CROP PROTECTION
PLANT PATHOLOGY

Research Findings:

Path.1 Epidemiological studies on cotton diseases

Path.1 (a): Observations on the occurrence of various diseases

NORTH ZONE

Cotton leaf curl disease (CLCuD), Bacterial Blight (BB), Fungal Foliar leaf spots (FFLS) were the diseases observed in different districts of Punjab by Faridkot center. The PDI of CLCuD varied from 2.9 to 88.3%, 10 to 75%; 22 % to 55 % on varieties/hybrids like RS 921, RST-9, F 846, F 505, F 1378, F 1861, F 2383, F2228, RCH 650 BGII, Bioseed 6488 BGII, Bioseed 6588 BGII, RCH 773 BGII and Ankur 3028 BGIIin different villages, research farms of Faridkot, Fazilka and Muktsar districts **(Table 1).** Bacterial blight was found 0.2 to 3.0 % in Faridkot and traces to 2% in Fazilka and traces to 2% in Muktsar on hybrids like NCS 855 BGII, RCH 650 BGII, Ankur 3028 BGII, Bioseed 6488 BGII and Bioseed 6588 BGII in different cotton areas. The fungal foliar leaf spots caused by *Alternaria, Myrothecium* and *Cercospora*, ranged from 0.0 to 2.9%, 0.1 to 2.4% and 0.1 to 2.1% DI on RST-9, RS 921, F 846, HS 6, NCS 855 BGII, RCH 650 BG II and RCH 773 BG II and on different entries of coordinated trials at research farm in *Kharif*-2016.

The Bhatinda center conducted surveys in Bathinda, Mansa and Mukstar Districts. The severity or PDI (Per Cent Disease) of CLCuD was recorded from 0.00 to 34.33 in the different villages of Bathinda; 0-17.33 in Mansa and 0-16.33 in Muktsar districts. In all the 3 Districts in 48 villages the Bacterial Blight in cotton was not noticed. Although the Fungal Foliar Leaf Spot was noticed in the later stages (120-140 DAS) having the grade 1and did not show any significant losses in the cotton crop. In case of root rot in cotton the disease was noticed in 1 or 2 locations having the per cent incidence attack of 5 -10% **(Table 2).**

The data on disease intensity of leaf curl virus was recorded during kharif 2016 by surveying the cotton growing areas of Sriganganagar and adjoining areas of Hanumangarh districts of Rajasthan state in India. Out of five tehsils surveyed in Sriganganagar district, Sriganganagar tehsil, disease intensity of leaf curl virus was found to be highest i.e. 17.3 per cent. In Sadulshahar, Srikaranpur and Padampur tehsils the average disease intensity was 6.7, 5.3 and 4.6 per cent, respectively. In adjoining cotton belt of Hanumangarh district the average disease intensity was 5.9 per cent **(Table 3).**

The survey was undertaken to record the occurrence of different diseases in major cotton growing districts (Hisar, Bhiwani, Fatehabad, Sirsa and Jind) as well as in the non-traditional areas of Haryana (Mahendergarh, Rewari and Rohtak) from July to September, 2016. At HAU Farm cotton leaf curl virus disease ranged from 22.7 to 49.9 per cent. Whereas at farmer's field the PDI was low as compared to the HAU Farm. The highest per cent disease index (PDI) of 13.0 (RCH 602 in Barwala distt. Hisar), 12.0 (RCH602 in Bhattu kalan district Fatehabad) and 9.4 (Pur village in

Bhiwani). Among the fungal diseases Myrothecium leaf spot (MLS) PDI varied from 0.0 to 5.3%. Other diseases *viz.* Alternaria leaf spot (ALS) and Bacterial leaf blight did not appear at farmer's field, Root rot (RR) was upto 2.0 per cent on all locations surveyed in Haryana **(Table 4).**

CENTRAL ZONE

Observations on incidence and intensity of different cotton diseases were recorded at the seedling, flowering and boll development stages at Rahuri farm and farmer fields.

Alternaria leaf blight was the major disease observed during the year on research farm. The disease intensity irrespective of variety/hybrids ranged from 3.22 to 27.60 per cent and it reduced from November onwards. The other foliar diseases *viz*.,*Myrothecium*, *Cercospora*, grey mildew and bacterial blight were observed in traces during crop growth. The incidence of Tobacco streak virus was up to 24.55 per cent which was mainly observed as localized infection i.e. chlorosis / necrosis of upper leaves of the plants **(Table 5).**

Alternaria blight was the major disease observed in farmer fields and the disease intensity ranged between 2.16 to 24.12 per cent irrespective of variety/hybrids and locations. Another disease mainly observed was Tobacco Streak Virus (TSV) while the other foliar diseases were observed in traces. During current year though the rainfall received was more than normal, the distribution of rainfall was uneven. There was a continuous dry spell of almost about 30-40 days (32-36 MW) in most of the cotton growing tract as a result of which the crop growth was suffered and para wilt incidence was observed in some areas. Whereas after the high rainfall received in the month of September, leaf reddening was more pronounced **(Table 5a).**

The A*lternaria* was found wide spread disease followed by bacterial blight and grey mildew on *G. hirsutum* and *G. arboreum* cotton at Nanded. The intensity of A*lternaria* varied from 1.03 to 19.43 PDI, while the intensity of bacterial blight ranged from 2.38 to 17.17 PDI, grey mildew intensity was varied from 0.00 to 2.77 PDI. The incidence of para wilt varied from 0.00 to 1.75 PDI, nematodes infection was not found during this year **(Table 6).**

During seedling stage crop was free from diseases at farmers and research field at Akola. The bacterial blight was observed in flowering stage and varied from 0.56 to 3.33 and 0.09 to 3.90 per cent disease intensity on farmers and research field. Maximum disease intensity was observed at boll development stage 5.37 and 4.26 per cent in varieties/hybrids Bt at farmers and research field respectively. The grey mildew was observed at farmers' field in the last week of September with very low intensity. The *Myrothecium* leaf spot was observed at flowering stage within range of 0.03 to 1.83 and 0.75 to 2.72 per cent on farmers and research field respectively. *Alternaria* leaf spot was not observed during crop season **(Table 7).**

A roving survey was conducted on cultivars' field during the crop season and a fix point survey on cotton was conducted periodically at Research farm at Surat. On Research farm, periodically observations were recorded on G. Cot. Hy. 12 revealed that bacterial blight appeared during the last week of July (0.5 %) *i.e*. in 31th Met. week and then gradually developed and reached at its peak (20.0 % PDI) during the first week of October (20.0 %) *i.e.* in 41st Met. week. The susceptible cultivars *viz*., LRA 5166 showed bacterial blight intensity to the tune of 0.0 to 20.0 per cent PDI. Moreover, non *Bt* cotton was more susceptible to the bacterial blight disease and also to

Alternaria leaf spot disease. During 30 - 45 DAS (vegetative stage of the crop), the BLB was more pronounced on the lower leaves. Alternaria leaf spot disease was observed to the tune of 0.0-10.0 % PDI in the cultivar G. Cot. 100.

Roving survey was conducted at Surat, Bharuch and Narmada districts on farmers' field where mostly BG II hybrids were cultivated. The incidence of bacterial leaf blight was in the range of 1.0 to 15.0 %, 0.0 to 12.5 % and 2.0 to 3.0 % PDI in Surat, Bharuch and Narmada districts, respectively on cultivator's fields in majority cultivated areas of BG II hybrids. Moreover, in case of Alternaria leaf spot disease it was observed in the tune of 0.0 to 10.0 %, 0.0 to 4.5 % and 0.0 % PDI in Surat, Bharuch and (No incidence of ALS in Dediyapada region) Narmada district, respectively **(Table 8).**

The Alternaria leaf spot (ALS) recorded in Junagadh district in different varieties ranging from 2.5 to 15.0, and bacterial leaf blight (BLB) 0.0 to 9.0 per cent disease intensity (PDI). In Amreli district, ALS disease was found in the ranging from 9.0 to 12.0 and BLB 1.0 to 5.0 per cent. In Morbi district, ALS disease was found in the ranging from 8.0 to 16.0 and BLB 0.0 to 1.0 per cent. In Surendra nagar district ALS disease noted to the ranging of 0.0 to 14.0 and BLB 0.0 to 5.0. In Jamnagar district ALS disease noted to the ranging of 7.0 to 14.0 and BLB 2.0 to 5.0 per cent.

Disease condition in Rajkot district, ALS was noted in the ranging of 10.0 to 13.0 and BLB 0.0 to 5.0 PDI. In Dwarka, ALS and BLB disease recorded in the ranging of 8.0 to 11.0 and 3.0 to 5.0 per cent, respectively. In Porbander district ALS and BLB disease incidence recorded in the ranging of 7.0 to 14.0 and 0.0 to 2.0 PDI, receptively.

At cotton research station, Junagadh, varieties G. Cot.hy-8BG-II and G. Cot hy-12 recorded ALS 9.0 to 11.0 and BLB 3.0 to 6.0 per cent, respectively. During the season Grey Mildew was not observed in all locations, while root rot and wilt were observed negligible in some locations **(Table 9).**

SOUTH ZONE

Survey results indicated the predominance of Alternaria blight (05-30%) in early stages of the crop growth followed by Grey mildew (03-15%) and Bacterial blight (05-20%) at Dharwad and farmer fields. Rust appeared after 90 DAS (05-20%) **(Table 10).**

Alternaria leaf spot, Helminthosporium leaf spot, Cercospora leaf spot, bacterial blight, grey mildew and rust were recorded during the surveys conducted from July 2016 to January 2017, in cotton growing districts of Andhra Pradesh *viz*., Guntur (1,40,590ha), Krishna (37,914ha) and Prakasam (13,930ha). Intensity of bacterial blight, Alternaria leaf spot, grey mildew and rust diseases in various hybrids and varieties of cotton trials conducted at RARS, Lam was also recorded.

Traces of bacterial blight were observed in Jadoo BG II during September 2016 at Mangollu village, Krishna district and 1.5 PDI in RCH 659 BG II at Machavaram village, Guntur district during October 2016. Traces of Boll rot was recorded during September 2016 in Jadoo BG II at Makkapeta village, Krishna district; in ATM at Narukullapadu village, in RCH 659 in Pedapalem, Pillutla and Tummalacheruvu villages during October 2016. Alternaria leaf spot (0 to 2.0 %) was observed

during in seedling stage (July and August 2016) and from 0 to 25% during boll formation and boll development stages. Helminthosporium leaf spot (0 to 13.5 PDI), Cercospora leaf spot (0 to 7 PDI) and anthracnose (0 to 17 PDI) were also observed during kharif 2016. Grey mildew was recorded to the tune of 0 to 19% in 90 to 125 day old crop and rust was observed (0 to 19.5PDI) during December 2016 and January 2017, during boll maturity and bursting stages, in farmers' fields **(Table 11).**

Alternaria leaf spot was the major disease (0 to 39%); low to moderate intensity of Helminthosporium leaf spot (0 to 10%), Cercospora leaf spot (0 to 5%), anthracnose (0 to 12.25), bacterial blight (0 to 6.67%) and grey mildew (0 to 27%) were observed at Regional Agricultural Research Station, Lam, Guntur while rust (0 to 17.5%) appeared late in the season during January 2017 **(Table 11).**

Survey results indicated that the foliar diseases *viz.,Alternaria* leaf blight, *Myrothecium* leaf spot, grey mildew, sooty mould and *Tobacco streak virus* and soil borne diseases *viz*., root rot and fusarium wilt were observed at Coimbatore **(Table 12).**During the survey, it was observed in Dindigul district that a few plants were infected with *Tobacco streak virus* (4-5 plants only). In southern parts of Tamil Nadu, especially in Madurai, fields grown with SVPR 2 and SVPR 4 had root rot incidence (10-15 %). Minimum incidence of *Alternaria* leaf blight and *Myrothecium* leaf spot was also observed. No TSV disease incidence was observed in Madurai district. Further, it was observed that mealy bug and stem weevil infestation were more in surveyed areas.

