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Short Communication

Progress and severity of cotton rust in relation to weather parameters in Andhra Pradesh

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Cotton is an important commercial crop in India with a production of 377 lakh bales of 170 kg lint in 2017-2018 from an area of 122.35 lakh ha with a productivity of 524 kg ha^{-1}, which is far behind the leading countries. Andhra Pradesh stood 7th in area (5.44 lakh ha) but 5th in production (22.0 lakh bales) and 3rd in productivity (688 kg ha^{-1}) during 2017-2018 (Anonymous, 2018). In India, foliar diseases have been estimated to cause yield losses up to 20 to 30 per cent. Cotton leaf rust caused by *Phakopsora gossypii* (Arth.) Hirat. f. has become an important problem of south zone. Yellowish brown uredia form on both the surfaces of leaves. Primary uredia, on the upper surface, are deeply immersed in the tissues while shallowly seated secondary uredia are on the lower surface of leaf. Though the disease occurs during later part of crop season it may cause losses in late sown as well as prolonged irrigated crop. Avoidable losses due to rust disease were estimated to be 21.7 per cent in Bunny Bt (Monga *et al.*, 2013) and 34.05 per cent in RCH 2 BG II (Bhattiprolu, 2015). Understanding the influence of weather factors on host stage and disease development is prerequisite to strategically manage the disease. Hence an experiment was conducted to assess the progress and severity of cotton rust in relation to environmental factors.

Field experiment was conducted under All India Coordinated Cotton Improvement Project over the years to investigate the appearance and progress of the rust in *Bt* Cotton hybrids (Bunny BG II, Jaadoo BG II, RCH 2 BG II) during *kharif* 2012-2017 at Regional Agricultural Research Station, Lam, Guntur. The crop was raised in a bulk plot of 150 m^2. Rust disease was scored on 0 to 4 scale (Sheo Raj, 1988) at weekly intervals on randomly labeled plants up to the end of the January and expressed as Percent Disease Index (PDI) using Wheeler's 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), rain fall, rainy days, sun shine hours (SSH), evaporation and wind speed) was recorded

