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Short Comminucation

Influence of weather parameters on the development of bacterial blight in cotton

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Cotton is one of the most important commercial crops of the world, referred to as "King of Fibres". India produced 351 lakh bales of 170kg lint in 2016-2017 from an area of 105 lakh ha with a productivity of 568 kg ha^{-1}, which is far behind the leading countries. Andhra Pradesh stood 6th in area (4.49 lakh ha) but 8th in production (13.10 lakh bales) and 2nd in productivity (719 kg ha^{-1}) during 2016 – 2017 (Anonymous, 2017). Cotton crop is affected by fungal, bacterial and viral diseases. In India, foliar diseases have been estimated to cause yield losses up to 20 to 30 per cent (Mayee and Mukewar,2007). Bacterial blight of cotton caused by *Xanthomonas axonopodis* pv *malvacearum* (Smith) is an economically important disease in Andhra Pradesh causing losses to the tune of 22.0 to 36.3 per cent (Bhattiprolu, 2013). Environmental conditions are known to influence the pests and disease incidence in cotton (Kumar *et al.* 2018). Understanding the influence of weather factors on disease development is prerequisite for prediction and developing management strategy of the disease. Hence the present investigation was carried to assess and predict the progress of bacterial blight in relation to environmental factors.

The effect of weather factors on the development of bacterial blight in cotton varieties *viz*., L 604, L 761, Narasimha (NA 1325), LRA 5166, Non *Bt* Bunny hybrid, Bunny Bt, RCH 2 Bt and Bunny BG II was investigated during *kharif* 2007 to 2012 in vertisols at Regional Agricultural Research Station, Lam, Guntur under rainfed conditions. The crop was raised in a bulk plot with an area of 150 m^2. Twenty five plants, in the middle rows, at random, were tagged and bacterial blight was scored on 0 to 4scale (Sheo Raj, 1988) at weekly intervals on labelled plants, starting from the appearance of the disease and expressed as Percent Disease Index (PDI) using Wheelers *et al.* (2007) formula: PDI= Sum of numerical ratings X 100/ Total Number of leaves scored x maximum disease grade

Meteorological data (maximum temperature, minimum temperature, morning relative humidity (RH I), evening relative humidity (RH II), rainfall, sunshine hours, wind speed and evaporation) were recorded daily from sowing onwards and weekly means were calculated while rainfall during the standard meteorological week was totalled. Correlation between progress of bacterial blight severity and weather factors was calculated and multiple regression equation was derived. The regression equation developed was validated for predicting the intensity of bacterial blight of cotton.

Table 1: Correlation between bacterial blight and weather factors during *kharif* (Pooled data 2007-2012)

S. No.	Variable	Correlation coefficient (r)
1	Maximum temperature	-0.894**
2	Minimum temperature	-0.799**
3	Morning relative humidity	0.669**
4	Evening relative humidity	-0.662**
5	Rain fall	-0.664**
6	Rainy days	-0.774**
7	Sunshine hours	0.634**
8	Wind speed	-0.142NS
9	Evaporation	-0.785**

N=20; ** Significant at 1% level; NS-Non Significant

The results indicated that bacterial blight appeared during 36th to 45th weeks when the maximum temperaturewas between 30^{0}C to35^{0}C, minimum temperature was between 20^{0}C to 27^{0}C and morning relative humidity was more than 70 per cent and attained maximum intensity during 43rd to 52nd week(Fig 1). The maximum temperature of 34.6±1°C and minimum temperature of 25.0±1°C with relative humidity above 85.5 per cent followed by rains favoured faster development of disease (Ashwani Kumar *et al*., 2012) .

Correlation analysis of pooled data (2007 – 2012)