In Virudhunagar district, one of the prominent zone where rainfed cotton is being grown, it was observed during the visit that the cotton crop was infected with *Alternaria* leaf blight and *Myrothecium* leaf spot in minimum level only. No TSV disease incidence was observed. As that of Madurai district, mealy bug infestation was more in Virudhunagar district as well. The cotton crop was moderately susceptible to *Alternaria* leaf blight in Virudhunagar district. A similar trend was observed in Tirunelvelli, another district in southern zone of Tamil Nadu. *Alternaria* leaf blight and bacterial leaf blight were minimally observed **(Table 12).**

The cotton plants in Coimbatore district were found to have *Alternaria* leaf blight and *Tobacco streak virus* diseases. It was observed in Coimbatore (Vaiyampalayam) that the Plant Disease Index was 3 for *Alternaria* leaf blight, 2 for Grey mildew (non Bt-Cotton) and 3 for *Tobacco streak virus* (ratoon cotton). The incidence of both wilt and root rot was found to be higher in cotton varieties. Stem weevil infestation followed by wilt and root rot incidence were also observed in Coimbatore. The aphid infestation followed by secondary sooty mould infection occurred in these areas. In Erode district, in North eastern zone along with Coimbatore, *Alternaria* leaf blight and grey mildew were observed in surveyed areas at a minimal level **(Table 12).**

Path.1 (b): Disease progress in relation to weather factors.

NORTH ZONE

Cotton leaf curl disease (CLCuD) was first observed on variety F 846 in the 26thStandard meteorological weeks (SMW) at Faridkot. Observations on the appearance and progress of CLCuD were taken at weekly interval starting from 25th to 44th meteorological week. It was found that CLCuD % increased upto 42nd meteorological week. The bacterial blight was started late in the

season in 30th meteorological week with 0.2 % DI. The fungal foliar leaf spots caused by (*Alternaria, Myrothecium, and Cercospora*) ranged from 0.0 to 2.6; 0.0 to 2.5 and 0.0 to 2.3 disease index from 30th to 44th meteorological week. The data reflects that CLCuD was positively significant with maximum relative humidity and white fly population. The CLCuD was negatively co-related with maximum, minimum and mean temperature and wind speed. The percent increase in CLCuD was positively co-related with minimum, mean relative humidity, rainfall and whitefly population **(Table13).**

Leaf curl disease first appeared on susceptible variety RST-9 on 2nd July after 35days of sowing during 27th St. Week and the incidence at the end of this week was only 0.70 per cent. However in subsequent standard week's leaf curl incidence in crop showed fast progressive increase reaching maximum level of 100.0 per cent on 21st August during 34th Standard week.

Data presented in **Table 14**indicate that disease remained slow up to 29th Std. Week (16 July – 22 July) with disease severity of 5.61 per cent. In subsequent 30th to 34th std. week disease progression was found very fast reaching to the level of 100.0 per cent. The overall precipitation from June to August (vegetative phase) during this year was 250.9 mm. The average weekly temperature during this period of June to August remained between 25.3 and 40.5 ^{o}C and Relative humidity between 49.0 and 85.7 per cent.

CLCuD appeared on 22th June, 2016 in the 25th standard meteorological week after 42 days of sowing on susceptible cultivar HS-6 and disease incidence was 5.33 and Per cent disease index was 1.33 which increased up to 100 per cent disease incidence and 33.32 per cent disease index on 30th week (23.7.16 to 29.7.16). During this period the average maximum and minimum temperature recorded were 35.7 and 25.7^{o}C, whereas, morning and evening relative humidity ranged from 92 to 74 per cent with 6.1 bright sun hours having whitefly population 15.1 per three leaves **(Table 15).** The per cent disease index increased upto 63.80 per cent in the first week of October 2016.

The disease progression was negatively correlated with temperature (maximum and minimum) and wind speed with maximum value. Correlation coefficient was found with maximum temperature (-0.82). The disease progression was better associated with relative humidity during morning time as compared to humidity during evening time. Multiple regression model was developed using the most significant weather parameters for prediction of disease progression, the regression equation is as under:

Y= 34.629 - 0.17588*T Max - 0.6220* + 2.206 RHM + 0.740* RHE- 6.365*WS + 0.195*Rain

The weather parameters; Where, TMAX: Maximum temperature (°C), TMIN: Minimum temperature (°C), AVPm: Actual vapour pressure at morning, AVPe: Actual vapour pressure at evening, RHm: Relative humidity at morning (%), RHe: Relative humidity at evening (%), AVGWS: Average wind speed (km per hour), BSS: Bright sunshine hours, RAIN: rainfall (mm) collectively explain the variability in the disease progression upto 88 per cent.

The leaf curl virus disease initiated in 24th met week (12-18 June) and the incidence reached 100% by 33rd week (14-20 August) at Sirsa. An increasing trend of whitefly incidence from 1.75 per 3 leaves up to 14.33 whiteflies per 3 leaves was observed during the season. The maximum temperature ranged from 30.5 to 40.2^{0}C whereas minimum temperature was

between25.4 to 30.1^{0}C. Relative humidity morning and evening ranged between 66.4 - 91.1 and 35.3-73.9 % respectively. The total rainfall received during this period was 194.2 mm**. (Table 16)**

CENTRAL ZONE

The first incidence of *Alternaria* blight was noticed on 18th August (33 MW) on research farm at Rahuri on cotton var. LRA-5166. The average maximum and minimum temperature during 32rd MW was 30.1^{0}C and 23.1^{0}C and average morning and evening humidity 70 and 65 per cent, respectively with 50.6 rainfall in 31stMW.The intensity of *Alternaria* blight increased gradually from 3.8 per cent in 33rd MW and maximum i.e. 27.6 per cent was recorded in 40th MW. The average maximum and minimum temperature during 39th MW was 30.1^{0}C and 22.2^{0}C and average morning and evening humidity was 82 and 65 per cent, respectively **(Table 17).**

The correlation between the disease intensity and weather parameters was worked out. There was significant positive correlation of rainfall and rainy days (at 1%) with *Alternaria* blight development. The minimum temperature and evening humidity had positive and maximum temperature and sunshine hours had negative correlation with PDI of *Alternaria* blight in cotton **(Table 17a).**

At Nanded, the grey mildew was recorded in 45th met week and the maximum incidence of 2.77 % was observed in 47th week. The incidence declined to 0.77% by 52nd week **(Table 18).** An attempt was made to develop a prediction model with eleven year data (2003-2013).The overall incidence of disease was moderate during 2003-2016. Peak period of Grey mildew predictability (39.2 per cent/plant) was observed during 2016 **(Table18a).** First appearance of disease were observed during 37th SMW, peak period of incidence were observed during 47th SMW, during the crop age at first appearance and crop age at peak period variations were observed due to different sowing dates.

For each weather variable two indices have been developed, one as simple total of values of weather parameter in 37th to 51th SMW for Grey mildew on cotton. The other one as weighted total, weights being correlation coefficients between disease infestation to forecast and weather variable in respective weeks. Further regression analysis was carried out for this purpose the weather variables which showed significant contribution were incorporated in the study. Among these, results indicated that the R^2 value for Grey mildew was 0.78 at maximum severity predictability **(Table18b).** It clearly indicates that the significant R^2 value was observed in Grey mildew. Therefore the stepwise regression analysis was carried out for prediction model of Grey mildew on cotton.

Bacterial blight was initiated at Akola during first week of August (31 MW), when the maximum and minimum temperature was 29.8^{0}C and 23.6 ^{0}C along with relative humidity between the range of 91 and 72 percent. Later gradually increased and maximum per cent disease intensity i.e. 9.0% was observed during (35thMW). Maximum and minimum temperature was 31.0 ^{0}C and 24.5^{0}C with relative humidity range of 85 - 62 percent. Later decreasing trend was observed. In LRA-5166 as well as Bunny Bt similar trend was observed. *Myrothecium* leaf spot disease was initiated during second week of August 2016 (32 MW), maximum disease intensity i.e. 2.08% was observed during (34 MW). Maximum and minimum temperature was 31.0 and23.4^{0}C along with relative humidity between the range of 85 and 58 per cent in LAR 5166 and Bunny Bt respectively.

Grew mildew initiated in the last week of October i.e. 43 MW with 1.66% disease intensity on AKA-8. The maximum disease intensity 6.86 was recorded at 47th MW, when maximum temperature was 30.7 and morning relative humidity 85.3 and evening 32.0 per cent. The LRA 5166 and RCH-2 were free from grey mildew **(Table 19).**

Bacterial blight disease (BLB) progress was recorded with its first appearance and subsequently at weekly interval till it prevailed on G. Cot. Hy. 12 on Research farm at Surat. The result presented in **Table 20**, which indicated that the disease first appeared in last week of July (0.5 %) *i.e*. in 31st Met. week. The incidence of bacterial blight disease (BLB) was noticed from 31st to 50th standard week with the maximum disease intensity in first week of October (20.0 %) *i.e.* in 41st Met. week. Bacterial leaf blight (BLB) has positive correlation with the minimum temperature, morning humidity and sunshine hour for the disease development.

Incidence of foliar disease *viz.* Alternaria leaf spot, bacterial leaf blight and grey mildew in relation to weather factors was studied at Junagarh. Weekly observations on the incidence of the above diseases were recorded in the cultivar G. Cot. Hy-12. The first occurrence of ALS was observed during second week of September (37thSMW). Highest percent disease incidence of 15.3 was recorded during first week of December (49thSMW). The first occurrence of BLB was recorded during second week of August i.e. 32ndmeteorological standard week. The maximum of 13 % BLB incidence was recorded during last week of October (44th SMW) and there after it declined. The grey mildew disease was absent during the season **(Table 21).**

The results reveled that Alternaria leaf spot disease found non-significant with maximum temperature and rainfall. The minimum temp and relative humidity (%) at morning & evening and were recorded significant and rainy days negative correlation at 1 per cent level. The maximum temperature and rainfall were found negative correlation at 5 per cent level.

