

Influence of High Density Planting System (HDPS) on Occurrence of Fungal Foliar Diseases in Cotton

Ch Yamuna, S L Bhattiprolu, V Prasanna Kumari, Ch Chiranjeevi and P Anil Kumar

Department of Plant Pathology, Agricultural College, Bapatla, A.P.

ABSTRACT

Optimum plant density is one of the determining factors to reap potential yields in any crop. In cotton HDPS is advocated for varieties to realise maximum yields under rainfed conditions in light soils. Hence, a study was conducted to understand the impact of HDPS on fungal foliar diseases in cotton. Diseases were recorded at different stages of crop viz., seedling, squaring, flowering, boll formation and boll development, boll maturity and bursting and boll bursting and picking stages. *Alternaria* leaf spot appeared at seedling stage and reached maximum during boll formation and boll development stage. The percent disease index (PDI) ranged from 10 to 21% in different compact genotypes during boll formation and boll development stage. *Corynespora* leaf spot was observed during boll maturity and boll bursting stage with 3.0 to 5.0 PDI; grey mildew and rust diseases were observed during boll bursting and picking stage with 4.0 to 7.0 and 5.0 to 13.0 PDI, respectively.

Key words: *Alternaria*, *Corynespora*, Cotton, Grey mildew, High density planting system, Rust.

Cotton (*Gossypium* spp.), referred as 'King of Fibre' and 'White Gold', is the most extensively cultivated commercial crop which plays a key role in economic development. In India, cotton cultivated in an area of 122.38 lakh ha with an annual production of 361 lakh bales of 170 kg and a productivity of 501 kg lint ha⁻¹ during 2018-19. Gujarat (104 lakh bales), Maharashtra (85 lakh bales) and Telangana (57 lakh bales) are the major cotton producing states followed by Haryana (25 lakh bales) and Andhra Pradesh (20 lakh bales). During 2018-19, it occupied an area of 5.51 lakh ha with a productivity of 617 kg lint ha⁻¹ in Andhra Pradesh (ICAR-AICRP on Cotton, 2019).

Cotton crop is affected by number of foliar, wilt and rot pathogens, of which foliar diseases account for 20 to 30% yield losses (Mayee and Mukewar, 2007). Losses due to foliar diseases such as *Alternaria* leaf spot, grey mildew and rust were up to 26%, 31% and 34% respectively (Chattannavar *et al.*, 2006; Bhattiprolu, 2012 and Bhattiprolu, 2015). Hagan and Sikora, 2012 recorded 100-200 lb/acre losses due to *Corynespora* leaf spot.

High Density Planting System is advocated for cotton varieties to realise maximum yields under rainfed conditions in light soils. Keeping in view of the economic importance of fungal foliar diseases, present investigation was carried out to observe the prevalence of fungal foliar diseases at Regional Agricultural Research Station, Lam, Guntur.

MATERIAL AND METHODS

Seventy two genotypes of compact cotton were sown on 15.07.2018 at RARS, Lam, Guntur during *kharif* 2018 under High Density Planting System (HDPS), by adopting 60cm x 10cm spacing. Relevant agronomic practices were followed for protection of sucking pests and bollworms. Severity of different fungal foliar diseases was recorded starting from germination to harvesting at regular intervals *i.e.*, seedling stage (20-30 days); squaring (45-60 days); flowering (60 days onwards), boll formation and boll development (80-100 days); boll maturity and bursting (110 to 130 days); boll bursting and picking (120 - 150 days). In each genotype, 10 plants in the central rows, were tagged randomly leaving border rows to record the occurrence of fungal foliar diseases using 0-4 scale (Sheo Raj, 1988).

