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A Note on the Germination of Neem Seeds

(*Azadirachta indica A. Juss.*)

by

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The neem tree (*Azadirachta indica*) is economically an important one in that it gives valuable timber and yields good quality seeds containing 35% to 40% oil. Its bark, gum, leaves, oil etc., are put to a variety of uses in medicine. In recent years much emphasis has been laid on the importance of large-scale planting of oil bearing trees such as Iluppai (*Bassia* sp), Neem (*Azadirachta* sp), Pungam (*Pongamia glabra*) and Pinnai (*Calophylum inophylum*). Of these neem is a very common and quick-growing tree and its planting on a large scale is generally done during *Vanamahotsava* commencing from July–August. The propagation of this tree is only through the seed and as such the seeds are to be preserved carefully and utilised for raising seedlings for planting. Neem trees begin to flower during February–March and fruits ripen and begin to drop down from June. Some birds like Crows, Mynahs and Cuckoos eat the whole fruits and the seeds come out along with their excreta. The seeds that are found shed underneath the trees are collected by poor people in the villages and sold to the oil-crusher.

Neem seeds extracted from freshly picked fruits, dried in sun for 3 to 5 days and stored under ordinary room conditions were found to loss viability within a few weeks. Similar observation was also noted in the case of seeds collected near about the trees. Seedlings raised from fresh seeds available during the months of June and July do not stand transplantation in January as they are overgrown. If the planting of neem seedlings are to be done during July–August when the monsoon rains set in. seedlings of optimum age should become available to the planter. But seedlings of three months age can be supplied only if the seeds are sown in the nursery some time during April—May. This means the seeds require to be stored from the period of harvest in August to April.

The work on neem seeds reported herein was bsgun in 1956 to study the loss of viability under different conditions of humidity, and repeated during 1957.

Materials and Methods: The neem trees commonly grown can be classified into two groups; (a) trees yielding round seeds and (b) trees yielding elongated or oblong seeds. Both round and elongated seeds were used for the study and they were collected during June–July from known trees (more than 10 years old). Depulped white (Prasan, 1941) seeds were taken up for storage under different humidity and temperature levels. The depulped white seeds were dried in the sun for three to five days and stored under four conditions in the first year viz., control (room temperature, 28°C), 0°C, and 25% and 50% humidity levels. Concentrated sulphuric acid was used and its normality was modified as described by Puri (1949) to give the requisite humidity levels. In the second year there were three treatments viz.. control, 40% and 80% humidity levels. Samples were taken monthly and viability assessed by germinating the seeds in sand, in the green house.

Observations and Results: The elongated type of seeds were found to lose their viability less rapidly than the round shaped ones. Storing at 0°C appeared to destroy the viability of the seeds completely. The fall in viability was reduced at 25% and 50% humidity levels. Similar trends were observed in the experiments carried out during the second year as well (Tables I and II).

Discussion: The loss of viability in general is rapid. Storing at 0°C was found to kill the embryo in the seeds completely. Similar observations were made in groundnut (Gopalakrishnan, 1955–56). The round seeds stored in the month of July under most of the conditions of storage lost viability more rapidly than the elongated ones. There is a steep fall up to August–September and a steady level is maintained for a couple of montns thereafter. After November the curve dips down to zero (Graph) under different humidity levels of storage. It is well known that under humidity conditions the longevity of seeds may be prolonged. Similar observations have been reported by Johnson (1946) in *Populus* and *Ulmus*.

Summary and Conclusions: Studies conducted to test the loss of viability of neem seeds under different humidity and temperature levels revealed that humidity treatments tended to delay the rapid loss of viability. Storing at 0°C has been observed to kill the embryo in the seeds.