Bacterial leaf blight disease correlation coefficient studies recorded non-significant with maximum & minimum temperature, rainfall and rainy days. The relative humidity (%) morning & evening and rainy days were found negative correlation at 1 per cent level. While rainfall was found negative correlation at 5% level. The Grey mildew disease was not occurred during the *Kharif*-2016 season **(Table 21a)**

At Khandwa, Susceptible cultivar JK-4 was sown on 25/6/2016. Bacterial blight was first observed in traces on 26th Standard Meteorological Weeks (SMW). The disease intensity gradually increased up to 36th SMW then decreased upto 47th SMW. From the last week of September disease increased and in 36th SMW incidence was maximum (16.77) in the grade 3.0 using 0-4 scale. Myrothecium leaf disease was also first noted in 29th SMW and increased up to 37th SMW. The incidence of Grey Mildew was first noted in 40th SMW and increased up to 44th SMW, the grade was 2.0 **(Table 22).**

SOUTH ZONE

Alternaria leaf blight was recorded from 31st met week whereas bacterial blight, grey mildew and rust diseases appeared from 34th, 37th and 44th met weeks on different varieties/hybrids at Dharwad. The maximum incidence for all diseases was noticed between 44-46 weeks **(Table 23).** The correlations with weather parameters were worked out and are presented below:

Maximum and minimum temperature **(Table 23a and 23b).**

Alternaria leaf blight: With respect to Alternaria blight, significant positive correlation was observed between the maximum temperature and the genotypes. Significant negative correlation was observed between minimum temperature and genotypes like Abhadita, Bunny Bt and Dr. Brent Bt.

Bacterial blight: With respect to Bacterial blight,significant positive correlation was observed between the maximum temperature and the genotypes and significantly negative correlation was observed with respect to minimum temperature and the genotypes.

Grey Mildew: With respect to Grey mildew, significant positive correlation was observed between the maximum temperature and genotypes like Abhadita, Jayadhar, Bunny Bt and Dr. Brent Bt where as significant negative correlation was observed between the minimum temperature and the genotypes Abhadita and Jaydhar.

Rust: With respect to rust also, significant positive correlation was observed between the maximum temperature and the genotypes whereas no correlation was observed between the minimum temperature and the four genotypes.

Relative Humidity Correlations: No correlation was observed between RH Morning and RH Evening in four genotypes with respect to four diseases

Rainfall and Rainy days Correlations:

Significant positive correlation was noticed between total rainfall and rust in all the genotypes and no correlation was noticed between rainy days and the genotypes with respect to all the four diseases.

Jadoo BG II cotton hybrid was sown on 31.07.16 in an area of 150 sq. m at Guntur. Weekly observations were made on the percent intensity of Alternaria leaf spot and grey mildew diseases after appearance of the disease. Alternaria leaf spot appeared in 37th standard meteorological week (SMW) during September 2016 when the mean maximum temperature was 32.1^{0}C; mean minimum temperature was 23.4 ^{0}C; mean relative maximum humidity of 85.86 %; mean minimum humidity of 77.0%; mean rainfall was 27.2mm; rainy days were 4.0; sun shine hours were 0.5; wind speed 6.4 kmph and evaporation was 2.5. Alternaria leaf spot attained a maximum PDI of 39.25 on Jadoo BG II during 1st standard week i.e., first week of January, during which the mean maximum temperature was 31.33^{0}C; mean minimum temperature was 15.86^{0}C; mean relative maximum humidity of 76.00 %; mean minimum humidity of 55.86 %; sun shine hours were 8.3; wind speed 2.8 kmph and evaporation was 3.57. Intensity of Alternaria leaf spot increased during December and reached second peak during January 2017 **(Table 24).**

Disease intensity was negatively correlated with minimum temperature, relative humidity, rainfall, number of rainy days and wind speed; positively correlated with maximum temperature, sun shine hours and evaporation during kharif 2016. Significant correlation was recorded with minimum temperature, RH, RF and sun shine hours. Multiple linear regression analysis revealed that temperature, RH, rainfall, sun shine hours, wind speed and evaporation significantly influenced the progress and disease intensity during kharif 2016. Minimum temperature and

number of rainy days influenced at 1% level of significance while other parameters were significant at 1%.

Y = 124.6111 + 6.656375 max temp - 3.14304 min temp - 4.46044 RHI + 2.440026 RH II - 0.52277 RF + 12.58357 RD + 9.552177 SSH + 4.087883 WS-35.7902 Evap. (r^2=83.85%)

Grey mildew disease appeared in 47th standard meteorological week (SMW) during November 2016 on Bt variety 221 and 205 when mean maximum temperature was 32.9^{0}C; mean minimum temperature was 16^{0}C; mean relative humidity of 78.29%; sunshine hours were 6.89, wind speed 2.33kmph and evaporation was 3.86. The disease progressed and reached PDI of 25 on Bt variety 221 during 52nd week of 2016 during which the mean maximum temperature was 31.33^{0}C; mean minimum temperature was 15.86^{0}C; mean relative humidity was 76%; sunshine hours were 8.3, wind speed 2.8kmph and evaporation was 3.71. Disease intensity was negatively correlated with temperatures, RH II, wind speed and evaporation; positively correlated with RH I and sun shine hours. Multiple linear regression analysis revealed that maximum temperature, wind speed (at 1%) and RH II (at 5%) significantly influenced the progress and disease intensity.

Y = 325.2028 - 6.15759 max temp -1.71805 RH II - 5.88439 WS (r^2=76.99%; BT Var. 223)

Y = 264.2793 - 5.01562 max temp -1.36638 RH II - 5.31198WS (r^2=76.99%; BT Var. 205)

Grey mildew appeared during January 2017 in Jadoo BG II and less number of observations did not permit to draw regression equation during kharif 2016-17. Similar situation was encountered with respect to rust.

Studies on the impact of weather factors on the intensity of foliar and soil borne diseases starting from 45th meteorological week at Coimbatore revealed that foliar diseases such as *Alternaria* leaf blight and bacterial leaf blight were found in the varieties *viz.,* MCU13, SVPR-4 and hybrid RCHBGII. It could be inferred that after rainfall, foliar diseases namely *Alternaria* leaf blight and bacterial leaf blight were found to infect cotton crop. From 45th week, coinciding with rainfall in November, all the entries under study had moderate infection. The hybrid RCHBGII and varieties MCU13 and SVPR4 were moderately susceptible to *Alternaria* leaf blight (3.0 PDI). The cotton plants of hybrid RCHBGII were less susceptible to bacterial leaf blight as few plants were seen with the symptoms (2.0PDI). The hybrid RCHBGII was found to be susceptible to soil borne disease (root rot -5.0%) **(Table 25).**

Path.1 (c) Studies on the variability in Alternaria causing leaf spot in cotton.

Alternaria isolates collected from cotton research station, Nanded and ten different locations of Nanded District.Artificially spraying of A*lternaria* culture on plants was done. Re Isolated samples of *Alternaria* were submitted to Cotton Pathologist, Dept. of Plant Pathology TNAU, Coimbatore for diversity analysis **(Table 26).**

The isolates collected from 10 different locations around Dharwad have been sent to cotton pathologist, Dept of Plant Pathology, TANU, Coimbatore for diversity analysis.

During the survey for cotton diseases Alternaria leaf spot samples were collected from farmers' fields and experimental plots at RARS, Lam, Guntur and observed for the presence of *Alternaria* **(Table 27).** Based on the spore structure the species was identified as *Alternaria macrospora*. The fungus was cultured and the isolate was sent to National Centre of Fungal Taxonomy, New Delhi for confirmation and TNAU, Coimbatore for molecular analysis.

Path 1 (d): Survey and Epidemiology of TSV

CENTRAL ZONE

The occurrence of Tobacco streak virus (TSV) was observed from first fortnight of July on most of the Bt cotton hybrids sown on farmers field as per survey conducted by Rahuri center. There was dry spell in the month of August particularly in the district of Ahmednagar. This resulted in high incidence of thrips on the crop, the vector for TSV. The virus caused mosaic, chlorosis and necrosis on upper leaves of the plants. Square drying was also noticed in some plants whereas stunting of plants was rarely observed. Maximum incidence of the virus i.e. 21.56 per cent was recorded in Rahuri area **(Table 28).**

During 2016-17, survey was undertaken in eight district of Marathwada region/ VNMKV Jurisdiction by Nanded center for TSV incidence and no TSV infected plant was observed **(Table 29).**

SOUTH ZONE

During the surveys conducted in Cotton growing districts by Guntur center, Tobacco Streak Virus disease was recorded from July to December 2016. The incidence on different hybrids varied from 0% to 0.88% **(Table 30).** Tobacco streak virus disease incidence was negligible on cotton varieties and hybrids in experimental plots of Regional Agricultural Research Station, Lam during August 2016 to January 2017 **(Table 30a).** Progress of TSV disease incidence (%) was in the range of 0.35% to 12.46% in RCH 2 BG II (**Table 30b).** The incidence was more during October when the crop was at 11 to 12 weeks old and thrips counts were in the range of 0.0 to 2.9 per three leaves. The symptoms were restricted to few leaves and/or branches. The incidence of TSV disease was less from second fortnight of November onwards and thrips were not found.

Generally, the incidence of TSV was found to be minimal in all the cotton growing tracts of Tamil Nadu. The incidence was maximum (10.0%) in Coimbatore and a very few places

surveyed in Dindigul district showed minimal incidence of TSV. It is observed from **Table 31** that excluding Coimbatore and Dindigul locations, none of the areas surveyed was infested with TSV.

Path. 2 (a): Screening of breeding lines for disease reaction.

The breeding lines in various national and zonal trials were screened against important diseases in the area. In each screening trial susceptible checks for the diseases were maintained and their reaction is presented at the end of each table where data from different locations of a trial is pooled. The reaction of a particular entry is considered valid provided there is either susceptible or moderately susceptible reaction in the susceptible check.

The results of National trials are given in Tables- 32 to 41.

The results of zonal trials (north zone) are given in Tables- 42 to 46

The results of zonal trials (central zone) are given in Tables-47 to 59

The results of zonal trials (south zone) are given in Tables- 60 to 69

Path.2 (b): Confirmation and maintenance of disease resistant lines.

NORTH ZONE

The data of Faridkot center presented in **Table-70** revealed that out of 25 entries tested under field conditions against cotton leaf curl disease (CLCuD), two entries *viz.,* Su-Flum and Bihani-251 gave moderately resistant reaction and seven entries each gave moderately susceptible and susceptible reaction respectively and all other entries gave highly susceptible reaction. Against bacterial blight five entries *viz.,* Su-Flum, Bihani-251, F 2501, RS 2765 and MR 68 gave resistant reaction and all other entries gave moderately resistant reaction only RST 9 gave moderately susceptible reaction against Bacterial blight. Against fungal foliar leaf spots (FFLS) caused by *Myrothecium, Alternaria* and *Cercospora,* three entries *viz.,* Su-Flum, Bihani-251 and MR 68 gave resistant reaction. All other entries gave moderately resistant reaction, except RST 9 which gave moderately susceptible reaction. At Sirsa, four entries AOZN-80, B-B-1371, DL-1 and GRS 6015 were found moderately resistant to root rot disease **(Table71)**

CENTRAL ZONE

Twenty three breeding lines showing resistant reaction during 2015-16 under field conditions were screened against *Alternaria* blight disease by artificial inoculation. The susceptible check LRA-5166 was also sown for comparison. The three entries namely RAHC 1011, ARBHB 1401and RAHC 1017 showed disease free reaction against HS reaction in susceptible check. **(Table 72).**

It was observed that during 2015-16 and 2016-17, among 14 genotypes tested at Akola, 9 genotypes showed resistance to bacterial blight i.e. (P-2151, ADB – 542, 201, BS 40, BS30 BS 79,

CPD 168, X -1353, AKH 8828) whereas remaining genotypes were categorized as moderately resistant i.e. (BS –30, BS – 79, BGHV -180, SCS – 793) **(Table 73).**

