J. Cotton Res. Dev. **39**(1), 47-51 (January, 2025) **ISSN No. 0972-8619**

Effect of weather factors on the development of Corynespora leaf spot in cotton

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Abstract : The effect of weather factors on the development of Corynespora leaf spot in *Bt* Cotton hybrids, Jaadoo BG II and RCH 2 BG and cotton varieties, L 1060 and NDLH 1938 was investigated at Regional Agricultural Research Station, Lam, Guntur during *kharif* 2019-2023. Maximum and minimum temperatures, morning relative humidity, rain fall and wind speed were significant and negatively correlated with percent disease index in BG II hybrids whereas the number of rainy days was also significant with negative correlation in varieties. Regression analysis of pooled data (2019-2022) for L 1060 revealed that minimum temperature, morning relative humidity and wind speed significantly influenced the progress of Corynespora leaf spot in cotton (R2=0.935). With respect to NDLH 1038, rainfall, number of rainy days, wind speed and evaporation were critical and maximum temperature also played major role in BG II hybrids. Validation of regression models during 2023-24 resulted in R2 values from 0.822 to 0.849 and thus these predictions are useful in weekly weather advisories to cotton farmers.

Keyword: Corynespora leaf spot, cotton, weather parameters.

Cotton, the most important commercial crops of India is the largest source of natural fibre. Andhra Pradesh stood 8th both in cultivated area (4.27 Lakh ha) and production (11.58 Lakh bales) and 6th in productivity with 461kg lint/ha in India (Anonymous, 2024). Among all the fungal foliar diseases, Corynespora leaf spot caused by *Corynespora cassiicola* has been increasing its prevalence and severity (Salunkhe *et al.*, 2019; Siva Prasad *et al.*, 2022). Corynespora leaf spot has been observed in Andhra Pradesh since 2017 which attained major status. On infected cotton leaves initially, minute pinhead size light orange to brick red minute spots appeared that gradually enlarged and became circular to oval or irregular concentric spots with tan to light brown centre with yellow halo around the margin. These spots enlarged and concentric zonations were formed resulting in target board symptom. In advanced stage, uncontrolled conditions lead to premature defoliation and yield losses. Corynespora target spot caused 224-448 kg/ha equivalent to 5 to 40 per cent loss of lint in susceptible cotton cultivars (Conner *et al.*, 2013; Hagan *et al.*, 2015). Understanding the influence of weather factors disease development is prerequisite to strategically manage the disease. Hence, a field experiment was conducted to assess the progress of Corynespora leaf spot in relation to environmental factors.

MATERIALS AND METHODS

In view of the economic importance of Corynespora leaf spot, studies were carried out under All India Coordinated Cotton Improvement Project over the years to investigate the appearance and progress of Corynespora leaf spot in BG II hybrids (Jaadoo and RCH 2) and non Bt varieties (L 1060 and NDLH 1938) during *kharif* 2019-2023, in relation to environmental factors at Regional Agricultural Research Station, Lam, Guntur. The crop was raised in a bulk plot of 500 m^{2}adopting a spacing of 105 cm x 60 cm. Corynespora leaf spot was scored on 0 to 4scale (Sheo Raj, 1988) at weekly intervals on randomly labelled plants up to the end of the

