 to 14. Only in 1918, in which year the total rainfall in the entire South-west Monsoon season was only 0.77", the total number

TABLE I

Continuously droughty weeks in the South-west Monsoon period.

Classi- fication	S. No.	Year	Number of Weeks	Duration		Rain fall	Departure from mean	Remarks
				From	To			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DELAYED ONSET	1	1909	4	8th June	5th July	6.1	-0.5	1. In 1918 the first fifteen weeks were droughty weeks. 2. In years marked bold two spells of continuously droughty weeks of four and above occurred. 3. Monsoon mean rainfall = 6.6".
	2	1913	4	1st June	28th June	4.4	-2.2	
	3	1926	5	1st June	5th July	8.1	+1.5	
	4	1935	5	1st June	5th July	3.0	-3.6	
	5	1937	7	1st June	19th July	4.7	-1.9	
	6	1939	6	1st June	12th July	5.4	-1.2	
	7	1945	4	1st June	28th June	4.6	-2.0	
	8	1949	6	1st June	12th July	5.4	-1.2	
	9	1952	5	1st June	5th July	3.7	-2.9	
	10	1958	4	1st June	28th June	6.2	-0.4	
	11	1960	4	1st June	28th June	5.0	-1.6	
WEAK DEVELOPMENT	1	1907	4	22nd June	19th July	6.8	+0.2	
	2	1908	4	22nd June	19th July	2.3	-4.3	
	3	1911	5	27th July	30th August	12.9	+6.3	
	4	1913	8	20th July	13th September	4.4	-2.2	
	5	1914	4	17th Aug.	13th September	4.8	-1.8	
	6	1915	5	10th Aug.	13th September	9.8	+3.2	
	7	1919	5	3rd Aug.	6th September	6.2	-0.4	
	8	1922	4	27th July	23rd August	4.9	-1.7	
	9	1925	5	10th Aug.	13th September	8.3	+1.7	
	10	1927	5	3rd Aug.	6th September	5.6	-1.0	
	11	1928	4	10th Aug.	6th September	2.7	-3.9	
	12	1929	5	13th July	16th August	8.9	+2.3	
	13	1930	6	27th July	30th August	3.4	-3.2	
	14	1938	6	15th June	26th July	5.9	-0.7	
	15	1942	5	6th July	9th August	4.3	-2.3	
	16	1947	4	15th June	12th July	2.9	-3.7	
	17	1951	5	15th June	19th July	5.3	-1.3	
	18	1951	7	27th July	13th September	5.3	-1.3	
	19	1957	5	13th July	16th August	3.4	-3.2	
	20	1960	4	10th Aug.	6th September	5.9	-1.6	
ABRUPT CESSATION	1	1920	5	17th Aug.	20th September	4.6	-2.0	
	2	1934	12	6th July	27th September	4.0	-2.6	
	3	1942	4	31st Aug.	27th September	4.3	-2.3	
	4	1947	6	17th Aug.	27th September	2.9	-3.7	
	5	1948	7	10th Aug.	27th September	5.4	-1.2	
	6	1949	4	31st Aug.	27th September	5.4	-1.2	
	7	1952	4	31st Aug.	27th September	3.7	-2.9	

TABLE II.

Continuously droughty weeks in the North-east Monsoon period.

Classification	S. No.	Year	No. of weeks	Duration		Rain-fall	Departure from mean	Remarks	
				From	To				
DELATED ONSET	1	1955	4	1st October	28th October	5.2	-7.1		
	1	1909	6	22nd October	2nd December	8.4	-3.9	1. In the year marked bold two spells of continuously droughty weeks, each of four weeks duration, occurred.	
	2	1911	4	22nd October	18th November	9.9	-2.4		
	3	1914	4	29th October	25th November	10.1	-2.2		
	4	1923	6	5th November	16th December	7.5	-4.8		
	WEAK	5	1926	4	5th November	2nd December	12.6		+0.3
	6	1929	4	5th November	2nd December	7.2	-5.1		
	DEVE-	7	1935	4	19th November	16th December	9.5		-2.8
	8	1942	6	22nd October	2nd December	10.9	-1.4		
	LOPMENT	9	1945	4	19th November	16th December	17.2		+4.9
	10	1950	4	19th November	16th December	8.9	-3.4		
	11	1952	4	29th October	25th November	6.7	-5.6		2. Monsoon Mean Rain-fall.
	12	1954	5	5th November	9th December	12.7	+0.4		
13	1957	4	19th November	16th December	26.9	+14.6			
ABRUPT CESSA- TION	1	1908	8	5th November	30th December	11.2	-1.1	=12.3°	
	2	1910	5	26th November	30th December	14.4	+2.1		
	3	1912	5	26th November	30th December	20.3	+8.0		
	4	1916	4	3rd December	30th December	9.7	-2.6		
	5	1920	5	26th November	30th December	8.6	-3.7		
	6	1921	7	5th November	23rd December	9.9	-2.4		
	7	1922	4	3rd December	30th December	16.3	+4.0		
	8	1924	4	3rd December	30th December	12.0	-0.3		
	9	1930	4	3rd December	30th December	28.1	+15.8		
	10	1932	4	3rd December	30th December	13.9	+1.6		
	11	1937	4	26th November	23rd December	6.5	-5.8		
	12	1938	7	5th November	23rd December	5.0	-7.3		
	13	1939	6	19th November	30th December	17.0	+4.7		
	14	1943	5	26th November	30th December	13.2	+0.9		
	15	1947	6	19th November	30th December	4.8	-7.5		
	16	1949	5	26th November	30th December	7.0	-5.3		
	17	1951	4	3rd December	30th December	9.9	-2.4		
	18	1955	4	3rd December	30th December	5.2	-7.1		
	19	1956	4	26th November	23rd December	15.6	+3.3		