The entries found disease free and resistant during previous year were tested this year under natural field and artificial condition against the different diseases at Surat. Infester row of susceptible check LRA 5166 was grown alternating every four rows of the test entries. Artificial inoculation was made twice by preparing the spore suspension of BLB. Total 44(G hirsutum-8,G arboreum-18 &G herbaceum-18) entries were screened through artificial inoculation, from these entries GSHH 2729, GSHV 162,172,173 were free from BLB &ALB whereas GN Cot. 22 was free from ALB. The arboreum and herbaceum entries remained free from both diseases **(Table 74).**

SOUTH ZONE

The genotype SVA-1118 exhibited high degree of resistance to Alternaria blight, Bacterial blight, Grey mildew and Rust at Dharwad. The genotypes DB-14, DB-40 and ARBB-1501were found to be resistant against Alternaria blight, Bacterial blight and Grey mildew and Rust **(Table 75).**

Six varieties viz., L 799, TCM 1716 (2a), DB 1502 (12a), ARBD 27, GSB 44, GSB 43 (14a); Two checks RCH 2 BG II (for bacterial blight and rust) and Jadoo BG II (for Alternaria leaf spot and grey mildew) were sown on 31.07.2016 at Guntur and evaluated for second consecutive year. The reaction of these varieties is presented in **Table 76.** Two checks RCH 2 BG II (for bacterial blight and rust) and Jadoo BG II (for Alternaria leaf spot and grey mildew) after every four rows of randomized entries and also as border. Natural disease pressure was supplemented with artificial inoculations with grey mildew spore suspensions. All test entries viz., L 799, TCM 1716, DB 1502, ARBD 27, GSB 44 and GSB 43 maintained their resistant reaction to grey mildew disease while L 799 remained resistant to Alternaria leaf spot and DB 1502 continued to show resistance to rust; respective check entries showed susceptible reaction.

The results from **Table 77** indicated that Entries TCH 1716 and GSHV 171 were observed to be free from the diseases at Coimbatore.

Path.2 (c) Monitoring of breakdown of resistance against CLCuD in cotton.

NORTH ZONE

In this experiment, three each of tolerant and susceptible varieties against CLCuD and one each of tolerant and susceptible Bt cotton hybrid were selected and sown at three locations to see how their reaction against CLCuD changes over the years. The PDI in case of tolerant varieties/hybrid was much less compared to susceptible varieties/hybrid at all the locations **(Table 78).** However when we look at the reaction category, the tolerant varieties were grouped in categories from MR to HS. The susceptible varieties were grouped in categories from S to HS. The tolerant Bt hybrid was grouped from MR to MS and susceptible hybrid from MS to HS category.

Path.3 (a.3): Evaluation of TrichoCASH (*Trichodermaharzianum*) CICR-G 1% WP for cotton root diseases.

CENTRAL ZONE

Among the ten treatments including control tested against Fusarium wilt at Pune center, Tricho CASH) @10g/kg seed +Thiram @3g/kg showed maximum 49.63% disease control followed by Tricho CASH) @5g/kg seed + Thiram @3g/kg (49.17%) and Thiram @3g/kg (46.67%). All these treatments were at par with each other **(Table 79).**

Path.3 (c): Development of IDM modules for management of cotton diseases.

CENTRAL ZONE: Akola, Junagarh (Old centers); Nanded, Surat &Khandwa (New Centres)

Akola: The seed treatment and soil application of bioagents in combination with foliar sprays on *Bt* hybrids (Bunny Bt) were undertaken as per modules 1 to 6 and compared with control (neither seed treatment nor any fungicide / bioagent spray). **(**Details of treatments for IDM trials 1-7 given in Table 80**)**

Only bacterial blight was observed on cotton in the experimental plot. The per cent disease intensity of BLB, plant height and root length were recorded on randomly selected five plants and days to flowering were recorded when 50 per cent plants in each plot showed first flowering. However, the seed germination was recorded 15 days after sowing and seed cotton was harvested separately from each plot and the data was subjected to statistical analysis.

Per cent disease intensity: The maximum disease intensity 8.49 per cent was recorded on Bunny Bt in the Control plot (untreated plot). All six different modules irrespective of *Bt* hybrids were found effective in managing the bacterial blight disease of cotton over untreated plot. The minimum disease intensity was recorded in module 6 i.e. 5.98 %. **(Table 81).** However, the seed treatments of bio agent with chemical sprays were found more effective in minimizing the BLB disease intensity in Bt hybrid.

Seed cotton yield: The seed cotton yield influenced by different treatments irrespective of *Bt* hybrids were statistically non-significant. However, the maximum seed cotton yield (9.91 q/ha) was recorded in the treatment of Bunny Bt + module 6 followed by the treatment Bunny Bt + module 5 (9.24 q/ha). Rest of the modules were at par with each other over control. Whereas, the minimum seed cotton yield 6.92q/ha was recorded in untreated plot **(Table 81).**

Ancillary data: The results on yield contributing parameters revealed that there was not much difference in seed germination (94.09 to 98.89 %), days to flowering (38 to 42days) and root length (36.36 to 39.81 cm) due to different treatments. There was not much variation in plant height in *Bt* hybrid with different module, however plant height of Bunny Bt was (64.32 to 69.80 cm) whereas, the highest plant height 69.80 cm was recorded in the treatment of soil application of *Psudomonas fluorescens* (PF - TNAU) @ 2.5 Kg/ha and Foliar spray with *P*. *fluorescens* (module 3), which was followed by ST - PF CICR @ 10 g/ kg of seed + Soil Application of *Trichoderma viride* @ 2.5 kg/ ha TV- TNAU1 in 250 kg of Compost or FYM and foliar spray with Kresoxim methyl (ergon) @ 1 ml/

litre followed by Captan + Hexaconazole @ 1.5 g/ litre for fungal diseases or COC (0.3 %) + Streptocycline (0.01 %) for grey mildew on need basis (module 6) **Table 81).**

The field experiment was conducted with total nine modules including the control during *Kharif* 2016 at Junagarh. The results presented in **Table-82 &82a** revealed that the significantly minimum Alternaria leaf spot was recorded in Module-7 (8.16%) and it was at par with Module-6 (9.28%), Module-8 (9.65%), Module-5 (9.73%),Module-1(10.48%) and Module-2 (11.42%) in RCH-2 BG-II hybrid, while all the remaining Modules found statistical at par with each other for alternaria leaf spot at Junagadh center. The maximum alternaria leaf spot (19.18%) was recorded in module-9 i.e. control.

For bacterial leaf blight was recorded significantly minimuminModule-7 (1.37%) and it was at par with Module-5 (1.97%), Module-6 (2.28%) and Module-8 (2.48%) in RCH-2 BG-II hybrid as compared to the control. The maximum bacterial leaf blight (4.64%) was recorded in Module-9 i.e. control.

Considering the plant mortality per cent, the significantly minimum plant mortality per cent (4.45%) was recorded in Module-7 and it was at par with Module-6 (5.78%). However Module-5 was found statistically at par with rest of the Modules, to reduce the mortality per cent age. The maximum plant mortality per cent (14.04%) was recorded in module-9 i.e. control.

The statistically significantly height seed cotton yield was recorded in Module-7 (2442 kg/ha) and it was at par with Module-6 (2230 kg/ha) as compared to rest of Modules .The minimum seed cotton yield of 1583 kg/ha was recorded in module-9 i.e. control.

For the character germination percentage at initial stage of seedlings in all the Modules were calculated on the basis of initial plant stand. On the mean results of Table-2 indicated that the highest mean germination percentage was recorded in Module-7 (95.00%) and Module-6 (94.67%). The lowest mean germination percentage was recorded in control (89.33.00%). The same results were also found for plant height in RCH-2 BG-II hybrid.

Comparison of the efficacy between the bio-control agents used in different modules indicated that Module-7 (**ST:***Pseudomonas fluorescence* (PF-JAU) @10g/kg seed; **SA**: of *T.harzianum* (TH-JAU) @2.5 kg/ha in 250 kg of FYM; **FS**: with *Pseudomonas fluorescens* (PF-JAU) 1% for ALS and COC (0.2%) + Streptocycline (0.01%) for BLB on need basis) and Module–6 (**ST:** *Pseudomonas fluorescens* (PF-CICR)@ 10g/kg seed; **SA:** of *T.viride* (TV-TNAU) @2.5Kg/ha in 250kg of FYM ; **FS:** with Ergon@ 1ml/lit followed by Taqat @1.5g/lit for fungal diseases or COC (0.3%)+ Streptocycline(0.01%) for BLB) were found effective in reducing the alternaria leaf spot, bacterial leaf blight diseases, mortality percent of soil borne diseases and improving seed cotton yield in RCH-2 BG-II hybrid cotton

Treatment T6 *i.e.,* Module 6 and then treatment T3 i.e Module 3 were found superior than all other modules, in PDI and all other parameters of cotton plants in this experiment in this year 2016-17 at cotton research station, Nanded **(Table 83).**

The results of IDM trial at Surat presented in **Table 84** revealed that out of the total seven modules including the control, module 6 (6.50 % PDI) followed by module 5 (8.50 % PDI) significantly recorded minimum bacterial leaf blight infection in comparison to the module 7 *i.e*. control (18.50 % PDI) in RCH 2 BG II hybrid for the control of bacterial leaf blight at Surat centre. For Alternaria leaf spot disease, module 6 (2.50 % PDI) were recorded significantly minimum Alternaria leaf spot disease in RCH 2 BG II hybrid as compared to the control (10.50 % PDI) followed by module 5 (4.50 % PDI) and module 4 (5.50 % PDI).

The highest seed cotton yield was recorded in module 6 (2690.00 kg/ ha), followed by module 5 (2430.67 kg/ ha) and module 4 (2311.00 kg/ ha).

Comparison of the efficacy between the biocontrol agents used in different modules at Surat centre indicated that module 6 (ST - PF CICR @ 10 g/ kg of seed + Soil Application of *Trichoderma viride* @ 2.5 kg/ ha TV- TNAU1 in 250 kg of Compost or FYM and foliar spray with Kresoxim methyl @ 1 ml/ litre followed by Captan + Hexaconazole @ 1.5 g/ litre for fungal diseases or COC (0.3 %) + Streptocycline (0.01 %) for BLB) and module 5 (ST – PF CICR @ 10g / kg of seed + Soil Application of *Trichoderma viride* @ 2.5 kg/ ha TV-TNAU1 FS with Propiconazole 0.1 % for fungal diseases and COC (0.3 %) + Streptocycline (0.01 %) for BLB or Carbendazim 0.1 % for grey mildew on need basis) were found effective in reducing the bacterial leaf blight and Alternaria leaf spot diseases in RCH 2 BG II hybrid cotton.

The experiment on management of soil and air borne disease of cotton using different IDM Module was conducted at Khandwa during *Kharif* 2016. The results are presented in **Table 85**. In case of Grey mildew at 110 DAS the results obtained during 2016, revealed that all the treatment were significantly superior over untreated control. T5 (3.33 PDI) showed very less per cent disease index followed by T6 (4.33 PDI), T4 (7.33 PDI), T3 (7.67 PDI) T2 (14.33 PDI) and T1 showed significantly high grey mildew per cent disease index (19.33 PDI).

In case of Bacterial blight at 110 DAS the results obtained during 2016, revealed that all the treatment were significantly superior over untreated control. T5 (8.33PDI) showed very less per cent disease index followed by T4 (11.33 PDI), T6 (11.67 PDI), T2 (17.33PDI) T3 (17.67 PDI) and T1 showed significantly high bacterial leaf blight per cent disease index (22.33 PDI).