Table 1. Disease scale for fungal foliar diseases of cotton

Scale	Per cent of leaf area covered
0	No infection
1	Few spots of less than 2 mm size, leaf area covering less than 5%
2	Spots of 3 mm size, covering 6-20% of leaf area
3	Spots of 3-5 mm size, irregular in shape coalesce and covering 21-40% of leaf area.
4	Spots covering more than 40% of leaf area

Table 2. Disease observations in compact cotton greiplasm lines under High Density Planting System (HDPS)

Entry	Per cent disease index (%)								
	Alternaria leaf spot						Corynespora leaf spot	Grey mildew	Rust
	SES	SQS	FLS	BFD	BMB	BBP	BMB	BBP	BBP
LGH-CG-1	3.5	5.5	9.5	12.4	5.6	2.5	3.8	4.7	6.2
LGH-CG-2	3.5	5.3	9.2	12.0	5.0	2.7	4.3	5.2	6.7
LGH-CG-3	3.6	4.8	8.6	12.6	5.5	3.0	4.0	5.2	6.5
LGH-CG-4	3.7	4.9	8.8	13.1	6.3	3.6	4.6	4.7	7.2
LGH-CG-5	3.2	5.0	9.0	13.6	6.5	3.3	4.6	5.2	8.0
LGH-CG-6	3.1	4.3	8.5	12.1	6.1	3.1	4.2	4.0	8.2
LGH-CG-7	3.5	5.5	10.0	15.5	7.5	3.7	3.3	4.5	7.2
LGH-CG-8	3.1	4.2	8.3	12.3	6.0	3.0	3.3	4.7	7.0
LGH-CG-9	3.5	4.9	8.9	13.7	7.8	2.9	3.6	4.2	6.7
LGH-CG-10	3.3	4.3	8.5	13.5	7.5	3.6	3.5	5.0	6.7
LGH-CG-11	3.4	5.3	8.9	14.5	6.4	1.9	3.0	4.7	7.2
LGH-CG-12	2.8	4.2	8.1	13.2	5.9	1.7	3.3	5.0	6.7
LGH-CG-13	3.0	4.7	8.8	13.8	6.5	2.7	3.4	5.0	5.5
LGH-CG-14	3.3	4.3	9.3	15.3	7.0	3.1	3.7	5.2	6.7
LGH-CG-15	3.6	5.4	9.8	15.4	6.9	2.8	3.7	5.2	6.0
LGH-CG-16	3.7	5.6	10.5	16.3	7.2	3.5	3.6	5.0	7.7
LGH-CG-17	3.2	5.1	10.0	16.0	7.1	3.3	3.3	5.2	7.2
LGH-CG-18	3.8	5.7	11.3	16.9	6.9	3.1	3.8	5.2	6.7
LGH-CG-19	3.3	4.8	8.2	12.5	4.7	1.9	3.6	5.2	6.6
LGH-CG-20	3.2	4.5	9.5	13.6	5.3	2.7	3.5	4.5	7.5
LGH-CG-21	2.9	4.2	9.3	13.8	5.8	3.0	3.3	4.7	7.2
LGH-CG-22	2.7	4.1	8.8	12.9	4.7	2.9	3.7	4.7	5.0
LGH-CG-23	3.8	5.8	11.5	16.9	6.6	3.6	3.5	5.2	6.2
LGH-CG-24	2.9	4.3	9.5	16.8	6.5	3.5	3.1	5.0	6.7
LGH-CG-25	3.7	5.2	9.7	17.2	7.3	3.7	3.8	4.7	7.0
LGH-CG-26	3.7	5.5	10.0	17.4	7.5	3.3	3.6	5.2	7.2
LGH-CG-27	3.5	5.2	10.5	18.3	7.6	3.6	4.0	5.7	7.7
LGH-CG-28	3.3	5.8	11.5	18.5	7.1	3.0	3.6	4.5	7.7
LGH-CG-29	3.2	5.3	11.2	18.9	7.7	3.8	3.3	5.0	8.2
LGH-CG-30	2.5	4.0	8.0	10.0	4.0	1.0	4.1	5.5	7.5
LGH-CG-31	3.8	5.5	11.3	16.8	5.4	1.6	3.8	5.5	10.0
LGH-CG-32	3.3	4.9	10.5	15.7	5.9	1.9	3.8	5.2	8.7
LGH-CG-33	2.9	4.4	9.6	14.8	6.0	2.6	4.2	5.7	8.0
LGH-CG-34	2.7	4.8	9.2	14.3	6.4	2.8	3.5	5.5	9.0
LGH-CG-35	3.7	5.8	10.4	17.9	6.5	2.9	3.6	5.2	8.2
LGH-CG-36	3.3	5.6	11.5	18.7	7.5	3.7	3.3	5.5	8.7
LGH-CG-37	3.5	4.7	9.6	17.5	7.2	3.4	4.1	6.0	8.2
LGH-CG-38	3.3	5.2	10.3	17.4	7.4	3.5	3.5	5.2	8.5
LGH-CG-39	3.5	5.0	11.3	18.6	7.4	3.1	3.6	5.2	8.7
LGH-CG-40	3.3	5.0	11.4	18.9	7.0	3.0	3.5	5.2	6.7
LGH-CG-41	3.5	5.5	11.5	19.4	7.2	3.3	3.2	5.2	8.5
LGH-CG-42	3.5	5.4	11.2	19.3	7.0	3.5	3.2	5.7	8.0
LGH-CG-43	3.3	5.6	11.6	19.6	7.4	3.8	3.6	6.2	7.7