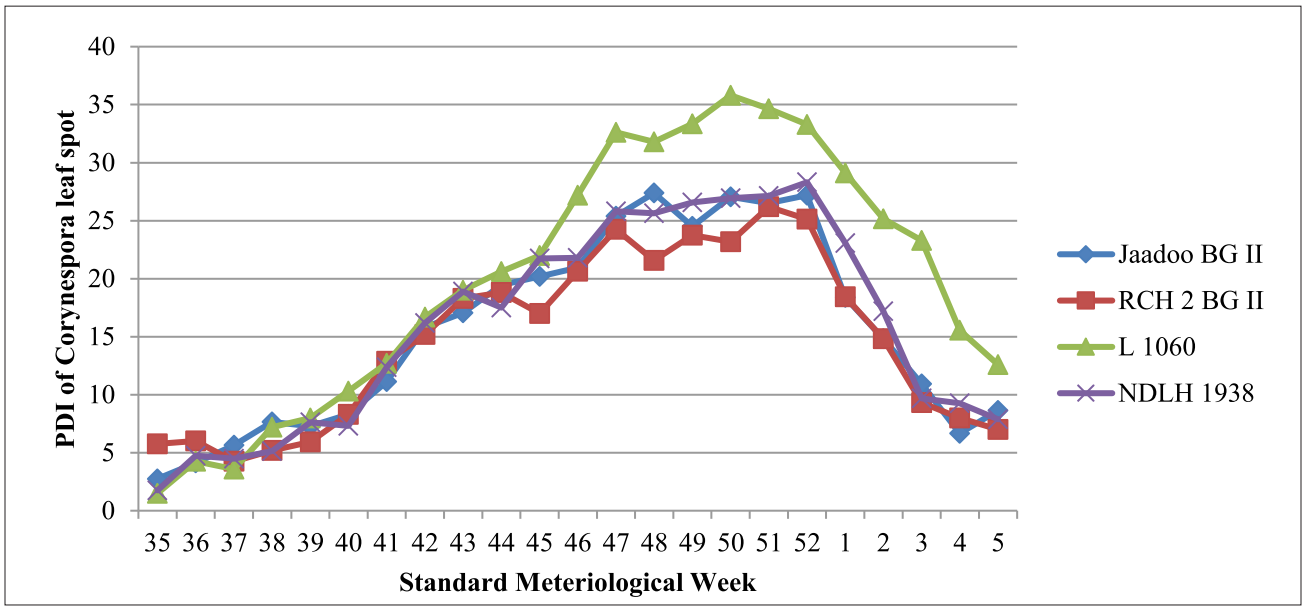

Fig. 1. Progress of Corynespora leaf spot in cotton during 2019-23

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 (T_{max}), minimum temperature (T_{min}), morning relative humidity (RH I), evening relative humidity (RH II), rain fall (RF), rainy days (RD), sunshine hours (SSH), wind speed (WS) and evaporation (Evap.) was recorded daily from sowing onwards and weekly means were calculated while rainfall during the standard meteorological week was totalled. Correlation between progress of Corynespora leaf spot severity and weather factors was calculated to understand the quantitative relationship. Year wise multiple regression equations with independent weather variables to identify the critical parameters for development of diseases were derived using Excel programme. The regression equations developed during 2019–2022 were validated in 2023-2024 for predicting the intensity of Corynespora leaf spot of cotton.

RESULTS AND DISCUSSION

The progress of Corynespora leaf spot during the different years of study is presented in Fig. 1. The disease appeared from 35th to 41st week during vegetative stage and reached maximum PDI from 47th to 52nd at boll formation and development during *kharif* 2019 to 2023. Correlation analysis of Pooled data (2019 – 2023) indicated that maximum, minimum temperatures, morning relative humidity, rain fall and number of rainy days were negatively correlated with percent disease index in BG II hybrids whereas the number of rainy days was also significant with negative correlation in varieties (Table 1).

Multiple linear regression analysis of pooled data revealed that minimum temperature, morning relative humidity and rainfall significantly influenced the progress of Corynespora leaf spot during 2019-2022 in L 1060 (R^2=0.963) whereas number of rainy days (R^2=0.628), maximum temperature (R^2=0.413) and wind speed (R^2=0.415) expressed partial influence on the disease development (Table 1). In case of NDLH 1938 (2020-2022), rainfall, number of rainy days, wind speed and evaporation were critical factors (R^2=0.84). With respect to BG II hybrids (2020-2022), maximum temperature, rainfall, number of rainy days,

Table 1: Continued Correlation between Corynespora leaf spot and weather factors in cotton (Pooled 2019-2023)

Weather variable	Cotton Variety / BG II Hybrid			
	L 1060	NDLH 1938	Jaadoo BG II	RCH 2 BG II
Maximum temperature (°C)	-0.886**	-0.782**	-0.741**	-0.730**
Minimum temperature (°C)	-0.883**	-0.746**	-0.711**	-0.695**
Morning relative humidity (%)	-0.596**	-0.645**	-0.625**	-0.651**
Evening relative humidity (%)	-0.271	-0.229	-0.249	-0.213
Rain fall(mm/wk)	-0.729**	-0.618**	-0.570**	-0.585**
Rainy days	-0.606**	-0.444*	-0.413	-0.408
Sunshine hours (hrs/day)	0.231	0.051	0.042	-0.014
Wind speed (km/h)	-0.707**	-0.617**	-0.576**	-0.583**
Evaporation	-0.050	0.052	-0.034	-0.013

n=22; * at 5% level of significance; at 1% level of significance

Table 2: Regression equations for Corynespora leaf spot of cotton at Guntur (pooled for 2019 to 2022 and validated in 2023)

