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## A NOTE ON DURATION OF SUNSHINE AT COIMBATORE

*1. Introduction*—One of the aims of research in Agricultural Meteorology is to assess the nature of relationship existing between the microclimate and crop growth. Next to rainfall, sunshine plays an important role in effecting fluctuations in the microclimate of a crop. Bright sunshine is of immense value during harvest season. Lack of bright sunshine, or in other words, continuous cloudiness in the months of November and December is conducive for the spread of fungal diseases in the standing crops in Madras State. Considering the importance of sunshine, the analysis of the number of hours of bright sunshine recorded at the Agricultural College and Research Institute from 1929 to 1935 and at the Cotton Breeding Station from 1938 to 1950, was taken up to study the relationship among the different months. Some interesting correlations are discussed in the following paragraphs.

*2. Material and methods*—The daily sunshine values were collected from the records of the Campbell Stokes type of sunshine recorder kept on the terrace of the Agricultural College and Research Institute, Coimbatore from 1929 to 1935 and again reinstalled at the Cotton Breeding Station, Coimbatore, a place seven furlongs away from the original site, in the year 1938. As the two stations are only seven furlongs apart, within the Agricultural College Estate, no appreciable difference between the sunshine values of the two sites were expected and the two sets of data were taken to be homogeneous. Therefore, the data collected from 1929 to 1950 (except the years 1936 and 1937) were treated as a single series for the analysis.

With the above data collected for 20 years, 66 inter-monthly correlations were worked out, out of which, presented in Table 1, only three correlations which are indicated in thick types are significant. The significant correlations and their respective regression equations have been furnished in Table 2.

Weekly data were further analysed for the significant months of February and March, April and December, and July and September and 84 inter-weekly correlations were worked out. Details regarding the significant inter-weekly correlations with their corresponding regression equations are given in Table 3.

In Table 4 have been furnished the correlation co-efficients of monthly mean duration of sunshine and the maximum temperature.

In testing the significance of a large number of correlations the ordinary test ($r > 2SE$) mentioned above is not sufficient. Walker and later Savur and Gopala Rao have developed tests based on the probability distribution of the highest of a number of correlation co-efficients. The above correlation co-efficients have been tested with reference to these tests also and the results are discussed in the next paragraph.

*3. Significance of the correlations*—From Table 4 it is seen that, using the ordinary tests of significance, sunshine in the month of February is correlated significantly with that of March. Similarly, the sunshine during the hot weather period of April bears a negative correlation with that of the fag end of the northeast monsoon, namely December. It is seen also that sunshine during July has a positive significant correlation with that of September. Using Walker's (1914) criterion for significance, it is seen that only correlation co-efficients greater than 0·4258 may be deemed to be significant. But applying a more stringent test (Savur 1932), the '5 per cent chance' of highest value of $Z$ due to accident is ·6871 , the corresponding value of $r$ being 0·5961. By this test, none of the inter-monthly correlations can be considered significant.

Using the ordinary tests of significance among the inter weekly correlations, the noteworthy points are that the sunshine during the first week of July bears a positive

TABLE 1

**Inter-monthly correlation of sunshine date at Agricultural College and Research Institute, Coimbatore**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | .. | —0·26 | —0·30 | +0·24 | —0·30 | —0·02 | +0·13 | +0·34 | +0·03 | +0·02 | +0·04 | +0·17 |
| Feb | .. | .. | +0·49 | +0·12 | +0·05 | +0·28 | +0·32 | —0·04 | +0·42 | +0·01 | +0·11 | —0·13 |
| Mar | .. | .. | .. | +0·04 | —0·17 | +0·06 | +0·31 | —0·41 | +0·38 | +0·08 | +0·12 | +0·01 |
| Apr | .. | .. | .. | .. | —0·08 | +0·38 | +0·01 | —0·11 | +0·16 | +0·16 | —0 03 | —0·44 |
| May | .. | .. | .. | .. | .. | —0·26 | +0·20 | —0·18 | +0·16 | +0·27 | +0·16 | —0·31 |
| Jun | .. | .. | .. | .. | .. | .. | +0·04 | —0·17 | +0·25 | +0·14 | —0·37 | —0·01 |
| Jul | .. | .. | .. | .. | .. | .. | .. | —0·12 | +0·50 | +0·04 | —0·22 | —0·11 |
| Aug | .. | .. | .. | .. | .. | .. | .. | .. | —0·07 | —0·37 | +0·14 | +0·36 |
| Sep | .. | .. | .. | .. | .. | .. | .. | .. | .. | +0·04 | —0·15 | —0·14 |
| Oct | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | —0·05 | —0·25 |
| Nov | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | —0·05 |

TABLE 2

**Significant inter-monthly correlations**

| S. No. | Details of correlations | Correlation co-efficient $r=$ | Regression equation | Remarks : Significant at |
|---|---|---|---|---|
| 1 | February and March | +0·4944 ±0·2049 | $Y = +0·5028X + 4·89$ | $P=0·05$ level |
| 2 | April and December | —0·4399 ±0·2117 | $Y = -1·0477X - 2·02$ | $P=0·05$ level |
| 3 | July and September | +0·4960 ±0·2047 | $Y = +0·3963X + 5·17$ | $P=0·05$ level |

(Where $X$ is the value of the former month and $Y$ is the probable value of the latter month corresponding to value of $X$)

significant correlation with that of September fourth week and the sunshine of July third week with those of July fourth week and September second week. All values above even $r = ·3848$ may be taken to be significant according to Walker's (1914) criterion, but anyhow values above $r = ·5724$ only can be deemed to be significant by the more stringent test of ' 5 per cent chance '. Even by this severe test significant correlations are obtained in the sunshine values of the following periods.