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TABLE I

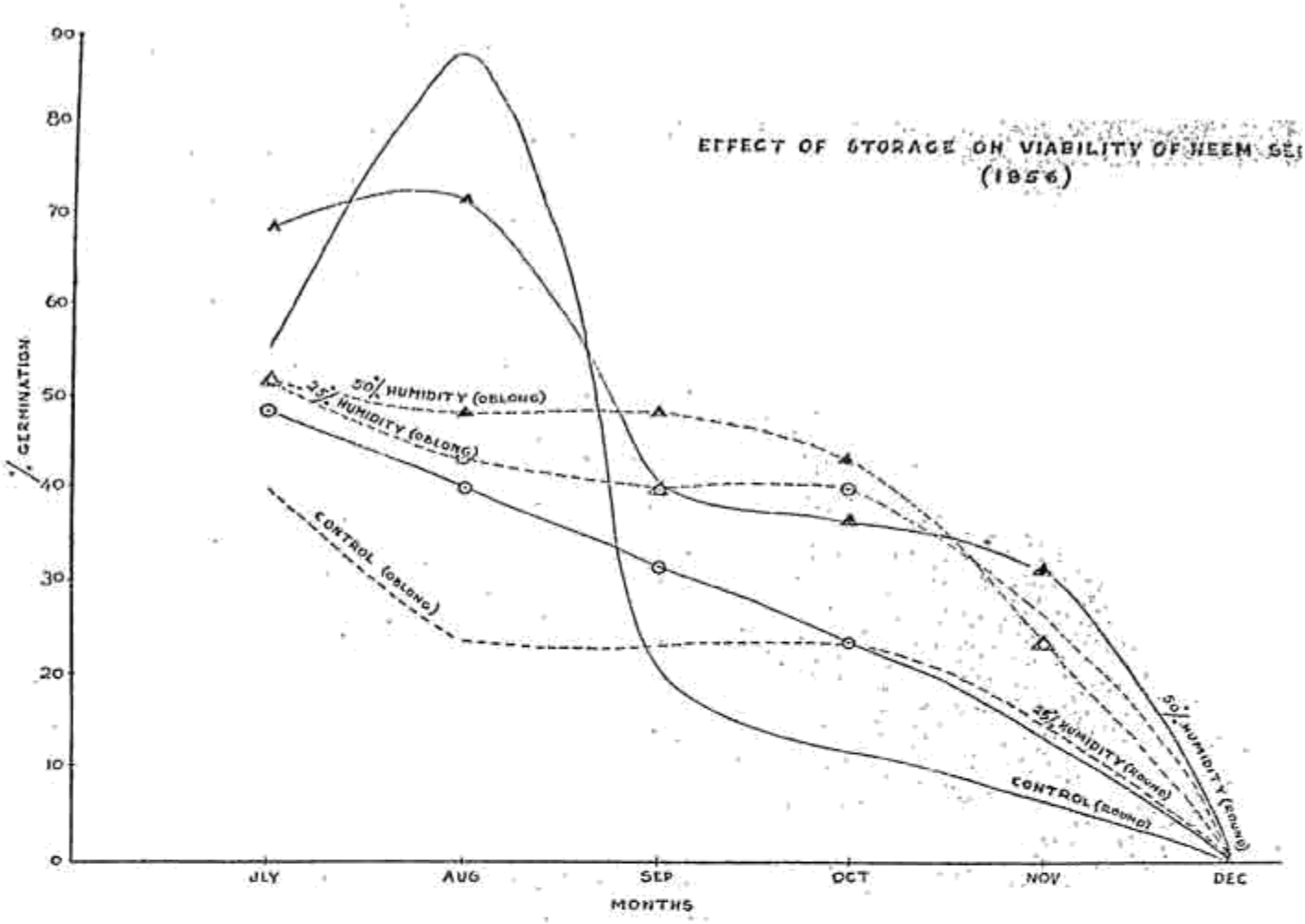
Effect of Humidity on the viability of neem seeds (I year). *Date on Mean percentage of germiuation* (Mean of 5 replications). (1956)