Variety/BG II Hybrid	Year(s)	Multiple Regression Equation	Coefficient of determination (R2)
L 1060	2019 to 2022	Y=147.907-3.926 Tmin ** -0.533 RH I** + 0.149 RF**	0.963
		Y=34.128-10.586 RD**	0.628
		Y=61.417-7.78 WS**	0.415
		Y= 351.888-10.687 Tmax **	0.413
	2023	Y = 286.111 - 2.789 RH II**+0.182 RF** – 16.398 RD** – 15.989 Evap.**	0.822
NDLH 1938	2020 to 2022	Y=60.862+0.199 RF-4.971 RD-4.869 WS-5.192 Evap.	0.840
	2023	Y=29.874+0.914 Tmax **+0.178 RF**-7.778 RD**-3.702 WS**-5.696 Evap.**	0.879
		Y=-59.944+1.105 RH II**	0.538
Jaadoo BG II	2020 to 2022	Y=8.12 + 1.50 Tmax** + 0.183 RF** - 7.661 RD** - 3.339 WS** - 4.862 Evap.**	0.840
	2023	Y=8.123 +1.499 Tmax**+0.183 RF**-7.661 RD**-3.669 WS**-4.862 Evap.**	0.840
		Y= -44.718+0.906 RH II**	0.382
RCH 2 BG II	2020 to 2022	Y=7.592 + 1.273 Tmax** +0.158 RF**-7.727 RD**-2.89 WS**-4.021 Evap.**	0.840
	2023	Y=7.592+1.273Tmax*+0.178RF**-7.727RD**-2.89WS**-4.022 Evap.**	0.840
		Y= -38.377+0.794 RH II**	0.420

**Significant at 1%; * Significant at 5%

Y = Per cent Disease Index; Max T = Maximum Temperature; Min T = Minimum Temperature; RD = Rainy Days W = Wind Speed and E = Evaporation

wind speed and evaporation were critical factors (R^2=0.84) (Table 1).

Validation of regression equations during 2023-24 resulted in evening relative humidity, rainfall, number of rainy days and evaporation influencing the disease progress with R^2 value of 0.822 in L 1060 whereas maximum temperature, rainfall, number of rainy days, wind speed and evaporation were critical with R^2 values of 0.879 in NDLH 1938; 0.84 in Jaadoo BG II and 0.84 in RCH 2 BG II. RH II recorded partial influence in both the hybrids (Jaadoo, R^2=0.382; RCH 2, R^2=0.42) and NDLH 1938 (R^2=0.538) (Table 1).

Sharma (2017) reported that long period of leaf wetness and moderate temperatures favoured target spot development in cotton under greenhouse conditions. Overall rainfall and temperature patterns from July to September favoured the development of Corynespora leaf spot (Bowen *et al.*, 2018). Roshan *et al.* (2022) observed that sunshine hours, the number of rainy days and wind speed were the common critical parameters contributing to the development of Alternaria and Corynespora leaf spots in cotton. Significant negative correlation was observed between PDI and maximum temperature, minimum temperature, rainfall, wind speed and