In case of Myrothecium leaf blight at 110 DAS the results obtained during 2016, revealed that all the treatment were significantly superior over untreated control. T5 (7.33PDI) showed very less per cent disease index followed by T6 (7.67 PDI), T4 (13.33 PDI), T1 (14.33 PDI), T3 (15.67 PDI) and T2 showed significantly high Myrothecium leaf blight per cent disease index (18.67 PDI).

In case of Grey mildew at 140 DAS all the treatment were significantly superior over untreated control. T5 (5.33 PDI) showed very less per cent disease index followed by T6 (7.67 PDI), T4 (10.33 PDI), T3 (12.33 PDI) T2 (19.67 PDI) and T1 showed significantly high grey mildew per cent disease index (23.33 PDI).

In case of Bacterial blight at 140 DAS all the treatment were significantly superior over untreated control. T5 (15.66PDI) showed very less per cent disease index followed by T6 (19.66 PDI), T4 (22.33 PDI), T3 (27.66 PDI), T2 (29.33 PDI) and T1 showed significantly high bacterial leaf blight per cent disease index (31.66 PDI).

In case of Myrothecium leaf blight at 140 DAS all the treatment were significantly superior over untreated control from the data it is clear that, T5 (12.67PDI) showed very less per cent disease index followed by T6 (14.67 PDI), T3 (22.67 PDI), T1 (24.00 PDI), T4 (27.00 PDI) and T2 showed significantly high Myrothecium leaf blight per cent disease index (29.67 PDI).

Germination %: The results are presented in **Table 85a.** The maximum germination percentage was recorded by T3 and T5 (97.40) followed by T2 (96.35), T4 (96.35) and T6 (95.31). The minimum germination percentage was recorded by T1 and T7 (93.75).

Yield: The yield of cotton was significantly superior in all the treatments as compared to untreated control. Maximum yield was recorded in T5 (1332.00 kg/ha) significantly superior in all the treatments, followed by T4 (1253.09 kg/ha), T6 (1251.00 kg/ha), T3 (1090.09 kg/ha) and T2 (1085.07 kg/ha). The results indicated that, all above mentioned treatments showed higher yield of cotton. Least yield was recorded in T1 (926.67 kg/ha) followed by untreated control T7 (816.67 kg/ha) **Table 85a.**

Plant height: At 50 DAS the maximum plant height was recorded by T5 (76.11) cm. followed by T4 (66.44), T6 (62.44), T1 (58.89) and T3 (54.33) cm. The minimum plant height was recorded by T2 (51.44 cm.). At 80 and 110 DAS the maximum plant height were also recorded by T5 followed by other treatments. The minimum plant height was recorded after 80 and 110 DAS by T1 (76.33) and (92.67) cm. respectively **Table 85b.**

SOUTH ZONE

Dharwad (Old center)

At Dharwad, least per cent of seedling mortality was found in T7 (Seed Treatment*Trichoderma viride* (UASD)10g/kg of seed) .With respect to per cent disease index of *Alternaria* blight and rust disease, T6 recorded lower incidence with higher yields **(Table 86).**

Path.3 (e): Innovative interventions for the management of CLCuD.

NORTH ZONE

All the treatments showed reduction of CLCuD. Pooled results of five sprays of different interventions showed lowest PDI in Apis mallifera followed by Lachesis and Difenthiuron treatments. Highest seed cotton yield was observed in treatment Cow urine+Calcium nitrate followed by Apis mallifera and Digitalis treatments **(Table 87 & 87a).**

Based on the sprays applied from 3-5 times according to the incidence of Whitefly at various locations, the Diafenthiuron (Polo) reduced maximum whitefly population followed by Neem oil at almost all the locations. In Haryana, at CICR Experimental area, population reduction in Whitefly ranged between 7.79-59.40%. Among the various innovative interventions, Cow urine + Calcium nitrate found to be superior in reduction of Whitefly population followed by Mustard oil, Digitalis, Lachesis & Butter milk + Calcium nitrate. In Rajasthan at Sriganganagar location,

population reduction ranged between 9.21 – 65.44% in all the treatments. Between the locations of Punjab, Polo was found to be Superior in reduction of Whitefly followed by Jasmonic acid, Neem oil. At Faridkot, Whitefly population reduction ranged from 17.51-42.25%where as in Bathinda it ranged between 5.10-59.17% **(Table 87b).**

Path.4. (e):Expt.1: Crop loss estimation due to CLCuD and distribution pattern of CLCuD in north zone

Pooled data of Hisar, Faridkot and Sriganganagar seed cotton yield reduction (Grade wise from 1-6) due to CLCuD in different Bt hybrids varied from 4.15 to 51.48, 5.15to 48.02, 3.40 to 47.26 and 4.00 to 46.34 percent in Bt hybrids Bioseed 6588 BG II,RCH 650 BG II, Ankur Jai 3028 BG II and MRC 7017 BG II respectively. Based on mixed grades it was 28.39, 29.20, 34.28 and 36.66 percent respectively in Bioseed 6588 BG II, RCH 650 BG II, Ankur Jai 3028 BG II and MRC 7017 BG II **(Table 88).**

Path.4 (e). Expt.2: Distribution pattern of CLCuD on local popular BT hybrid at farmer's field.

NORTH ZONE

The maximum leaf curl disease was noted in Punjab followed by Sriganganagar and Haryana during the 2016 season. In Punjab, maximum CLCuD was noted in Fazilka district followed by Faridkot and Muktsar. The Minimum PDI was observed in Mansa district. In Rajasthan, Sriganganagar district showed maximum CLCuD followed by Hanumangarh. In Haryana the maximum CLCuD was recorded in Hisar followed by Jhajjar and Rohtak. The minimum incidence was noted in Sirsa district **(Table 89).**

Path. 4(e): Expt. 3. Study of CLCuD progress and yield estimation (Sirsa).

In the trial at Sirsa, two tolerant and two susceptible hybrids were planted, the disease initiation was delayed by two weeks in both the tolerant hybrids (Yuva and Bunty) during both years and upto one month in case of both hybrids during 2016. The disease incidence was low and its progress was slower as compared to susceptible hybrids Ankur Jai Bt and Ankur 3028 BG II. However the disease progress was fast during 2016 compared to 2015 in both hybrids and the maximum incidence reached upto 4.2 and 14.6 % in Yuva and 14.1 and 39.8 in Bunty with pooled average of 9.4 and 26.9 respectively. In case of susceptible hybrids, the disease initiation was observed in both hybrids at 50 DAS during 2015 and at 65 DAS during 2016. The maximum incidence reached upto 48.7 and 57.1 respectively in Ankur Jai Bt and Ankur 3028 during 2015 whereas it was 100% in 2016 in both the hybrids. Pooled average of 74.3 and 78.5 % incidence was observed in Ankur Jai Bt and Ankur 3028BG II **(Table 90).** The PDI in general was higher in 2016 compared to 2015 and tolerant hybrids Yuva and Bunty showed pooled average PDI of 3.6 and 8.7 respectively. The susceptible hybrids Ankur Jai Bt and Ankur 3028 BG II showed pooled average of 43.5 and 40.9 respectively **(Table 90a).**Seed cotton yield reduction trend ie more reduction when

the disease appears early was noted in case of all the hybrids. However in tolerant hybrids the reduction was more prominent in Yuva compared to Bunty. In case of susceptible hybrids the reduction was more in Ankur 3028BG II compared Ankur jai Bt.Maximum seed cotton yield was observed in Bunty followed by Ankur 3028 BG II and the minimum yield was shown by Ankur jai Bt**(Table 90b).**

Path 7: Fusarium wilt of cotton. (Pune center)

Seedling Resistance Test: Total 46 genotypes received from CICR Regional station Coimbatore, Regional Cotton Research Station, Viramgam and Principal Scientist and I/C Agricultural Research Station, Jalgaon were tested for Seedling Resistance (SRT). Out of 46 cotton genotypes, the genotype DWDa1601 exhibited resistant reaction and 11 entries exhibited moderately resistant reaction to *Fusarium* wilt in seedling resistance test conducted in glasshouse.

Adult Plant Resistance Test: Twelve cotton genotypes out of 46, found resistant (R & MR) to *Fusarium* wilt in seedling resistance test conducted under glasshouse condition were screened in sick field. Out of 12 genotypes, 9 exhibited less than 50% vascular discoloration and were found resistant to *Fusarium* wilt **(Table 91).**

Path 1(a): Observations on the occurrence of various diseases (in farmer's field and research farms)

NORTH ZONE

Table 1: Occurrence of Cotton Disease in Punjab (Faridkot).

District	Locations	CLCuD (PDI)	BB (DI)	FFLS (DI)	Variety/Hybrid	Acerage
Faridkot	R.S. Faridkot	71.0 72.0 76.0 79.0 67.0 79.0 67.0 63.0 2.9-88.3	1.0 1.0 0.0 1.2 1.2 1.3 2.2 Traces 0.2-3.00	0.0 1.4 Traces 1.9 1.9 Traces 2.2 1.7 0.0- 2.9	F 2228 F 2383 F 2164 F 1054 F 1378 F 505 F 846 F 1861 Different entries of Co-ordinated and State trials	
	Machaki mal singh	40.0 30.0	Traces 1.0	1-2 1-2	Bioseed 6488 Bt, RCH 602 Bt	2acre 1.5 acre
	Kingra	30.0 40.0	Traces Traces	1-2 Traces	Bioseed 6588Bt Bioseed 6488 Bt	1acre 1acre
	Bihlewala	42.0 58.0 66.0	Traces 2.1 1.8	Traces 1-3 1-2	RCH 650 Bt Bioseed 6588 Bt Bioseed 6488 Bt	3 acre 3acre 3 acre
	Sedha singh wala	47.0 49.0	Nil Traces	0.1 – 2 Traces	RCH 650 Bt RCH 773 Bt	2 acre 2 acre
	Khara	57.0	0.8	2	Bioseed 6488 Bt	5 acre
	Romana	43.0	1.1	1.2	Bioseed 6588 Bt	7 acre
Fazilka	CRS Abohar	44.0 47.0 51.0 58.0 45.0 66.0 64.0	1.0 1.1 Traces Traces 1.1 0.8 0.1	1.7 1.1 1.9 2.4 1.7 1.1 1.1	F 2228 F 2383 F 505 F 846 F 1861 F 1378 F 1054	
	Jandwala khatta	30.0 40.0	1.5 Traces	1.5 0.1	NCS 855Bt Bioseed 6588 Bt	5 acre 5 acre
	Khuiya khera	35.0 23.0	1.8 1.9	1.5 Traces	Bioseed 6488 Bt Bioseed 6588Bt	**3 acre** **5 acre**
	Alamgarh	40.0 47.0	0.7 0.1	1.5 1.1	Bioseed 6588 Bt Bioseed 6488 Bt	2 acre 2acre
	Kamalwara	45.0	Traces	Traces	Bioseed 6588 Bt	3 acre

		49.0	Traces	Traces	Bioseed 6488 Bt	3 acre
	Gobindgarh	75.0	0.1-1.0	1-2	Bioseed 6488 Bt	5 acre
		65.0	1-2	Traces	Bioseed 6588Bt	5acre
	Bhangala	55.0	Traces	Traces	Bioseed 6588 Bt	3 acre
		50.0	Traces	Traces	Bioseed 6488 Bt	5acre
		44.0	Traces	Traces	RCH 773 Bt	3acre
	Abohar	30.0	1-2	Traces	Bioseed 6588Bt	5acre
	Nihalkhera	30.0	1-2	1	RCH 773	2 acre
	Usman khera	30.0	Traces	Traces	RCH 653 Bt	5acre
		40.0	Traces	Traces	RCH 650 Bt	5acre
		44.0	Traces	Traces	Ankur-3028Bt	5acre
		10.0	Traces	Traces	US-51Bt	2 acre
Muktsar	Chaina	55.0	0.3-1	0.1-2.1	Bioseed 6488 Bt	10 acre
		55.0	1-2	1.1-1.5	Bioseed 6588 Bt	2acre
		47.0	Traces	Traces	RCH 773 Bt	2acre
		37.0	Traces	Traces	RCH 650 Bt	2 acre
	Sikhanwala	44.0	Traces	1-2	RCH 773 Bt	7 acre
		40.0	Traces	1-2	RCH 653 Bt	2 acre
		55.0	Traces	Traces	RCH 650Bt	2 acre
	Mal singh wala	40.0	1-2	1-2	RCH 773 Bt	4 acre
	Muktsar	52.0	1-2	Traces	Ankur 3028 Bt	5 acre
		46.0	1-2	Traces	Ankur 3244Bt	5 acre
	MahaBhaddar	22.0	1-2	1-2	RCH 653Bt	2.5 acre
	Kotbhai	44.0	1-2	Traces	Bioseed 6588 Bt	2 acre

Table 2: Occurrence of Cotton Diseases in Punjab (Bathinda).