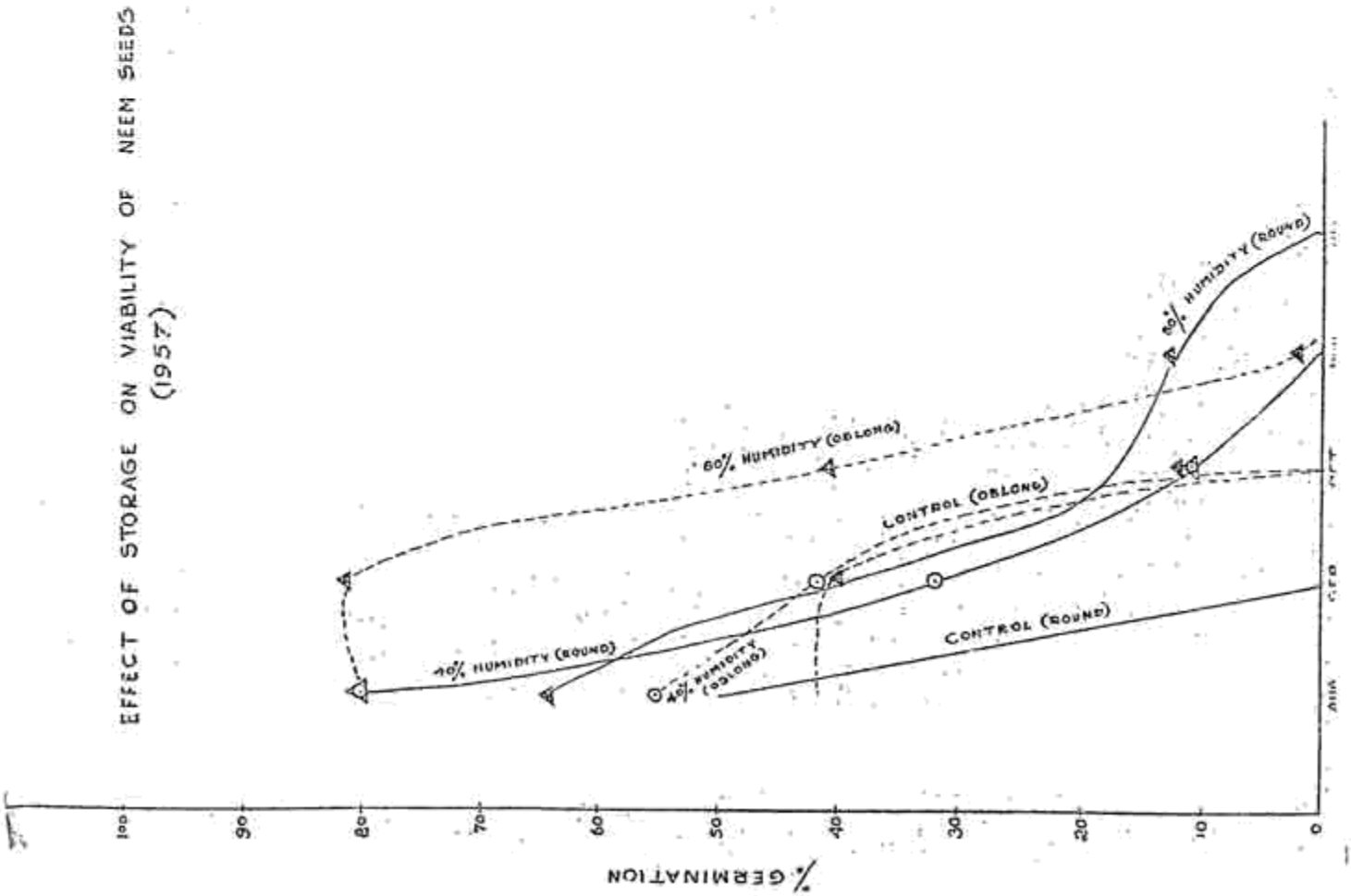
Treatments	Type of seed	July	Aug.	Sep.	Oct.	Nov.
Control	Round	56	88	20	12	16
28°C	Elongated	40	24	24	24	12
0°C	Round	Nil	Nil	Nil	Nil	Nil
	Elongated	Nil	Nil	Nil	Nil	Nil
25% Humidity	Round	48	40	32	24	24
	Elongated	52	44	40	40	44
50% Humidity	Round	68	72	40	36	32
	Elongated	52	48	48	44	24

TABLE II

Date on Mean percentage of germination (Mean of 5 replications). (1957)

