Mausam, (1982), **33**, 2, 263-266

Letters to the Editor

551.521.1 : 551.521 (548)

COMPARATIVE STUDY OF SOLAR ILLUMINATION AND GLOBAL RADIATION AT BANGALORE

1. Solar illumination is one of the criteria that decides the growth of plants. This factor is not only responsible for the occurrence of photosynthesis but also the growth pattern. The different phases of crop growth of most of the crops depend on solar illumination. Further, it governs the cropping system also. But the measurement of this parameter and its usage in agrometeorology is very scarce. Usually the meteorologists as well as agricultural scientists present the data giving the number of clear and cloudy days, number of bright sunshine hours, cloud amount etc, as an indication of solar illumination and the flow of radiant energy to plants (Yadav 1965, Rao and Rao 1966, Ganesan 1972). It is an established fact that out of the entire solar radiation flux, only the radiation in the visible region (400-700 μm) affect plant life directly. Hence it is interesting to study this parameter in detail with respect to the global radiation received at the earth's surface. Narasimhan and Sarvendra Kumar (1965) studied the seasonal variations of solar illumination and computed illumination equivalent during clear sky conditions. In the present study an effort is made to find out a relationship between solar illumination and incoming radiation during two different sky conditions, namely, clear sky and variable sky over Bangalore region, in view of the fact that most of the cropping season in this region experience more number of cloudy days thereby limiting the availability of light.

2. The light intensity measurements were made using a Luxomet-300 S. The amount of solar radiation reaching the surface of the earth was measured by N. I. precision pyranometer. The sensitive elements of both these instruments were kept on an elevated platform and were fully exposed. The observations were taken from 0630 to 1730 hr (LMT). On the clear day (14 May 1980) the observations were made at hourly interval as there would not be any sudden fluctuations in these parameters and the data are presented in Fig. 1. On the cloudy day (11 June 1980) with variable sky conditions, the observations were made at 15 min interval from 0630 to 1830 hr (LMT) and are presented in Fig. 2.

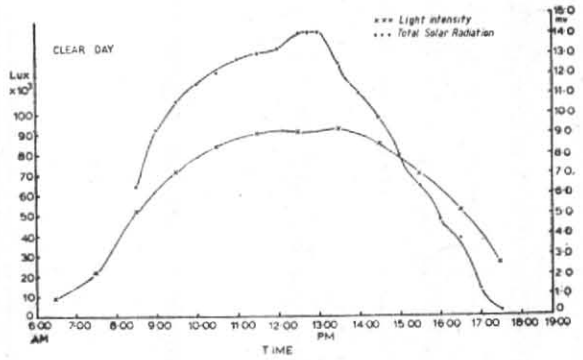

Fig. 1

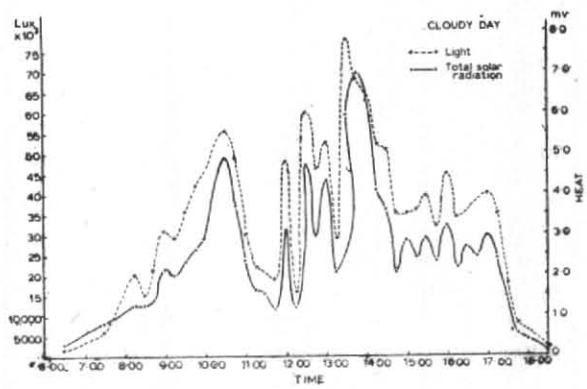

Fig. 2

3. On the clear day the solar illumination varied from 8,500 luxes to 93,000 luxes, the maximum intensity occurring at 1330 hr. The rate of increase was found to be higher before noon than the rate of decrease in the afternoon. The