S.No.	Village	Block	District	Hybrid	CLCuD (PDI)	BB (Grade)	FFLS (Grade)	Root rot (%)
1	Sema	Nathana	Bathinda	RCH 650 RCH 653 Bio 6588 Desi Cotton	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0
2	Poohli			NCS 855	0.0	0.0	0.0	0.0
3	Poohla			RCH 776	16.16	0.0	0.0	0.0
4	Bath			Unknown Bt Hybrid	29.83	0.0	1.0	0.0
5	Lehra Bega			RCH 773	0.0	0.0	0.0	0.0
6	Chak Fateh Singh wala			RCH 650 RCH 653 Desi Cotton	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0
7	Chak Ram Singh Wala			NCS 855	24.16	0.0	0.0	0.0
8	Chak Bhakhtu			RCH 650	25.33	0.0	0.0	0.0
9	Burj Kahn Singh Wala			Ankur 3028	0.0	0.0	0.0	0.0
10	Bhucho Khurd			RCH 773 PCH 105 RCH 602	26.16 32.00 29.00	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0
11	Bhucho Kalan			SRCH 666	34.33	0.0	1.0	0.0
12	Bibiwala			RCH 650 RCH 653	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
13	Gobindpura			RCH 650 RCH 653 Sri Ram 105 Desi Cotton	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0
14	Dhilwaan			Bio 6488-2 Sri Ram 105	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
15	Ganga			RCH 650	0.0	0.0	0.0	0.0
16	Nathpura			RCH 653	0.0	0.0	0.0	0.0
17	Gidder			Bio 6488-2 Bio 6588 RCH 653	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0
18	Bagha	Talwandi Sabo		RCH 773 Desi Cotton	27.67 0.0	0.0 0.0	0.0 0.0	0.0 0.0
19	**Kot bhara***			RCH 650 Gujarat seeds (unknown)	0.0 16.50	0.0 0.0	0.0 1.0	0.0 0.0

20	Ramgarh Bhunder			RCH 650	0.0	0.0	0.0	0.0
21	Yatri			RCH 653	0.0	0.0	0.0	0.0
22	Lele wala			Unknown seeds	0.0	0.0	0.0	0.0
23	Jeonsingh Wala			RCH 650	0.0	0.0	0.0	0.0
24	Kotfatah			RCH 773 Deltapine Desi Cotton	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	10% 5% 0.0
25	KotliSabo	Sangat		BIO 6588	0.0	0.0	0.0	0.0
26	Faridkot Ketli			RCH 773	0.0	0.0	0.0	0.0
27	Gursarsainwala			RCH 650	0.0	0.0	0.0	0.0
28	Mehta			Ankur 3028	0.0	0.0	0.0	0.0
29	Dunewala			RCH 650	0.0	0.0	0.0	0.0
30	Malwala			Ankur 3028	0.0	0.0	0.0	0.0
31	Pucca Kalan			RCH 653	0.0	0.0	0.0	0.0
32	Macchana			NCS 855	0.0	0.0	0.0	0.0
33	Deon	Bathinda		RCH 653	0.0	0.0	0.0	0.0
34	Jodhpur			NCS 855	21.83	0.0	0.0	10%
35	Bathinda		Bathinda	NCS 855	24.33	0.0	0.0	0.0
36	Lalsingh Basti			RCH 653	0.0	0.0	0.0	0.0
37	Narwana			Ankur 3028	0.0	0.0	0.0	0.0
38	Jodhpur Romana			RCH 650 NCS 855 MRC 7017 Desi Cotton	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0
39	Jodhpur Pakhar	Maur		Bio 6588 Sri Ram 100	0.0 25.17	0.0 0.0	0.0 0.0	0.0 0.0
40	Ghasohana			RCH 773	0.0	0.0	0.0	0.0
41	Burj			73C34 BGII RCH 2830 Sri Ram 105	0.0 0.0 21.67	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0
42	Sandoha			RCH 773 RCH 653 RCH 2830 Sri Ram 100 Sri Ram 105	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0
43	Dhinger	Mansa	Mansa	RCH 773 73C34BGII	0.0 17.33	0.0 0.0	0.0 0.0	0.0 0.0
44	Chahilawali			RCH 602	0.0	0.0	0.0	0.0
45	Beniwal			RCH 773 Desi Cotton	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
46	Doda	Giddarba	Mukstar	Desi Cotton	0.0	0.0	0.0	0.0
47	Plian			Unknown Bt Hybrid	0.0	0.0	0.0	0.0

48	Kothe Chet Singh Wala			Unknown Bt Hybrid PCH 105	0.0 16.33	0.0 0.0	0.0 0.0	0.0 0.0

Table 3: Observations on the occurrence of cotton diseases in Rajasthan (Sriganganagar).

Tehsil	Area surveyed	Bt hybrids/varieties	CLCuD PDI	Disease range
Sriganganagar district				
Sriganganagar	Kaliyan, Khatlabana, Shivpur head, Sadhuwali, Sujawalpur, Hindumalkot, Kotha, Pakki, Sadhuwali, Mirzewala, Daulatpura, 15Z, 20Z, Sahibsinghwala	Sriram 6588 RCH773 RCH 776 RCH 314 Bioseed 6488 MRCH 7017 NCS 855 Bihani 161 RCH 650 Bihani 251 Shakti82	17.3	4.4-45.5
Sadulshahar	Chak 6BGS, 7KW, 14PTP, 6LNP, 7LNP, Kaluwala, Budhsingh wali, Chak Sohnewala, Pannawali		6.7	4.3-16.5
Srikaranpur	8 NN, Bhagwansar, Delwa, Kharlan, Kureshian, 44 GG, 3T, 16H, 11Q Bakhtana, 12 Q, 13 Q, Kaminpura,		5.3	5.0-17.9
Padampur	Sahuwala, Chunawad Kothi, Rattewala, Jodhewala, 14 Tattarsar, 1CC, Sawantsar		4.6	0-11.3
District average			**8.4**	**0-45.5**
Hanumangarh district				
	8PTP, Hirasinghwala, Bolanwali, 11SBN, Nagrana, Shergarh, Pakka saharana, Chohillawali, Jorkian, Chistiyan, Ayalki, Uttamsingh wala, Karnisar	Sriram 6588 MRCH 7017 NCS 855 NCS 858 NCS 9013 ABCH 243 Super 971 Bihani 161 RCH 650	5.9	3.3-13.3
District average			**5.9**	**3.3-13.3**

Table 4: Occurrence of cotton diseases in Haryana (Hisar).

District	Village	Cotton Hybrid	July					August				September				
			CLCuD	BB	MLS	ALS	RR	CLCuD	BB	MLS	ALS	CLCuD	B.B	MLS	ALS	RR
Hisar	Bahbalpur	RCH 650 BGII	Traces	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	5.0	0.0	1.0	0.0	0.0
	Barwala	RCH 602 BGII	9.90	0.0	0.0	0.0	0.0	13.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0
	Gyanpura	RCH 650 BGII	0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0
	Agroha	Bio 6488 BGII	0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	5.0	0.0	0.5	0.0	0.0
	Adampur	Bio 100 BGII	1.4	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0
	Sadalpur	Bioseed 6488 BGII	2.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0
	kisangarh	RCH 650 BG-II	1.5	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
	Mangali	Ankur 3028 BGII	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.0
	Kalirawna	RCH 650	0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0
	HAU, Research Farm	HS-6 (S)	22.7	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	49.9	0.0	0.0	0.0	0.0
		H-1098-1	18.3	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	39.9	0.0	2.0	0.0	0.0
		RST 9	20.5	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	43.3	0.0	1.0	0.0	0.0
		F-846	20.5	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	40.3	0.0	0.0	0.0	0.0
		6317 BG-II	14.9	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	38.3	0.0	0.0	0.0	0.0
		BUNTY	12.7	0.0	0.0	0.0	0.0	16.6	0.0	5.0	0.0	33.3	0.0	5.2	0.0	0.0
		CSH 3129	14.4	0.0	0.0	0.0	0.0	33.3	0.0	3.7	0.0	41.6	0.0	3.8	0.0	0.0
Fatehabad	Daryapur	Bioseed 6588 BGII	1.3	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0
	Badopal	RCH 650 BGII	1.5	0.0	0.0	0.0	0.0	1.0 1.5	0.0	4.5	0.0	1.5	0.0	4.5	0.0	0.0
	Khara Kheri	Bio 105 BG II	1.0	0.0	0.0	0.0	0.0	1.5	0.0	5.2	0.0	1.0	0.0	5.3	0.0	0.0
	Dingsara	RCH 602 BGII	2.5	0.0	0.0	0.0	0.0	4.5	0.0	5.1	0.0	1.0	0.0	5.2	0.0	1.4
	Bhattu kalan	RCH 602	10	0.0	0.0	0.0	0.0	12	0.0	3.3	0.0	7.0	0.0	3.5	0.0	0.5
	Dhabi Kalan	Ankur 3028 BGII	1.5	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	1.0	0.0	0.1	0.0	0.0
	Jhandi Khurd	RCH 650 BG-II	8.3	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	2.3	0.0	0.2	0.0	2.0
	Bhuna	RCH 773 BG II	9.3	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
	Jhalania	RCH 602 BGII	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
	Jandli Kalan	RCH 602 BGII	0.5	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0