Treatments	Type of seed	Aug.	Sep.	Oct.	Nov.
Control	Round	50·0	..	...	...
	Elongated	42·0	41·0	...	...
40% Humidity	Round	80·0	32·0	11·0	...
	Elongated	56·0	42·0	...	...
80% Humidity	Round	65·0	40·0	12·0	13·0
	Elongated	80·0	82·0	41·0	2·0


EFFECT OF STORAGE ON VIABILITY OF NEEM SE
(1956)
% GERMINATION
90
80
70
60
50
40
30
20
10
0
50% HUMIDITY (OBLONG)
25% HUMIDITY (OBLONG)
CONTROL (OBLONG)
50% HUMIDITY (ROUND)
25% HUMIDITY (ROUND)
CONTROL (ROUND)
JLY
AUG
SEP
OCT
NOV
DEC
MONTHS


EFFECT OF STORAGE ON VIABILITY OF NEEM SEEDS
(1957)
60% HUMIDITY (ROUND)
60% HUMIDITY (OBLONG)
CONTROL (OBLONG)
40% HUMIDITY (ROUND)
40% HUMIDITY (OBLONG)
CONTROL (ROUND)
100
90
80
70
60
50
40
30
20
10
0
% GERMINATION

Rainfall Pattern at Tindivanam (South Arcot District)

by

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Introduction: There is an Agricultural Research Station at Tindivanam. The main aim of this station is to improve the yields, by selection and breeding, of three main oilseeds crops, namely Groundnut, Gingelly and Castor. Prior to the opening of this station in May, 1935 similar research work on these three important oilseeds was done at Palakuppam. As major portion of crop cultivation in this station is under rain-fed condition, the study of rainfall pattern was taken up to know all about its variation.

Materials and Methods: The daily rainfall data collected for a period of thirty-three years - 1925 to 1957, both inclusive - were compiled from the Station records.

Methods: The monthly distribution of rainfall in quantity and number of rainy days was computed and its range of variation, extent of contribution to the annual pattern of rainfall and its standard deviation and coefficient of variation were worked out. Likewise for the four main seasons of the year, namely, Dry Weather Period of January and February, Hot Weather Period of March to May, South-west Monsoon Period of June to September and North-east Monsoon Period of October to December, the pattern of rainfall, both in quantity as well as distribution, range of variation, extent of contribution to the annual pattern of rainfall and its standard deviation and cofficient of variation were worked out for each period.

The dates of onset and cessation of the South-west Monsoon, which is the main monsoon and the North-east Monsoon, known otherwise as the retreating monsoon, were culled separately. The duration of activity of each monsoon in days was also worked out. The probable periods of the onest of these two monsoons were also assessed.

The intermonthly and interseasonal correlations were worked out seperately for the total rainfall and number of rainy days. The relationship between the duration of activity of each monsoon and the pattern of rainfall in that particular monsoon was also estimated.

Discussion : (i) The details of the monthly and seasonal pattern of rainfall, the nature of their range of variation and extent of contribution to the annual pattern of rainfall and their respective standard deviations and coefficients of variation are furnished in Table I. The following tentative inferences are drawn from this table.

(a) In regard to monthly rainfall the coefficient of variation is lowest for the months of August, September and October. This means that some rains are sure to be had in these three months. This inference is also supported by the nature of the range of variation of rainfall in these three months. A similar inference is drawn in regard to the number of rainy days. As in the case of rainfall, in the case of rainy days also, the coefficient of variation is lowest for these three months of August, September and October.

(b) Coming to the seasonal rains the coefficient of variation is lowest for the two monsoon periods. This indicates that rains are likely to be in good amount in these two monsoon periods. The nature of the range of variation of rainfall in these two monsoon periods is in unison with this inference. In a similar manner the coefficient of variation is lowest in the case of rainy days also in the two monsoon periods.

(c) From the point of view of the extent of contribution to the annual rainfall by the different monthly rainfalls, the months of October and November seem to be the rainiest months in the year. These two months constitute the major portion of the North-east Monsoon period, in which 50·2% of the annual rainfall is received. Out of this 50·2%, 40·3% of rains are received in these two months of October and November. This connotes that the North-east monsoon is more important than the main South-west Monsoon from the point of view of total rainfall, inspite of its being only the retreating monsoon.