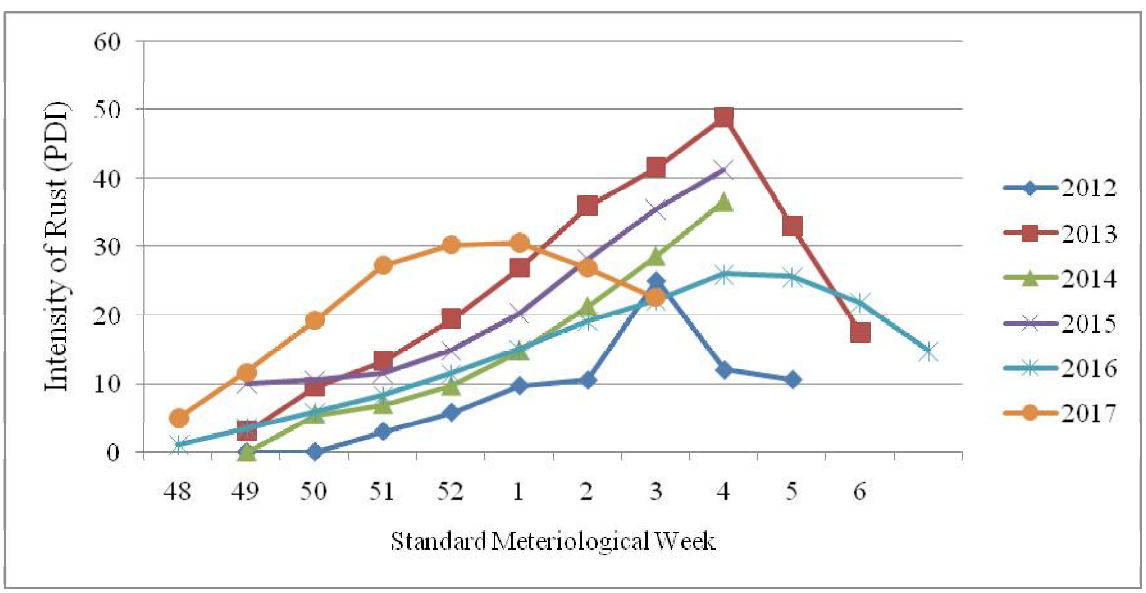

Fig. 1: Progress of cotton rust during different years of study

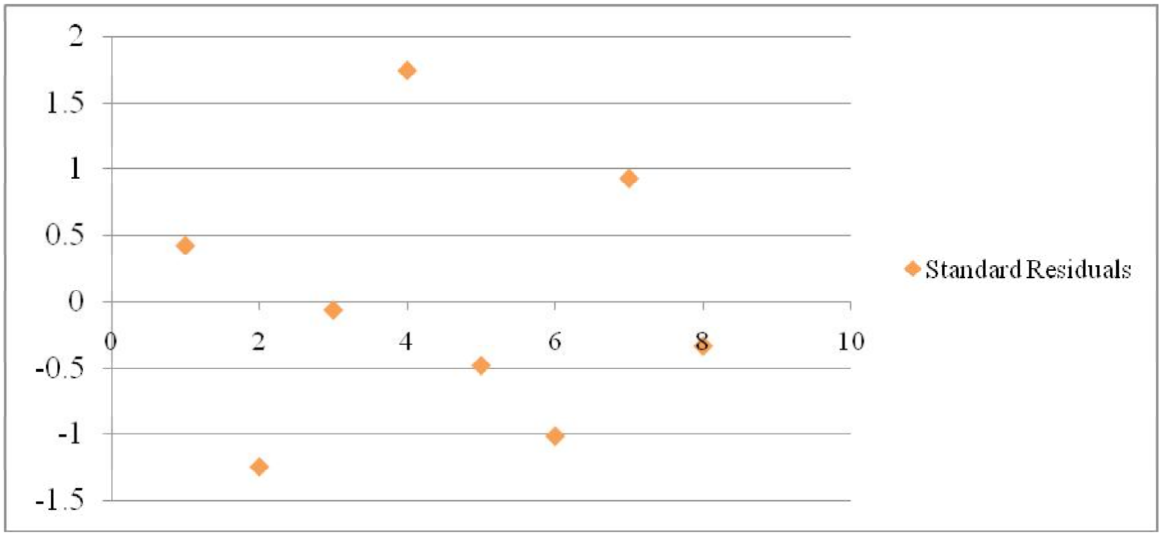

Fig.2: Validation of prediction model for cotton rust (2017-18)

Table 1: Correlation between cotton rust and weather factors(Pooled 2012-2017)

Weather variable	Correlation coefficient (r)
Maximum temperature (^{0}C)	-0.702**
Minimum temperature (^{0}C)	-0.616*
Morning relative humidity (%)	0.926**
Evening relative humidity (%)	-0.993**
Rain fall(mm/wk)	-0.853**
Rainy days	-0.346NS
Sunshine hours (hrs/day)	0.715**
Wind speed (km/h)	0.069NS
Evaporation	-0.962**

** Significant at 1% level; * Significant at 5% level; NS-Non Significant

daily from sowing onwards and weekly means were calculated while rainfall during the standard meteorological week (SMW) was totalled. Correlation between progress of rust severity and weather factors was calculated to understand the quantitative relationship. Multiple regression equations with independent weather variables to identify the critical parameters for development of diseases were derived using Excel programme. The regression equation developed for pooled data (2012 – 2016)was validated in 2017-18 for predicting the intensity of rust disease in cotton.

The appearance and progress of cotton rust in different *Bt* cotton hybrids during the period of study showed similar trend (Fig 1).Rust disease appeared during 48th to 50th SMW (mid November to mid December) during boll development at 32.6^{0}C mean maximum temperature, 18.8^{0}C minimum temperature, 84 per cent RH I and 63 per cent RH II and reached maximum PDI during 1st to 4th SMW (January) at boll development and bursting stage.

Correlation analysis of pooled data revealed statistically significant negative correlation with maximum temperature (r=0.702) and minimum temperature (r= 0.616), evening relative humidity (r=0.993), rainfall (r=0.853) and evaporation (r=0.962) while positive significant correlation was recorded with morning relative humidity (r=0.926) and sun shine hours (r=0.715). Number of rainy days showed non-significant negative correlation whereas wind speed expressed non- significant positive correlation with rust intensity(Table 1).

Multiple regression analysis of pooled data (2012 – 2016) showed that minimum temperature and morning relative humidity significantly influenced the disease development.

$PDI = -256.09-3.928T_{min}+3.535\ RH\ I\ (R^2=0.879)$

Where, PDI = percent disease index, T_{min} = minimum temperature and RH I = morning relative humidity

Yellow rust of wheat was negatively correlated with maximum temperature and sunshine hours and was positively correlated with relative humidity (Dutta *et al*., 2008). Significant negative correlation of minimum temperature with per cent disease index of soybean rust was observed by Pankaj Baiswar *et al* (2013). Significant positive impact of evening relative humidity on the incidence of rust in cotton crop was emphasized while developing decision support system for cotton (Nesur, 2014).

The multiple regression equation developed using pooled data (2012-2016) was validated during 2017-18 (Fig. 2). The standard residuals of PDI during *kharif* 2017 showed deviation to an extent of 1.68. Thus the developed model can be used for prediction of rust in cotton under given environmental conditions.

Based on the present investigations it is concluded that minimum temperature, RH I, RH II are the critical parameters contributing to the development of cotton rust and farmers are advised take up preventive and / or protective measures with recommended fungicides under favourable weather conditions as given under weekly advisories from the university.

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