Contd…

Contd…

District	Village	Cotton Hybrid	July					August				September				
			CLCuD	BB	MLS	ALS	RR	CLCuD	BB	MLS	ALS	CLCuD	B.B	MLS	ALS	RR
Sirsa	Panjuwana	RCH 650 BG II	1.7	0.0	0.0	0.0	0.0	0.2	0.0	2.0	0.0	1.0	0.0	2.0	0.1	0.0
	Panjuwala	Bioseed 6588 BGII	2.5	0.0	0.0	0.0	0.0	6.0	0.0	1.5	0.0	1.0	0.0	1.6	0.0	0.0
	Dabra Kalan KKKalan	RCH 650 BGII	0.0	0.0	0.0	0.0	0.0	6.0	0.0	1.6	0.0	0.0	0.0	1.7	0.0	0.0
	Nahrena	Bio 105 BG II	2.7	0.0	0.0	0.0	0.0	5.3	0.0	2.0	0.0	0.5	0.0	2.2	0.0	0.0
	Ludesar	RCH 602 BGII	0.4	0.0	0.0	0.0	0.0	4.2	0.0	1.2	0.0	0.3	0.0	1.2	0.0	0.0
	Jamal	RCH 773 BG II	0.0	0.0	0.0	0.0	0.0	2.0	0.2	0.0	0.0	2.0	0.0	0.0	0.0	0.0
	Baruwali	RCH 602 BGII	3.1	0.0	0.0	0.0	0.0	3.5	0.0	1.0	0.0	3.7	0.0	1.3	0.0	0.0
	Alandewala	RCH 602 BGII	2.2	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0
	Bhuratwala	RCH 773 BG II	2.1	0.0	0.0	0.0	0.0	2.7	0.0	0.1	0.0	1.0	0.0	0.2	0.0	0.0
	Dhani Dalip Nagar	RCH 602 BGII	0.1	0.0	0.0	0.0	0.0	2.5	0.0	0.5	0.0	3.0	0.0	0.5	0.0	0.0
	Odhan	RCH 602	0.5	0.0	0.0	0.0	0.0	0.2	0.0	2.0	0.0	0.5	0.0	2.0	0.0	0.0
	Kalawali	RCH 602	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.1	0.0	0.3	0.0	1.5	0.0	0.0
Jind	Danoda Kalan	7142	5.2	0.0	0.0	0.0	0.0	6.0	0.0	1.0	0.0	2.0	0.0	1.1	0.0	0.0
	Uchana	7142 BGII	0.8	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
	Khatkar	Bioseed 6588 BGII	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0
	Baroda	Xylem	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0
	Kandale	6488	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0
Rohtak	Kalanur	RCH 650	3.5	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0
	Meham	RCH 653 BGII	3.0	0.0	0.0	0.0	0.0	6.2	0.0	0.1	0.0	7.0	0.0	0.2	0.0	0.0
Bhiwani	Bswani Khera	Bio 6588 BGII	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.1	0.0	2.5	0.0	0.3	0.0	0.0
	Pur	NCS9012	5.0	0.0	0.0	0.0	0.0	9.4	0.0	0.0	0.0	6.0	0.0	0.1	0.0	0.0
	Siware	Bio 6588 BG II	2.5	0.0	0.0	0.0	0.0	7.6	0.0	0.0	0.5	5.1	0.0	0.1	0.0	1.0
	Kungar	RCH 650 BG II	0.8	0.0	0.0	0.0	0.0	2.0	0.0	0.0.	0.0	2.0	0.0	0.1	0.0	0.0
	Aurangnagar	Bio 6588 BG II	1.0	0.0	0.0	0.0	0.0	1.2	0.0	1.0	0.0	1.4	0.0	1.0	0.0	0.0

CENTRAL ZONE

Table 5: Occurrence of cotton diseases on Research farm in Maharashtra (Rahuri)

Sr.No.	Locations	Variety / Hybrid	% Disease Intensity/Incidence	
			ALB	TSV
1.	Cotton Improvement Project, MPKV, Rahuri	LRA-5166	27.60	7.20
		Phule 688	15.48	24.55
		Phule 388	14.19	11.06
		Phule 492	13.25	4.15
		RHC 717	8.05	0.0
		Kanak 954	11.22	5.00
		NCS 245 (Bhakti)	7.44	9.22
		Ajit 155	5.25	4.00
		Ajit 199	4.72	6.85
		MRC 7351	16.23	6.16
		RHcB -011	5.30	9.34
		Phule Dhanvantari	3.22	0.0

Table 5a: Occurrence of cotton diseases on farmer's field in Maharashtra (Rahuri)

Locations	Variety/hybrids	ALB (% intensity)
Rahuri	Ajit 199	8.72
	Ajit 155	9.15
	Bhakti	15.10
	Jadoo(Kaveri)	12.11
	MRC 7351	15.37
Pathardi	Chamatkar	10.11
	Ajit 155	8.43
	Ajit 199	8.12
	Mallika Bt	15.14
Shevgaon	MRC 7351	16.15
	NCH 954	13.44
	Chamatkar	11.43
	Ajeet 199	6.29
Sangmner	Chanakya	12.15
	Ajit 199	9.10
	Bt No. 228	6.55
Sangola	Surbhi	4.56
	Phule 388	2.16
	RHB 0711	2.52
Dhule	Rashi 2	14.30
	Mallika	24.12
	Trinetra	20.65
	MRC 7351	15.06
	Jadoo(Kaveri)	13.28
Jalgaon	Ajit 199	9.85
	Chamatkar	8.21
	NCS 245(Bhakti)	14.14
	Jadoo (Kaveri)	17.40
	MRC 7351	13.33
Nandurbar	Mallika	15.36
	Pancham	10.30
	MRC 7347	15.35
	Ajit 199	10.54
	MRC 7351	20.73

Table 6: Occurrence of cotton diseases on farmer's field in Maharashtra (Nanded)

Varieties / hybrids	Bacterial blight(PDI)	Alternaria (PDI)	Grey-mildew (PDI)	*Para Wilt (PDI)
1	**2**	**3**	**4**	**5**
First Class	6.22	8.92	0.40	0.00
Bunny (Bt)	7.43	9.10	0.93	0.33
Ajeet 155 (Bt)	4.28	7.82	0.79	0.25
Dr. Brent (Bt)	3.78	7.45	0.25	0.00
Superb	6.63	10.61	1.35	0.00
RCH 769 (Bt)	5.37	9.58	1.27	0.00
Bramha (Bt)	7.03	12.78	0.77	0.00
Gabbar	5.57	11.17	1.67	0.00
Vitthal	6.67	11.88	1.95	0.00
LRA 5166 (Non Bt) (Ch)	17.17	19.43	2.77	1.75
PA 255 (*G.arboreum*)	2.38	1.03	0.00	0.00
RCH II	10.30	17.43	1.77	1.25
Suraj (Non Bt)	9.03	11.01	1.05	0.00
NH 615(Non Bt)	9.13	9.58	0.82	0.00
NHH 215 (Non Bt)	8.82	10.32	1.07	0.00
DCH 12-3	9.12	12.18	1.37	0.00
BGDS	10.00	12.67	1.48	0.00
GSHH 2595	10.43	14.45	1.25	0.00
NACH 433	11.04	13.30	0.72	0.00

Table 7: Occurrence of cotton diseases in Maharashtra (Akola)

Sr. No.	District/ Place	Variety/ Hybrid	Crop growth Stages								
			Percent Disease Intensity (PDI)								
			Seedling (20-30 DAS)			Flowering (60-80 DAS)			Boll development (120-150 DAS)		
			BLB	MLS	GM	BLB	MLS	GM	BLB	MLS	GM
I. Akola district											
1	Hiwarkhed	Ajeet 155	-	-	-	2.6	-	-	4.5	-	
		Dr.Brent	-	-	-	1.75	-	-	3.11	-	
		AKH-081	-	-	-	1.75	1.48	-	4.65	-	
	Saundala	Mallika-207	-	-	-	0.60	-	-	4.41	-	
2	Adgaon	Ajeet 155	-	-	-	1.75	-	-	4.58	-	
3	Balapur	Bhakti	-	-	-	3.33	-	-	5.37	-	
4	Ugwa	Chaitannya	-	-	-	1.74	1.36	-	2.5	-	
5	Washimba	Rashi	-	-	-	1.02	-	-	2.9	-	
6	Akoli Jahangir	Dr.Brent	-	-	-	2.16	1.20	-	2.1	-	
		Ajeet-155	-	-	-	2.08	0.03	-	3.16	-	
7	Babhulgaon	Mallika-207	-	-	-	1.02	0.02	-	1.3	-	
		Paras Bramha	-	-	-	1.14	1.83	-	3.4	-	
Yavatmal											
9	Mahagaon	Ajeet155	-	-	-	0.56	Traces	-	2.6	-	
10	Pusad	First class	-	-	-	1.75	-	-	3.8	-	
Amravati											
11	Achalpur	Ajeet 155				1.62	-	-	1.8	-	
12	Anjangaon	First Class				2.1	0.83	--	2.6	-	
Buldhana											
13	Sangrampur	First class	-	-	-	1.75	Traces	-	2.41	-	

14	Motala	Rashi 569	-	-	-	2.41	0.81	-	3.3	-	
15	Jalgaon Jamod	Ankur									
II. Research field											
16	Akola	AKH-081	-	-	-	3.90	2.72	-	4.00	-	
		AKH-8828	-	-	-	2.33	1.2	-	3.78	-	
		PKV Rajat	-	-	-	0.33	-	-	3.06	-	
		AKH-9916	-	-	-	2.72	1.12	-	4.26	-	
		AKA-5	-	-	-	0.23	-	-	0.14	-	
		AKA-7	-	-	-	0.80	0.75	-	1.02	-	
		AKA-8	-	-	-	1.10	-	-	1.02	-	
		AKH-8401	-	-	-	0.09	----	-	3.25	-	

Table 8: Occurrence of cotton diseases in Gujrat (Surat)

Sr. No.	District	Taluka	Location/ Village	Month	Variety/ Hybrids/cultivars	Disease (PDI)	
						BLB	ALS
1	Surat	Choryasi	MCRS 21.101°N 72.4757 °E	Sep to Nov	GN Cot. Hy. 14	4.0-5.0	0.0-1.5
					G. Cot. Hy.10	0.0-5.5	0.0- 6.5
					LRA 5166	0.0-20.0	1.0-3.0
					G. Cot. Hy. 8	-	1.0
					G. Cot. Hy. 12	0.0-20.0	0.0-0.0
					G. Cot. Hy. 6 BG II	-	1.0-2.0
					G. Cot. Hy. 8 BG II	-	1.0-4.5
					G. Cot. Hy. 12 BG II	5.0-7.5	0.0-2.0
					GTHH 49	-	0.0-1.5
					G. Cot. 100	-	0.0-10.0
		Mangrol	Chandaniya 21.438762 °N 73.186162 °E	Sep	RCH 2 BG II	1.0-15.0	1.0-4.0
		Umarpada	Umarpada 21.6283 °N 73.58292 °E		Ajeet 155 BG II	1.0-2.5	0.0-0.0
			Nasarpur 21.505178 °N 73.354217 °E		RCH 2 BG II	1.0– 3.5	0.0- 1.0
2	Bharuch	Netrang	Chaswad 21.580132 °N 73.338452 °E	Sep	RCH-2 BG II	10.0-12.0	2.0-4.5
		Valiya	Eitagla 21.572528 °N 73.262595 °E	Sep	Israel 4G	0.0-0.5	1.0-3.5
			Tuna 21.807871 °N 72.995446 °E	Sep	Solar 76 BG II	0.0-1.5	1.0-4.0
			Pithora 21.568429 °N 73.238394 °E	Sep	Ajeet 155 BG II	1.0-1.5	1.0-2.0
		Bharuch	Hingalla 21.876291 °N 72.897076 °E	Sep	Solar 76 BG II	0.0-2.5	0.0-0.0
		Jambusar	Jambusar 21.81718 °N 73.06379 °E	Sep	ATM BG II	0.0-0.0	0.0-1.5
		Vagra	Pipaliya 21.799443 °N 72.760269 °E	Sep	Godhavari	0.0-0.0	0.0-1.5
			Janiadara 21.769975 °N 72.656227 °E	Sep	Desi cotton & GN Cot. 25	0.0-0.0	0.0-0.0
			Pisad 21.828283 °N 72.816149 °E	Sep	Ankur 3028 BG II	2.0-5.0	0.0-0.0
		Amod	Kurchan 21.917655 °N 72.978351 °E	Sep	Jadu BG II	0.0-12.5	2.0-4.0
3	Narmada	Dediyapada	Dediyapada	Sep	Ajeet 199 BG II	2.0-3.0	0.0-0.0