(d) In regard to the number of rainy days the difference is not much between these two monsoons. This clearly shows that the intensity of rainfall in the North-east Monsoon period of October to December is more than that of the South-west Monsoon period of June to September.

(ii) The probable weekly periods of onset of each of the South-west, and North-east, monsoon and the number of years in which the onset has actually occurred in everyone of these weekly periods are given in Table II. The probable period of the onset of

the South-west Monsoon appears to be from 20th May to 30th June, as in 25 out of 32 years this monsoon has actually set in this period. In one year, i. e., in 1926 the onset of the South-west Monsoon was not clear. If some more data are collected, it may be possible to narrow down the duration of the probable period of the onset of the South-west monsoon.

In regard to the onset period of the North-east monsoon, it is fairly well defined. Invariably in the first week of October this monsoon is likely to set in. In 26 out of 33 years the North-east monsoon has actually set in the first week of October.

Another inference from the data compiled in this connection is that the break period between these two monsoons has a wide range of variation from Zero to 34 days. But in 22 out of 33 years this break period is only within nine days. Hence, the tentative inference is that the retreating monsoon is likely to follow in fairly close succession the main monsoon.

As regards the duration of activity of these two monsoons, the duration of the South-west Monsoon varies with a range of 67 to 140 days, as in some years this monsoon sets very early in the month of May itself. The range of variation of active period of the North-east monsoon is from 44 to 91 days.

(iii) The particulars of inter-monthly correlations are presented in Table III. Only three out of the sixtysix correlations worked out in this connection are statistically significant from the point of view of the value of the correlation coefficient (r) being greater than twice the valve of the Standard Error (S. E.).

They are given hereunder :—

(a) February and June
(b) February and October
(c) March and October

The tentative inference is that if the rains are above normal in the month of February, it is fairly an indication of the timely and vigorous onset of both the monsoons. The heavy rains in the month of March may also indicate the vigorous onset of the North-east monsoon in the month of October.

(iv) the details of inter-seasonal correlations of the pattern of rainfall and the nature of their significance are incorporated in TableIV. The following tentative inferences are drawn from this table:

(a) The rains in the Hot Weather Period of March to May is significantly correlated in a positive manner with the annual rainfall. This is explainable, since in some years the South-west monsoon sets in vigorously very early even in the second week of May itself. In the year 1943, for instance, 32·15″ of rain were recorded in the month of May due to the very vigorous and early onset of the South-west monsoon in that year.

(b) The number of rainy days in the South-west monsoon period of June to September is significantly and positively correlated with the annual number of rainy days. It should be so since this particular monsoon period covers four months i. e., one third of the year.

(c) As regards the pattern of rainfall in the North-east Monsoon period of October to December, it is very highly correlated in a positive manner with the annual pattern of rainfall. This highly significant correlation may be due to the contribution of rainfall and number of rainy days in this period to the annual rainfall and number of rainy days to the extent of 50·2 and 44·5 per cent respectively.

(v) Pertaining to the duration of activity of each of these two monsoons and its influence on its pattern of rainfall, the inference is that the duration of activity of the South-west monsoon influences the number of rainy days in this monsoon period ($r = +0{\cdot}35 \pm 0{\cdot}17$). With reference to the North-east Monsoon the duration of its active period influences considerably the pattern of rainfall in this period (Rainfall $r = +0{\cdot}52 \pm 0{\cdot}15$; Number of rainy days $r = +0{\cdot}56 \pm 0{\cdot}15$). The broad inference is that greater is the active period of each monsoon, more will be its scope for its normal and satisfactory performance.

Conclusion: The tract, where the Agricultural Research Station, Tindivanam is located, depends for its rain both on South-west Monsoon and North-east Monsoon. The North-east Monsoon is usually heavy and cyclonic in nature and it is in this period that the numerous irrigation tanks, characteristic of the tract, get filled up with water, which is subsequently used for irrigation purposes.