February third week and
February fourth week

March third week and
March fourth week

April third week and
April fourth week

July first week and
September fourth week

July third week and
September second week

There is a negative significant correlation between the sunshine of April first week and December second week at $P = ·05$ level under ordinary tests of significance.

**TABLE 3**

**Significant inter-weekly correlations**

| S. No. | Details of correlations | Co-efficient of correlation ($r$) with S. E. | Regression equation | Remarks: Significant at |
|---|---|---|---|---|
| 1 | Feb 3rd wk *vs* Feb 4th wk | +0·6328 ±0·1825 | $Y = +0·5710X+4·62$ | $P = 0·01$ level |
| 2 | Feb 3rd wk *vs* Mar 1st wk | +0·4479 ±0·2107 | $Y = +0·3342X+6·54$ | $P = 0·05$ level |
| 3 | Feb 4th wk *vs* Mar 1st wk | +0·4691 ±0·2081 | $Y = +0·3877X+5·80$ | $P = 0·05$ level |
| 4 | Mar 3rd wk *vs* Mar 4th wk | +0·6378 ±0·1815 | $Y = +0·8189X+1·32$ | $P = 0·01$ level |
| 5 | Apr 1st wk *vs* Dec 2nd wk | —0·4883 ±0·2057 | $Y = +0·31—0·8593X$ | $P = 0·05$ level |
| 6 | Apr 3rd wk *vs* Apr 4th wk | +0·5850 ±0·1888 | $Y = +0·8440X+1·14$ | $P = 0·01$ level |
| 7 | Dec 2nd wk *vs* Dec 3rd wk | +0·5618 ±0·1950 | $Y = +0·5479X—3·50$ | $P = 0·01$ level |
| 8 | Jul 1st wk *vs* Sep 4th wk | +0·7051 ±0·1671 | $Y = +0·7342X+4·26$ | $P = 0·01$ level |
| 9 | Jul 3rd wk *vs* Jul 4th wk | +0·5520 ±0·1965 | $Y = +0·4344X+3·00$ | $P = 0·02$ level |
| 10 | Jul 3rd wk *vs* Sep 2nd wk | +0·5915 ±0·1900 | $Y = +0·3812X+4·58$ | $P = 0·01$ level |
| 11 | Jul 4th wk *vs* Sep 2nd wk | +0·4487 ±0·2106 | $Y = +0·3674X+4·61$ | $P = 0·05$ level |

**TABLE 4**

**Correlation between duration of bright sunshine and Maximum Temperature**

| | | | |
|---|---|---|---|
| Jan | +0·1438 ±0·2400 | Jul | +0·4008 ±0·2159 |
| Feb | +0·0453 ±0·2423 | Aug | +0·4188 ±0·2083 |
| Mar | +0·4197 ±0·2202 | Sep | +0·5548 ±0·1961 |
| Apr | +0·3291 ±0·2290 | Oct | +0·6971 ±0·1730 |
| May | +0·6839 ±0·1720 | Nov | +0·7845 ±0·1438 |
| Jun | +0·3936 ±0·2167 | Dec | +0·5201 ±0·2013 |

TABLE 5

**Monthly means of number of hours of bright sunshine and the maximum temperature for the period 1920 to 1950 (except 1936 and 1937)**

| Month | Number of hours of bright sunshine | | | Maximum Temperature | | |
|---|---|---|---|---|---|---|
| | Mean | S. D. | S. E. | Mean | S. D. | S. E. |
| January | 8·48 | 0·8616 | 0·1977 | 85·5 | 1·2850 | 0·2948 |
| February | 9·32 | 0·6612 | 0·1517 | 90·0 | 1·2230 | 0·2306 |
| March | 9·61 | 0·6720 | 0·1542 | 94·8 | 1·2840 | 0·2946 |
| April | 8·79 | 0·4805 | 0·1102 | 95·7 | 1·3170 | 0·3021 |
| May | 8·23 | 1·0600 | 0·2370 | 94·8 | 2·3780 | 0·53 |
| June | 5·88 | 1·0700 | 0·2393 | 89·4 | 2·1879 | 0·4890 |
| July | 4·85 | 1·2830 | 0·2869 | 87·4 | 0·8847 | 0·1978 |
| August | 6·21 | 0·8375 | 0·1828 | 88·5 | 1·1150 | 0·2433 |
| September | 7·17 | 1·0030 | 0·2444 | 89·5 | 1·5630 | 0·3495 |
| October | 6·66 | 0·8366 | 0·1871 | 87·7 | 1·4070 | 0·3146 |
| November | 6·49 | 1·2910 | 0·2887 | 85·0 | 1·6290 | 0·3643 |
| December | 7·17 | 1·1210 | 0·2506 | 85·0 | 1·3900 | 0·3108 |

To find out the relation between the duration of bright sunshine to the maximum temperature, the monthly means of both the elements were tested for their correlation. Positive significant correlations were obtained only for the months of May, August, September, October, November and December, proving thereby that only during these months maximum temperature is in direct relation to the number of hours of bright sunshine. The results have been furnished in Table 4. In addition, the monthly means of sunshine values and maximum temperatures, with their respective standard deviations and standard errors have been furnished in Table 5.

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