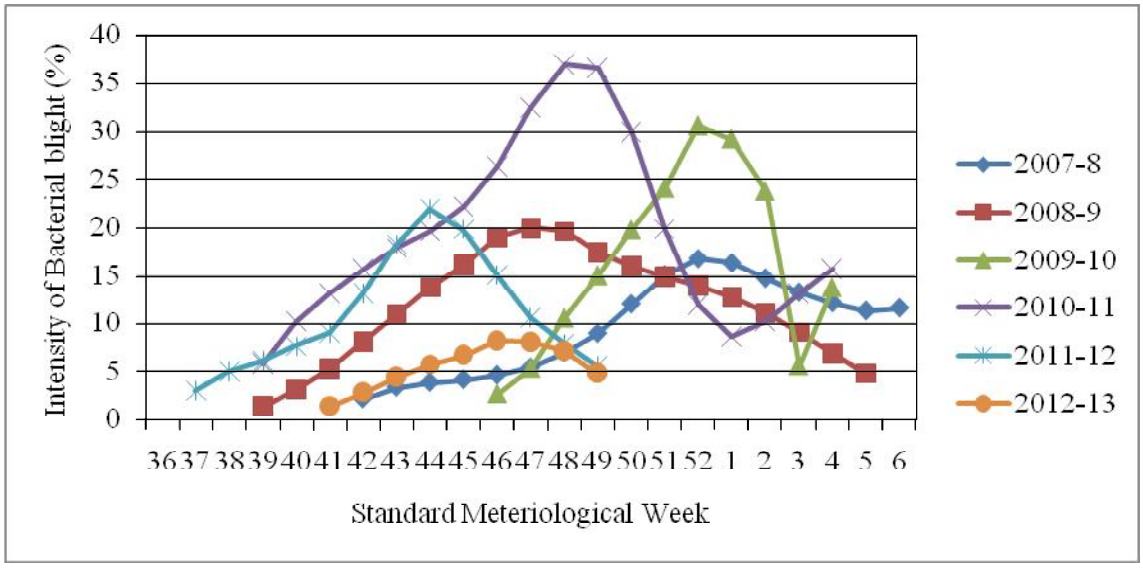

Fig. 1: Progress of bacterial blight during different years of study

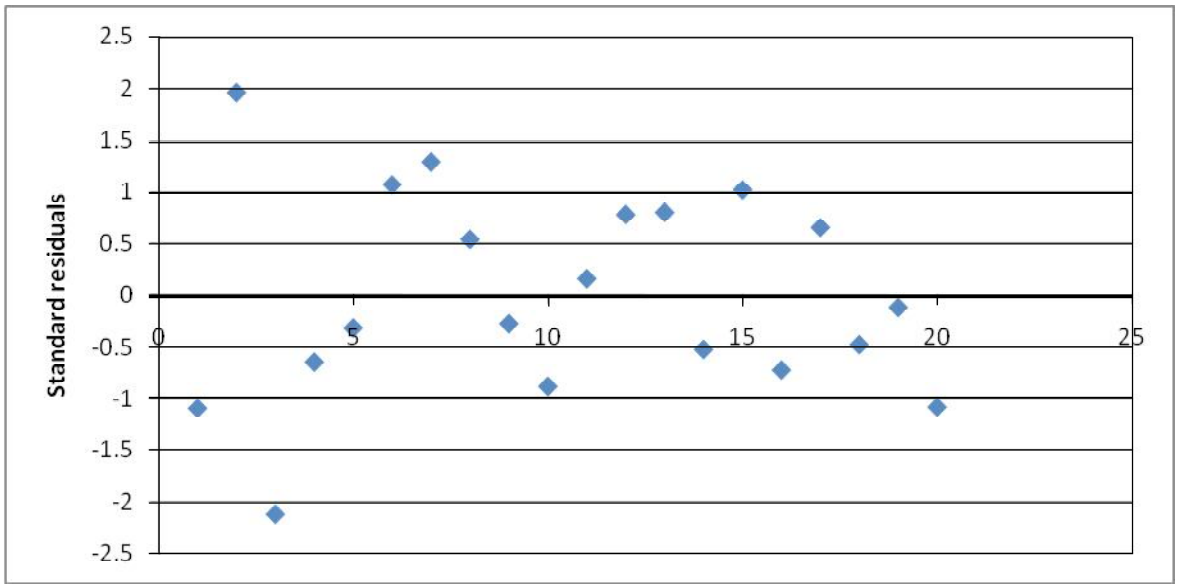

Fig.2: Validation of prediction model for bacterial blight of cotton

indicated statistically significant negative correlation of bacterial blight intensity with maximum temperature, minimum temperature, evening relative humidity, rainy days, rainfall and evaporation (p=0.01%); positive correlation with morning relative humidity and sunshine hours (p=0.01). Wind speed exhibited non significant negative correlation in different varieties/hybrids (Table 1).Similar observations including significant negative correlation of bacterial blight incidence with minimum temperature at Guntur, Parbani and Akola (1993-99) and significant positive correlation with rain fall and number of rainy day at Guntur (1986-94) was reported in cotton (Prasad *et al.*, 2007). According to Gholve and Kurundkar (2010) at seven days before observation of disease maximum temperature and bright sunshine (hrs) were positively and significantly correlated with bacterial blight intensity.

Regression analysis showed that weather parameters individually could explain 40 to 80 per cent variation of bacterial blight incidence in cotton. Maximum temperature alone caused variation in disease index to the extent of 80 per cent. Multiple regression analysis of pooled data revealed that maximum temperature, morning relative humidity, rain fall (p=0.01) and rainy days (p=0.05) together significantly influenced the development of bacterial blight disease (R^2=0.93). Moving averages of dependent as well as independent variables prompted the highest coefficient of determination as obtained by Prasad *et al*. (2007).

PDI= 263.22 - 5.68 T_{max} - 0.83RH I - 0.32Rf + 6.78Rd(R^2=0.93)

Where, PDI = Percent disease index, T_{max} = maximum temperature, RH I = Morning relative humidity, Rf = Rain fall, Rd = Number of rainy days]

Based on the present results from the interaction of independent weather variables it is concluded that weather parameters *viz*., maximum temperature coupled with morning relative humidity, rainfall and rainy days statistically significantly influenced the progress of bacterial blight in cotton. It was evident that for every one per cent decrease in maximum temperature, morning relative humidity and rainfall there was corresponding decrease of 5.68, 0.83 and -0.32 in per cent disease index, respectively. Similarly for every one per cent increase in rainy days there was corresponding increase of 6.78 in per cent diseases index. Validation of prediction model was depicted in Fig.2. The standard residuals of PDI of bacterial blight of cotton showed that the value of deviation was between $\pm$2 indicating high degree of accuracy of the model in predicting the intensity of bacterial blight of cotton. Thus the developed model can be used for prediction of bacterial blight in cotton under given environmental conditions.

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