Contd.....

LGH-CG-44	2.9	4.3	10.3	17.8	5.3	2.5	4.0	5.3	9.0
LGH-CG-45	2.8	4.0	8.5	12.8	4.7	1.9	3.2	5.7	11.0
LGH-CG-46	3.5	4.4	8.8	14.5	5.3	2.4	4.1	6.0	10.7
LGH-CG-47	3.4	4.6	9.2	12.5	4.9	2.7	3.6	6.5	11.5
LGH-CG-48	3.0	4.3	9.0	12.0	4.3	2.3	3.5	5.7	10.5
LGH-CG-49	3.6	5.0	9.9	13.6	4.8	2.6	3.5	6.5	11.2
LGH-CG-50	3.8	5.3	10.6	16.7	5.0	2.5	4.5	6.7	13.2
LGH-CG-51	3.3	5.2	11.3	18.5	6.7	3.7	4.8	7.0	12.0
LGH-CG-52	3.8	5.6	11.6	18.9	6.9	3.5	4.7	6.7	9.5
LGH-CG-53	3.5	5.5	11.2	18.0	5.9	2.6	4.8	6.0	12.2
LGH-CG-54	3.5	5.2	11.0	17.6	5.4	2.2	4.8	6.5	11.7
LGH-CG-55	3.5	4.7	9.6	12.5	4.8	1.5	4.7	5.7	11.5
LGH-CG-56	3.5	4.4	9.0	11.7	4.5	1.7	5.1	5.5	10.7
LGH-CG-57	3.3	4.5	8.8	13.6	6.3	3.1	4.5	5.5	11.7
LGH-CG-58	3.1	4.3	8.4	12.9	4.7	1.5	4.5	5.5	11.0
LGH-CG-59	4.0	9.0	12.0	20.0	8.0	4.0	4.6	5.0	11.2
LGH-CG-60	3.5	4.2	8.2	12.6	5.0	2.6	4.6	5.7	11.0
LGH-CG-61	3.6	4.7	9.6	14.7	6.5	3.6	5.0	5.5	11.2
LGH-CG-62	3.6	5.3	10.3	16.8	7.3	3.7	4.6	5.5	12.0
LGH-CG-63	3.8	5.5	10.6	17.0	6.2	3.1	5.5	4.7	11.5
LGH-CG-64	3.3	5.3	10.1	17.7	6.8	3.3	4.8	5.5	11.7
LGH-CG-65	3.1	5.4	11.2	18.5	7.5	3.6	4.2	5.0	10.7
LGH-CG-66	3.5	5.7	11.5	19.4	7.6	3.2	4.5	6.0	10.5
LGH-CG-67	3.3	5.5	11.4	19.5	7.7	3.0	4.7	6.2	10.2
LGH-CG-68	3.6	5.3	10.7	17.6	5.8	2.7	4.7	5.2	10.7
LGH-CG-69	3.8	5.2	10.2	15.3	4.9	3.1	5.2	5.0	10.7
LGH-CG-70	3.5	5.3	11.3	17.7	5.6	2.8	4.8	5.7	10.7
LGH-CG-71	3.1	5.7	11.5	18.4	7.7	3.5	4.7	6.1	11.2
LGH-CG-72	3.6	5.8	10.8	16.6	6.9	2.9	4.3	5.3	12.5
LHDP-1	2.7	6.4	10.4	20.5	8.6	4.8	4.8	6.4	9.0
LHDP-2	2.9	6.5	8.6	18.6	8.2	4.6	4.5	5.0	7.4
LHDP-3	2.3	6.0	9.5	13.8	6.8	3.5	4.5	7.0	6.0
LHDP-4	2.5	6.7	8.8	17.6	8.3	4.4	4.0	6.1	7.1
LHDP-5	2.7	6.3	8.7	18.4	7.7	4.7	5.0	6.3	8.6
L 604	2.0	4.0	6.0	11.0	5.0	3.0	4.6	5.7	6.9
L 1060	2.6	6.9	9.5	18.8	7.5	3.6	4.5	5.6	7.8
NDLH 1938	3.0	7.0	11.0	21.0	9.0	5.0	4.6	5.8	6.9