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Monthly and Seasonal Rainfall Pattern

S. No.	Month or Season	Rainfall					Number of Rainy Days					Remarks
		Average in inches	Range of variation	Percentage on annual	Standard Deviation	Coefficient of variation %	Average	Range of variation	Percentage on annual	Standard Deviation	Coefficient of variation %	
1.	January ..	1·13	Nil to 6·30	2·8	1·43	126·63	2	Nil to 9	3·7	2·06	103·00	* A day with ten cents and above of rain is taken as a rainy day.
2.	February ..	0·52	Nil to 7·27	1·3	1·40	269·30	1	Nil to 5	1·8	1·55	155·00	
3.	March ..	0·93	Nil to 6·94	2·3	1·65	177·40	1	Nil to 6	1·8	1·39	139·00	
4.	April ..	1·05	Nil to 4·45	2·6	1·20	114·30	1	Nil to 4	1·8	1·32	132·00	
5.	May ..	2·34	Nil to 32·15	5·8	5·60	239·30	2	Nil to 8	3·7	2.06	103·00	
6.	June ..	1 98	0·05 to 5·34	4·9	1·63	82·31	3	Nil to 8	5·6	2·16	72·00	
7.	July ..	2·75	0·30 to 14·07	6 8	2·65	96·36	5	1 to 11	9·3	2·65	53·00	
8.	August ..	4·94	0·49 to 13·72	12·1	2·83	57·29	8	2 to 17	14·8	3·35	41·88	
9.	September ..	4·56	0·13 to 11·48	11·2	2·54	55·69	7	Nil to 12	13·0	2·67	38·14	
10.	October ..	7·79	0·61 to 22·23	19·2	4·51	57·90	10	2 to 18	18·5	4·16	41·60	
11.	November ..	8·59	Nil to 26·04	21·1	5·95	147·20	9	Nil to 20	16·7	4·66	51·78	
12.	December ..	4·04	Nil to 19·77	9 9	4·71	116·60	5	Nil to 14	9·3	3·43	68 60	
13.	Dry Weather Period (January and February) ..	1·65	Nil to 10·32	4·1	4·48	271·50	3	Nil to 9	5·5	2·45	81·67	
14.	Hot Weather Period (March to May) ..	4·32	Nil to 34·18	10·7	5·95	137·73	4	Nil to 12	7·3	2·54	50·80	
15.	South-west Monsoon Period (June to September) ..	14·23	6·13 to 45·50	35·0	6·98	44·15	23	15 to 34	42 7	5·40	23·48	
16.	North-east Monsoon Period (October to December) ..	20·42	4·30 to 41·51	50·2	9·48	46·63	24	9 to 38	44·5	7·23	31·43	

TABLE II

Probable Onset Periods of the South-west and North-east Monsoons 1925 to 1957

S. No.	South West Monsoon		North East Monsoon		Remarks
	Period	No. of onsets	Period	No. of onsets	
1.	13th to 19th May	3	1st to 7th October	26	In 1926, the onset of the South-west monsoon was very weak
2.	20th to 26th May	7	8th to 14th October	4	
3.	27th May to 2nd June	3	15th to 21st October	Nil	
4.	3rd to 9th June	3	22nd to 28th October	1	
5.	10th to 16th June	6	29th October to 4th November	2	
6.	17th to 23rd June	1	..	..	
7.	24th to 30th June	5	..	..	
8.	1st July to 7th July	1	..	..	
9.	8th to 14th July	1	..	..	
10.	15th to 21st July	2	..	..	

TABLE

Intermonthly

S. No.	Month	January		February		March		April		May		June	
		r ± S.E	S	r ± S.E	S	r ± S.E	S	r ± S.E	S	r ± S.E	S	r ± S.E	S
1.	Jan. ..			+0·12 ±0·18	Not	—0·09 ±0·18	Not	—0·26 ±0·17	Not	+0·15 ±0·18	Not	—0·10 ±0·18	Not
2.	Feb. ..					+0·28 ±0·17	Not	—0·19 ±0·18	Not	+0·14 ±0·18	Not	+0·37 ±0·17	Yes
3.	Mar. ..							—0·02 ±0·18	Not	—0·05 +0·18	Not	—0·07 +0·18	Not
4.	Apr. ..									+0·13 +0·18	Not	—0·06 ±0·18	Not
5.	May ..											—0·05 ±0·18	Not
6.	June ..												
7.	July ..												
8.	Aug. ..												
9.	Sept. ..												
10.	Oct. ..												
11.	Nov. ..												