of droughty weeks was 16. Similarly in the North-east Monsoon season the total number of droughty weeks ranged from 3 to 10. The correlation coefficients and their levels of significance between the total number of droughty weeks and rainfall are given below separately for the two monsoons:—

South-west Monsoon:— $r = -0.6475$ ($P = 0.001$)

North-east Monsoon:— $r = -0.5891$ ($P = 0.001$)

This indicates that if the number of droughty weeks is high in any monsoon season in any year, then in that year the monsoon rainfall will be significantly low.

TABLE III

Agriculturally Sub-normal years

July 13th to August 23rd in South-west Monsoon period		October in North-east Monsoon Period		REMARKS
S. No.	Year	S. No.	Year	
1	1908	1	1908	1. In 1918 the first fifteen weeks were droughty weeks.
2	1918	2	1920	
3	1920	3	1925	2. In the years marked bold both the monsoon rains had been agriculturally unfavourable.
4	1922	4	1927	
5	1929	5	1928	
6	1930	6	1929	
7	1934	7	1931	
8	1935	8	1936	
9	1941	9	1937	
10	1945	10	1938	
11	1952	11	1940	
12	1955	12	1941	
13	1957	13	1947	
14	1962	14	1948	
15	1963	15	1951	
		16	1952	
		17	1955	
		18	1958	
		19	1963	

(ii) If the data, presented in Table I regarding the South-west Monsoon season, are examined, they reveal the following tentative inferences:—

(a) In a period of 56 years in eleven years the South-west Monsoon had delayed onset by four to seven weeks. In seven years it had an abrupt cessation. In twenty years-1951, occurring twice-the monsoon had weak development. In the years 1949 and 1952 the monsoon had both delayed onset and abrupt cessation. In the years 1913 and 1960 the monsoon had both delayed onset and weak development. In 1942 and 1947 the monsoon was not only weak in its development, but also had an abrupt cessation. If the monsoon rainfall of these six years (1913, 1942, 1947, 1949, 1952 and 1960) is considered, it is below the mean rainfall of 6.6" by 1.2" to 3.7".

(b) The monsoon had the lowest rainfall of 0.77" in 1918. In this year the first fifteen weeks had the continuous spell of droughty weather and the last week, i.e. seventeenth week also happened to be a week of 'drought'.

(c) Occurrence of two spells of droughty weather, each of four weeks and above duration, is fairly common in this monsoon season. In six out of fifty-six years such occurrences were observed.

(d) in the case of years of delayed onset of the monsoon the rainfall is invariably sub-normal, range being $-0.4''$ to $-3.6''$. The only exception to this inference is the year 1926, which had $1.5''$ of rain above the mean of the monsoon, due to its being unusually vigorous at the end. Out of twenty years of weak development of the monsoon-1951, occurring twice-in five years the rains were above the mean. This is due to the vigorous nature of the monsoon either at the beginning as in 1907 or at the end as in 1925 or both at the beginning and end as in 1911, 1915 and 1929. Generally when the development of the monsoon is weak, the subnormality of the rains will be in the range of $-0.4''$ to $-4.3''$. When the monsoon has an abrupt cessation, the subnormality of the rainfall is in the range of $-1.2''$ to $-3.7''$.

(iii) When the data in Table II, pertaining to North-east Monsoon, are examined, they lead to the following tentative inferences:—

(a) In a period of fifty-seven years only in one year, ie, in 1955 the North-east Monsoon had delayed onset. In addition in the same year it had an abrupt cessation as well. That was why in this year the monsoon rainfall was $7.1''$ below the mean rainfall.

(b) In thirteen years the monsoon had weak development. In four out of these thirteen years, ie, in 1926, 1945, 1954 and 1957 the monsoon rainfall happened to be above the mean. This was due to the fact that in 1945, 1954 and 1957 the monsoon had a very vigorous onset and in 1926 the monsoon was vigorous both at the beginning and end. Generally in the years of weak development of the monsoon, the subnormality of the rainfall will be in the range of $-1.4''$ to $-5.6''$.