SES = Seedling stage

SQS = Squaring stage

FLS = Flowering stage

BFD = Boll formation and boll development stage

BMB = Boll maturity and bursting stage

BBP = Boll bursting and picking stage

Per cent Disease Index (PDI) of different fungal foliar diseases was calculated using the formula given by Wheeler (1969).

$$\text{PDI} = \frac{\text{Sum of individual disease ratings}}{\text{No. of leaves scored} \times \text{Maximum disease rating}} \times 100$$

RESULTS AND DISCUSSION

Data recorded on disease severity during seedling, squaring, flowering, boll formation and boll development, boll maturity and bursting and boll bursting and picking stages, revealed that *Alternaria* leaf spot (ALS) (*Alternaria macrospora*) at seedling stage itself and progress up to boll formation and development stage. However, ALS reduction during boll maturity and bursting stage could be attributed to defoliation of senescing leaves. Disease severity when expressed as per cent disease index (PDI), ranged from 10.0 (LGH-CG-30) to 21.0% (NDLH 1938). In LHDP-1 (20.5) and NDLH 1938 (21.0%) PDI was more than 20% indicating their susceptible nature under HDPS (Table 2).

Corynespora leaf spot (CoLS) (*Corynespora cassiicola*) was found to occur only at boll maturity and bursting stage in old matured leaves to an extent of 3.0 (LGH-CG-11) to 5.5PDI (LGH-CG-63). Decreased of CoLS at boll bursting and picking stage may be attributed to leaf fall. indicating that disease did not have severe impact during *kharif* 2018 (Table 2).

Grey mildew (Areolate mildew, *Ramularia areola*) PDI ranged from 4.0 (LGH-CG-6) to 7.0% (LHDP-3 and LGH-CG-51) occurred during boll bursting and picking stage, *i.e.*, just before harvesting (Table 2). Such low severity coupled with last stage of the crop indicated lesser impact of grey mildew in affecting the crop during 2018-19.

Occurrence of rust (*Phakopsora gossypii*) was noticed at the last stage of the crop, *i.e.*, boll bursting and picking stage. The PDI ranged from 5.0 (LGH-CG-22) to 13.2% (LGH-CG-50). Similar to Corynespora leaf spot grey mildew, as also rust also appeared at the end of the cropping season, hence impact on the crop was very less (Table 2).

Divyamani *et al.* (2019) reported that PDI of *Alternaria* leaf spot and *Corynespora* leaf spot ranged from 3.0 to 17.0% and 5.0 to 28.0% respectively at RARS, Lam, Guntur. Bhattiprolu (2012) reported that disease intensity of grey mildew ranged from 9.0 to

47.14% during 2008-2011 at RARS, Lam, Guntur. The PDI of rust ranged from 8.8 to 35% during 2009-2012 at RARS, Lam, Guntur (Bhattiprolu, 2015). During *kharif* 2018, cotton crop did not receive any rain for more than 30 days during November and December months.

CONCLUSION

It can be concluded that, the dry conditions did not promote the development of fungal foliar diseases resulting in low intensity of the diseases.

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