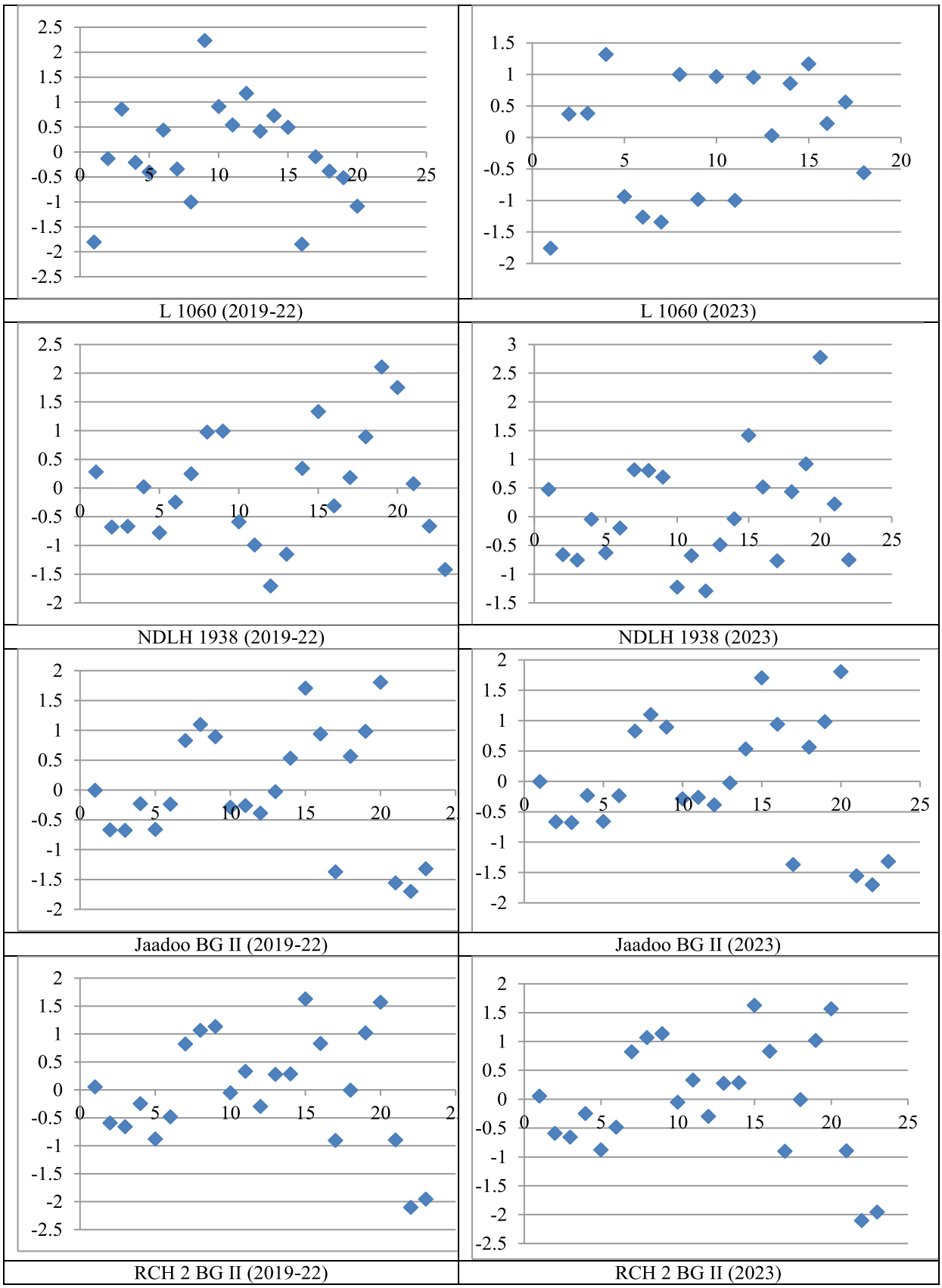

Fig. 2. Validation of regression models for Corynespora leaf spot in Cotton

evaporation whereas sunshine hours showed significant and positive correlation at different spacing(s) (Mounika *et al.*, 2023). They reported evening relative humidity, wind speed and evaporation as critical factors under close spacing in LHDP 5 cotton variety.

Predicted and observed PDI (Pooled for 2019 to 2023) in different genotypes is presented in Fig. 2. Standard residuals of pooled data (2019-2022) and validated data in 2023 are presented in Fig. 3 which represents the accuracy of models predicted. Thus the developed models can be used for prediction of Corynespora leaf spot in cotton under given environmental conditions.

ACKNOWLEDGEMENTS

The author expresses gratitude to Indian Council of Agricultural Research (ICAR) for having funded the work under All India Coordinated Research Project on Cotton and Associate Director of Research, RARS, Lam, Guntur, for providing the facilities for this project.

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Received for publication : July 26, 2024
Accepted for publication : September 9, 2024