Note: (1) 0*1 r = + 0·3409 ± 0·1688.; *2 = r = + 0·0044 ± 0·1796

Note: (2) r = correlation coefficient S. E. = Standard Error S. = Significance

No. III

Correlations (1925—1957)

July		August		September		October		November		December	
r ± S.E	S	r ± S.E	S	r ± S.E	S	r ± S.E	S	r ± S.E	S	r ± S.E	S
+0·12 ±0·18	Not	—0·25 ±0·17	Not	+0·14 ±0·18	Not	+0·31 ±0·17	Not	—0·20 ±0·18	Not	—0·12 ±0·18	Not
—0·17 ±0·18	Not	—0·07 ±0·18	Not	—0·18 ±0·18	Not	+0·41 ±0·16	Yes	+0·02 ±0·18	Not	—0·13 ±0·18	Not
+0·16 ±0·18	Not	+0·08 ±0·18	Not	—0·11 ±0·18	Not	+0·34*1 ±0·17	Yes	—0·03 ±0 18	Not	+0·13 ±0·18	Not
—0·14 ±0·18	Not	+0·09 ±0·18	Not	—0·03 ±0·18	Not	—0·09 ±0·18	Not	+0·05 ±0·18	Not	—0·17 ±0·18	Not
—0·11 ±0 18	Not	+0·09 ±0·18	Not	—0·11 ±0·18	Not	+0·07 ±0·18	Not	—0·13 ±0·18	Not	+0·03 ±0·18	Not
—0·12 ±0·18	Not	+0·11 ±0·18	Not	+0·03 ±0·18	Not	+0·09 ±0·18	Not	+0·10 ±0·18	Not	—0·22 ±0·18	Not
		+0·05 ±0·18	Not	—0·25 ±0·17	Not	+0·06 ±0·18	Not	—0·26 ±0·17	Not	—0 04 ±0·18	Not
				+0·01 ±0·18	Not	+0·22 ±0·18	Not	+0·04 ±0·18	Not	+0·05 ±0·18	Not
						—0·24 ±0·17	Not	—0·09 ±0·18	Not	—0·09 ±0·18	Not
								+0·12 ±0·18	Not	+0·09 ±0·18	Not
										+0·00*2 ±0·18	Not

based on r being greater than 2 S. E. in value.

TABLE IV

Inter Seasonal Correlations (1925 — 1957)

S. No.	Nature of Period.	Hot Weather Period		South-west Monsoon Period		North-east Monsoon Period		Annual		Remarks
		Rainfall	No. of rainy days	Rainfall	No. of rainy days	Rainfall	No. of rainy days	Rainfall	No. of rainy days	
		r ± S. E.	r ± S. E.	r ± S. E.	r ± S. E.	r ± S. E.	r ± S. E.	r ± S. E.	r ± S. E.	
1.	Dry Weather Period	+0·1983 ±0·1760	+0·0594 ±0·1793	+0·0462 ±0·1794	—0·2542 ±0·1737	+0·0732 ±0·1791	—0·1053 ±0·1795	+0·2985 ±0·1714	—0·0499 ±0·1794	
2.	Hot Weather Period			—0·0771 ±0·1791	—0·2023 ±0·1759	+0·0152 ±0·1796	No correlation	+0·5093** ±0·1546	+0·1718 ±0·1769	Remarks typed below
3.	South-west Monsoon Period					—0·1271 ±0·1781	+0·0321 ±0·1795	+0·2338 ±0·1746	+0·4693** ±0·1586	
4.	North-East Monsoon Period							+0·7584*** ±0·1171	+0·7901*** ±0·1101	

1. A day with ten cents and above of rain is taken as a rainy day
2. r ± S. E. (r = correlation coefficient; S. E. = Standard error)
3. Value of r for the leavels of P=0·01 (**) and P=0·001 (***) are respectively 0·4426 and 0·5471