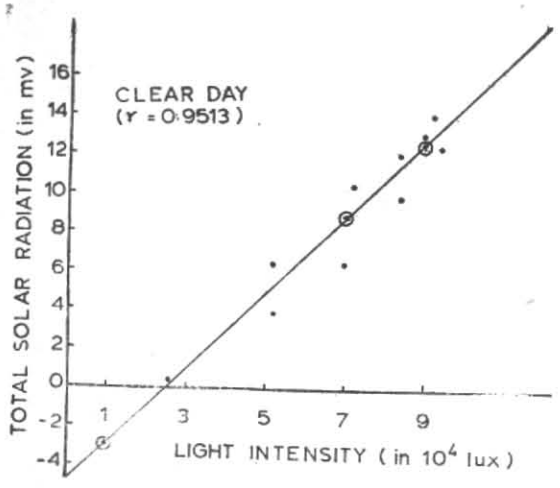

Fig. 3

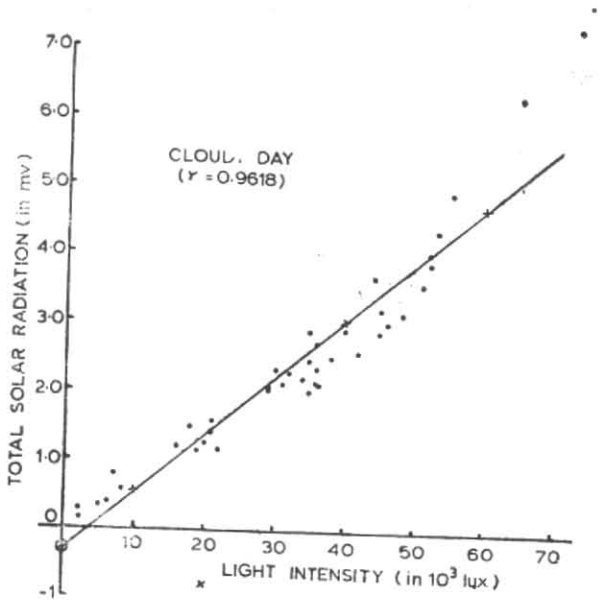

Fig. 4

light intensity had shown a sudden increase from 8,500 luxes at 0630 hr to 71,000 luxes at 0930 hr as compared to an increase of only 20,000 luxes from then onwards to noon time. While considering the rate of decrease, a variation of 21,000 luxes only was observed upto 1530 hr, and thereafter it had fallen by 44,000 luxes upto 1730 hr. Even though a similar trend of variation in global radiation was observed, the rate of increase and decrease were not as much as that of illumination. The radiation varied 0.0314 gm cal/sq-cm/min to 2.198 gm cal/sq-cm/min. It is interesting to note that the rate of increase in this parameter before noon is not as rapid as the rate of decrease in the afternoon. It increased from 1.0048 gm cal/sq-cm/min at 0830 hr to 2.198 gm cal/sq-cm/min at 1230 hr and diminished to as low as 0.0314 gm cal/sq-cm/min at 1730 hr.

On the cloudy day, due to highly variable sky conditions, the variations in light and radiation were not uniform. The illumination varied from 2,000 luxes to 73,000 luxes and the variation in radiation was from 0.0251 gm cal/sq-cm/min to 1.099 gm cal/sq-cm/min. It was observed that the maxima in light intensity and incoming radiation do not occur at the same time during the cloudy day, nor does it occur on the clear day.

The data is subjected to correlation and regression analyses. For both the days, it is found that the correlation coefficient (r) is highly significant (Figs. 3 & 4). The coefficient of determination of their inter-dependance on clear and variable sky conditions are 0.9050 and 0.9253 respectively. Even though the 'r' values on both the situations are almost equal and significant, simple regression lines are fitted to understand the effect of cloud on these parameters. These are given as below:

$$Y = -0.7969097 + 0.000030654\ X \text{ (Clear Day)}$$
$$Y = -0.046976 + 0.000017249\ X \text{ (Cloudy Day)}$$

From the analysis it is clear that for a unit variation in solar illumination, more radiation is required on cloudy day than during clear day. Further, regression coefficients are also tested to find out the differences in these two types of relationships between the two parameters under clear and variable sky conditions. It is found to be highly significant, indicating the nature of relationship between the two on the clear day is entirely different from the relationship on the variable sky.

4. This study indicates that there exists a good relationship between solar illumination and global radiation over Bangalore which is subjected to variations depending upon the state of the sky.

References

Ganesan, H.R., 1972, *Indian J. Met. Geophys.*, **23**, p. 395.

Narasimhan, K. and Sarvendra Kumar, 1965, *Indian J. Met. Geophys.*, **16**, 4, p. 677.

Rao, K.N. and Rao, D.R.K., 1966, *Indian J. Met. Geophys.*, **17**, 1, p. 17.

Yadav, B.R., 1965, *Indian J. Met. Geophys.*, **16**, 2, p. 261.

R. V. RAMAMOHAN
M. R. LAKSHINARAYANA
G. SURYANARAYANA
P. S. KAVI

Department of Physics,
University of Agricultural Sciences; Banglore
23 September 1980