Short communication

Influence of weather variability on nut yield of cashew under Bastar region of Chhattisgarh

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India has the largest area and stand as the second largest producer of cashew in the world. During the year 2018-19 the area under cashew was 11,05,000 ha with production of 7,42,714 MT with average productivity of 707 kg ha^{-1} (Anon., 2019). Cashew usually grown in subtropical to tropical region, thus weather parameters *viz.*, solar radiation, temperature, heat units, soil moisture, relative humidity etc. of those areas during different stages of crop growth are prime factors for deciding the yield as they strongly influence the physiological expression of genetic potential of the crop. High temperature (>34.4°C) and low relative humidity (<20%) during afternoon cause drying of flowers which lead to yield reduction in cashew. Studies have indicated that the rainfed cashew crop is highly sensitive to changes in climate and weather vagaries, particularly during reproductive phase (Datta 2013). In addition, unseasonal rains and heavy dew during flowering and fruiting period aggravated the incidence of pests and diseases. All of these resulted in yield reduction up to 50 to 65 per cent (Datta 2013). Keeping above concerns, a scientific analysis was done to identify the important weather variables which determines nut yield of cashew plantation under Bastar Plateau agro-climatic region of Chhattisgarh.

The study was conducted under Bastar Plateau region located in South Chhattisgarh which is in Central Plateau Zone of India sub humid tropical climate. Geographically Bastar is located between 17^0 45' to 20^0 34' N and 80^0 15'to 82^0 15' E longitude with altitude ranging from 550 m to 850 m above MSL. The region receives high rainfall with 1200-1400 mm of average annual rainfall with its peak in July and August coupled with comparatively lower temperatures and higher humidity. The maximum and minimum temperatures during peak summer and winter touches 37.4^0C and 10.0^0C, respectively. Secondary weather parameter data (daily climatic data converted in to annual data) and experimental data for cashewnut of 8 years (2010-2018) was collected from Gramin Krishi Mausam Sewa Kendra of Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur and All India Co-ordinated Research Project (AICRP) on Cashew, respectively. Weather data were utilized to workout correlation and regression analysis (Table 1) and yield data of variety Vengurle-4 was used for analysing the results which was planted in the year 1997. Model fitting, correlation analysis (Pearson), simple linear regression and step wise regression techniques were adopted in respect to study the fluctuations and the impact of weather parameters on cashew nut yield. Student's't' test technique was applied to test the significance of correlation coefficients. 'F' test was performed for testing its significance in simple linear regression and stepwise regression. In stepwise regression criteria of probability of F test of a variable to enter is F <= 0.01. Regression equations were developed for each season using the significant climatic parameters having the highest correlation coefficients. The data was analyzed using XLSTAT 2015.1 software package developed by Addinsoft.

Correlation analysis of weather parameters and cashew nut yield

The influence of weather parameters on yield as established by correlation analysis indicated that there was a significant relationship of cashew nut yield and weather parameters. Models were built in order to predict yield with the help of individual weather parameter and also by considering all the weather parameters at a time

Table 1: Correlation between yield and weather parameters
            (pooled over eight years)

Weather parameters	Correlation coefficient (r)
Maximum temperature (°C)	0.92**
Minimum temperature (°C)	0.57
Rainfall (mm)	0.20
Morning relative humidity (%)	0.53
Evening relative humidity (%)	-0.65
Wind velocity (kmph)	-0.36
Evaporation	0.87**
Bright sunshine (hours)	-0.60
Rainy days	-0.18

Significance: ** at 1 %

and eliminating non-significant parameters (step wise regression). Best models were selected based on the R^2 (coefficient of determination) values, which explains the variation in yield due to weather parameters.

Correlation coefficients between yield of cashew nut and weather parameters (Table 1) showed significant positive correlation with maximum temperature (r = 0.92**) and evaporation (r=0.87**) whereas minimum temperature, rainfall and morning relative humidity had non-significant correlation with yield. The parameters evening relative humidity, wind velocity, bright sun shine hours and rainy days had negative correlation with cashew nut yield (Table 1). Hurd and Graves (1985) suggested that by elevating the temperature often increases the fruit growth rate. Rejani *et al.* (2013) suggested that the mean annual temperature in cashew growing areas ranged from 20.0 to 27.5ºC, whereas the productivity was higher in region with 22.5 to 27.5ºC.

Stepwise regression analysis

Stepwise regression analysis between different weather parameters and nut yield   had explained considerable amount of variation. Maximum temperature along with evaporation (Y = – 45.172 + 1.433 X_1 + 2.012 X_7; R^2 = 0.89**) had explained about 89 per cent of variation. The parameters maximum temperature, evening relative humidity and evaporation has explained 99 per cent of variation (Y = –38.651+ 1.519 X_1 – 0.101 X_5 + 0.975 X_7; R^2 = 0.99**) whereas maximum temperature,

evening relative humidity, evaporation and bright sunshine hours (Y= – 38.583 + 1.517 X_1 – 0.101 X_5 + 0.979 X_7 – 0.003 X_8; R^2 = 0.99*) had also explained 99 per cent of variation in cashew nut yield. It indicated that maximum temperature and evaporation are important weather indices play a key role for prediction of cashew nut yield. Similar findings were reported by Yenda *et al*. (2018) that the maximum temperature which is an important weather parameter when combined with minimum temperature and evapotranspiration showed effect on fruit yield of tomato under late rabi planting condition in coastal plain zone of Odisha.

The findings of present study indicated that the weather parameters in the Bastar Plateau region of Chhattisgarh were marked by significant inter annual fluctuations and it was found that cashew yield could be predicted 89 to 99 % using weather parameters.

Conflict of Interest Statement: The author(s) declare(s) that there is no conflict of interest.

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