

Prediction of Crop Yield for Rice, Tea and Sugarcane in Sri Lanka using Sunspot Number

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In this research, the relation of crop yields to sunspot number for tea, rice and sugarcane was studied in Sri Lanka located between latitudes 5° 55' N and 9° 51' N and longitude 79° 41' E and 81° 53' E. Parametric analysis was carried out to obtain historical coefficients for solar activity index and crop yield data, using observed yields with time, sunspot number, and cultivated area as input variables. Data on the total cultivated area (ha) with yield (hg ha⁻¹) of rice, tea and sugarcane from 1961 to 2016 were statistically analyzed. Data were obtained from Food and Agricultural Organization, Statistics Division (FAOSTAT) and online data on yearly mean total sunspot number was retrieved from World Data Center – Sunspots Index and Long term Solar Observations (WDC - SILSO). To predict crop yield, a multiple linear regression model was used which best described the relationship between sunspot number and crop yield variables using Minitab Software. The coefficient of variation depicts the relative deviation in yields of the various crops, with sugarcane yields being the highest (29.4%) and rice yields being the lowest (23.7%). During periods of maximum solar activity in the years 1968, 1989, and 2000, yields for tea and sugarcane decreased significantly while yields for rice indicated an increment. Besides, yields for tea and sugarcane increased significantly and yields for rice decreased during periods of minimum solar activity in the years 1976, 1996, and 2008. The model explained 91.93% of yield variance for rice and 82.16% of yield variance for tea also 51.51% of yield variance for sugarcane. This overall study indicates that there is a considerable contribution to yield from SSN and the pattern of yield that varies with SSN can also be identified.

Keywords: Crop yield prediction; Multiple linear regression; Solar activity; Sunspot number