(c) In nineteen years the monsoon had an abrupt cessation in a period of fifty-seven years. In eight out of these nineteen years the rainfall happened to be above the mean due to either very vigorous onset or both vigorous onset and development of the monsoon. In the remaining eleven years the subnormality of the rains was in the range of $0.3''$ to $7.5''$.

(d) The occurrence of two spells of droughty weather, each of four weeks duration, was noted only in one year, that is in 1955, in a period of fifty-seven years. This indicates that the North-east Monsoon is more well-defined and dependable for rains than the South-west Monsoon (1).

(iv) The details of the correlations worked out between the total number of continuous droughty weeks and rainfall for each monsoon period are given hereunder:—

South-west Monsoon Period: $r = 0.3585$ ($P = 0.05$)

North-east Monsoon Period: $r = 0.3152$ ($P = 0.1$)

This indicates that the occurrence of spells of continuous droughty weather of duration of four weeks and above has less influence on rainfall in the North-east Monsoon season than that in the South-west Monsoon season. Further, from the data collected for working out these correlations it has been found that the maximum duration of the spell of droughty weather is 8 weeks in the North-east Monsoon season, whereas it is 15 weeks in the South-west Monsoon season. No doubt there is a difference of one month in the duration of the two monsoon periods South-west Monsoon period being of four months duration while the North-east Monsoon period is only of three months duration. Even then the occurrence of long spells of continuous droughty weeks is more common in the South-west Monsoon season than in the North-east Monsoon season, which again indicates that the latter is more well-defined and dependable for rains than the former (1).

(v) If the agriculturally subnormal years, based on the failure of rains in the period 13th July to 23rd August in the South-west Monsoon season and in the month of October in the North-east Monsoon season, as presented in Table III, are examined, the number of such years is fifteen for the South-west Monsoon season and nineteen for the North-east Monsoon season. Further, in six years in a period of fifty-seven years both the monsoons had been agriculturally unfavourable. But in the South-west Monsoon season only on three occasions in a period of fifty-seven years rains had been agriculturally unfavourable in two consecutive years; whereas in the North-east Monsoon season such occasions were five in number, two of them covering three consecutive years. The tentative inference is that the possibility of receiving inadequate rains for sowing dry cotton crop is more frequent and of greater magnitude than that in the case of dry *cholam* crop.

Summary and Conclusion : (i) In each monsoon period if the number of droughty weeks is high in any year, then in that year the rainfall will be significantly subnormal.

(ii) Delayed onset is more common in the South-west Monsoon than in the North-east Monsoon. But the North-east Monsoon is more noted for its abrupt cessation than the South-west Monsoon. The number of occasions of weak development is more in the South-west Monsoon than in the North-east Monsoon.

(iii) Agriculturally from the consideration of rainfall in the period 13th July to 23rd August in the South-west Monsoon season and in the month of October in the North-east Monsoon season, there were fifteen unfavourable years in the South-west Monsoon season and nineteen in the North-east Monsoon season in a period of fifty-seven years. In six years both the monsoons had been agriculturally unfavourable. The possibility of continuous failure of rains in the typical sowing period of dry land cotton crop and that too continuously even for three years is more pronounced than that in the case of dry land *cholam* crop.

This study has brought to light that the occurrence of droughty weeks and spells of droughty weather of four weeks and above of duration is more common in the South-west Monsoon season than in the North-east Monsoon season.

Further, it has been established that the North-east Monsoon, inspite of its being a retreating monsoon, is more well-defined and dependable for rains than the main South-west Monsoon.

But, agriculturally the timely sowing rains in the North-east Monsoon season had failed on nineteen occasions in a period of fifty-seven years, whereas such occasions were only fifteen in the South-west Monsoon season. Further, in the case of the North-east Monsoon such failure of rains consecutively for three years had been noted on two occasions and for two years on three occasions, while in the South-west Monsoon season there were only three occasions, of two consecutive years. So it may be mentioned that in and round about Coimbatore sowing of dry land crops like *cholam* and *Karunganni* cotton has to be taken up with some risk only. But the chances of successful raising of dry land crops are fairly bright in as much as the dry *cholam* crop will be benefited by the North-east Monsoon rains and *Karunganni* cotton by the early summer showers. In agriculture, particularly in rain-fed areas, speculation is necessary to some extent and the farmers also are aware of the same.

Acknowledgement: The author's thanks are due to all those, who have been responsible for the collection of the rainfall data, that have been made use of in this study. His thanks are also due to Kumari T. P. Anna for her assistance in the compilation of the data.

REFERENCES

1. Balasubramanian, C. 1958 Monsoons in Coimbatore. *Madras Agric. J.* 45 (1): 13-18.
 2. Mallik, A. K. and T. S. Govindaswamy 1963 The Drought Problem of India in relation to Agriculture. *Annals of Arid Zone* 1 (2): 106-113.
 3. Venkatanarasinga Rao, M. B. and C. Balasubramanian 1949 Forty-two years Rainfall data, collected in the Observatory attached to the Agricultural College and Research Institute, Coimbatore. *Ind. Geographical J.* 24 (4): 32-38.
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