Table 9: Occurrence of cotton diseases in Gujrat (Junagadh)

S. No.	Name of Farmer	Village	Taluka	District	Variety/hybrids/Bt	PDI (%)	Disease Percent (%)			
						ALS	BLB	GM	RR	Wilt
1	Pravin Vallabh	Moniya	Visavadar	Junagadh	Ajit-155,RCH-779	8	1	0	0	0
2	Malam Jeram	Baradia	Visavadar		Ankur Jay	15	1	0	0	1
3	Kinjansinh Sidhav	Chudava	Manavder		Utam,Manglum	15	2	0	0	0
4	Vaju lalji	Jamka	Junagadh		Suryavandna	10	9	0	1	1
5	Bhikhu Vithal	Shobhavadla	Visavadar		Unit-111	2.5	2	0	0	0
6	Ashvin Ravji Vamja	Vanthali	Vanthli		RCH-569,Badshah	14	0	0	0	0
7	Vaju Nanji	Prabhatpur	Junagadh		Ajit-155 BG II	4	0	0	0	0
8	Jagdish Puna	Sukhpar	Babara	Amreli	Badshah BG-2	12	1	0	0	0
9	Mangal Ramjibhai	Nani kherali	Rajula		Ajit-155 BG II	10	5	0	0	0
10	Devat Vaghabhai	Dolti	Saverkundla		Gopal BG-II	9	1	0	0	0
11	Dayaram lavjibhai	Halvad	Halvad	Morbi	Utam BG-II	16	1	0	0	0
12	Govind Chagan	Mayurnagar			Ankur Jay BG-II	8	0	0	2	0
13	Harji Narshibhai	Sangani	Chotila	Surendranagar	Badshah	14	5	0	0	0
14	Krunal pravinbhai	Jamjodhpur	Jamjodhpur	Jamnagar	Utam BG-II	14	2	0	0	0
15	Jaman Karsn	Bhanvad	Bhanvad		Solar-76, ATM	10	3	0	0	0
16	Devubha Jadeja	Khakhra	Dhoral		Ankur Jay BG-II	7	5	0	0	0
17	Sanjay Jayanibhai	Jasdan	Jasdan	Rajkot	Solar-76 BG-II	12	1	0	0	0
18	Magan Dayabhai	Movia	Gondal		Rashi-659 BG-II	13	1	0	0	0
19	Rajsih Makhi	Navapara	Upaleta		Malika BG-II	11	0	0	0	0
20	Chandresh Vekaria	Khajuri Gam	Paddhari		Ankur Bt	12	1	0	0	0
21	Ghansyam Rupapara	Jetpur	Jetpur		Vibhu,RCH-2	10	5	0	0	0
22	Dharmasi Govind	Kenedi	Kalyanpur	Dwarka	Ajit-155 BG II	8	3	0	0	0
23	Naran Arjanbhai	Bakodi			Vikaram-5 BG-II	11	5	0	0	0
24	Viram Bhagvanbhai	Valotra	Ranavav	Porbander	Ankur -28	14	0	0	0	0
25	Pravin Amrutbhai	Ishvariya	Kutiyana		Pratik BG-II	7	1	0	0	1
26	Ashok Mohanbhai	Marvad	Kutiyana		G.Cot.Hy-8 BG-II	12	2	0	0	0
27	Cotton Res. Station	Junagadh	Junagadh	Junagadh	G. Cot Hy-8 BGII	9	3	0	1	2
28	Cotton Res. Station				G. Cot Hy-12	11	6	0	0	0
	ALS= Alternaria leaf spot, BLB=Bacterial leaf blight, GM=Grey mildew, RR=Root rot									

SOUTH ZONE

Table 10. Occurrence of cotton diseases in Karnataka (Dharwad)

Locations	Genotype	Rainfed/ irrigated	Crop Stage	PDI			
				AB	BB	GM	Rust
Dharwad District							
Amminabavi	Bayer Superb Bt	R	Seedling stage	08	05	03	-
			Boll initiation	15	10	05	-
			Boll Maturity	25	12	08	15
Marewad	MRC-7351 Bt	R	Seedling stage	05	08	-	-
			Boll initiation	10	10	05	-
			Boll Maturity	20	12	10	10
Yadawad	Arjun Bt	R	Seedling stage	10	08	05	-
			Boll initiation	15	10	10	-
			Boll Maturity	20	10	10	12
Uppinbetageri	MRC-7351 Bt	R	Seedling stage	05	08	05	-
			Boll initiation	10	10	10	-
			Boll Maturity	20	15	10	15
Garag	First class Bt	R	Seedling stage	05	08	05	-
			Boll initiation	08	10	10	-
			Boll Maturity	15	10	10	15
Tadakod	Chiranjeevi Bt	R	Seedling stage	05	05	05	-
			Boll initiation	10	10	05	-
			Boll Maturity	20	10	10	10
Narendra	Bunny Bt	R	Seedling stage	10	05	05	-
			Boll initiation	15	10	10	-
			Boll Maturity	25	15	10	15
Mualamuttala	Arjun Bt	R	Seedling stage	10	05	05	-
			Boll initiation	20	10	10	-
			Boll Maturity	30	15	10	20
Gambypur	First class Bt	R	Seedling stage	10	05	05	-
			Boll initiation	15	10	10	-
			Boll Maturity	25	15	12	15
Dummavad	Arjun Bt	R	Seedling stage	10	05	05	-
			Boll initiation	25	15	05	-
			Boll Maturity	25	15	10	15
Belgaum District							
Murgod	Dr. Brent Bt	R	Seedling stage	05	10	05	-
			Boll initiation	15	15	10	-
			Boll Maturity	20	15	10	-
Malluar	RCH Bt	R	Seedling stage	05	05	05	-
			Boll initiation	10	10	10	-
			Boll Maturity	15	05	05	-
Savadatti	Chitannya Bt	I	Seedling stage	15	10	15	05
			Boll initiation	20	10	10	-
			Boll Maturity	25	15	10	20
Jalikoppa	ATM Bt	I	Seedling stage	10	10	05	-
			Boll initiation	15	15	10	-

			Boll Maturity	20	15	15	15
Arabhavi	First Class	I	Seedling stage	10	05	05	-
			Boll initiation	15	10	10	-
			Boll Maturity	25	15	10	20
Haveri District							
Motebennuar	Ajit 99 Bt	I	Seedling stage	05	05	05	-
			Boll initiation	10	10	10	-
			Boll Maturity	20	10	15	15
Varadahalli	MRC-7351 Bt	I	Seedling stage	10	05	-	-
			Boll initiation	15	15	-	-
			Boll Maturity	25	15	10	20
Bankapur	MRC-7351 Bt	R	Seedling stage	10	-	-	-
			Boll initiation	15	10	10	-
			Boll Maturity	20	15	15	15
Haveri	MRC-7351 Bt	R	Seedling stage	10	-	-	-
			Boll initiation	15	10	10	-
			Boll Maturity	20	15	15	15
Gadag District							
Laxmeshwar	Ajit-III Bt	I	Seedling stage	10	05	-	-
			Boll initiation	15	10	05	-
			Boll Maturity	20	15	10	15
Shigli	Jadu Bt	I	Seedling stage	10	05	-	-
			Boll initiation	15	10	-	-
			Boll Maturity	25	20	10	20
Mulagund		I	Seedling stage	10	05	-	-
	Tridev Bt		Boll initiation	15	10	10	-
			Boll Maturity	20	15	15	15
Bagalkot District							
Vaddarahatti	Bayer superb Bt	I	Seedling stage	10	05	-	-
			Boll initiation	15	10	-	-
			Boll Maturity	20	15	10	20
Hulageri	MRC-7351 Bt	I	Seedling stage	10	05	-	-
			Boll initiation	15	10	10	-
			Boll Maturity	30	10	15	15
Kulageri	Ajit 99 Bt	I	Seedling stage	10	05	-	-
			Boll initiation	15	10	10	-
			Boll Maturity	20	15	10	20

Table 11: Occurrence of cotton diseases in Andhra Pradesh (Guntur)

Month	Hybrids (BG II)	Mean Percent Disease Intensity (PDI)							
		Alternaria leaf spot	Helminthosporium leaf spot	Cercospora leaf spot	Anthracnose	Bacterial blight	Grey mildew	Rust	Boll Rot
July 2016	Jadoo, RCH 659, Bhakthi, ATM	0 to 2.0	0	0	0	0	0	0	0
August 2016	Bhakthi, Jadoo, Veera, ATM, RCH 659, Kohinoor, Ajit 155, Sadananda,	0 to 2.5	0	0	0	0	0 to 3.0	0	0
September 2016	Jadoo, ATM	2.5 to 11.0	0	0	0	0	0	0	0 to Traces
October 2016	Jadoo, ATM, Ujjwala, Bhakthi, RCH 659, Superb, Raja, Legend	0 to 25.0	0 to Traces	0.5 to 5.0	0	0 to Traces	0.5 to 19.0	0	0 to Traces
November 2016	Jadoo, ATM, Ujjwala, RCH 659, Vardhini, Ajit 155	0.5 to 15.0	0	0	0	0 to 1.5	0 to traces	0	0
December 2016	Lotus, Superb, RCH 659, ATM, Jadoo, Bhakthi, Police	0 to 22.5	0 to 13.5	0 to 7	0 to 17	0	0 to 12.5	0 to 17.0	0
January 2017	Jadoo, Bhakthi, RCH 659, ATM	0	0	0	0	0	0 to 17.5	0 to 19.5	0
RARS, Lam, Guntur	Varieties and Hybrids of cotton trials	0 to 39	0 to 10	0 to 5	0 to 12.25	0 to 6.67	0 to 27	0 to17.5	0

Table 12: Occurrence of cotton diseases in Tamil Nadu (Coimbatore)

S. No.	Place	District	Area (acre)	Hybrid / Variety	Disease Incidence
1.	Palam Rajakkapatti	Dindigul	3	Bt Cotton	TSV - minimum incidence (4-5 plants only)
2.	Alampatti	Madurai	1	Non-Bt	No disease incidence
3.	Kattrurampatti	Madurai	3	SVPR-2	Root rot (10%)
4.	Kattrurampatti	Madurai	6	SVPR-4	Root rot (15%)
5.	S. Ammapatti	Madurai	6	Bt Cotton	*Alternaria* leaf blight and *Myrothecium* leaf spot – minimum disease incidence. No TSV disease incidence. Mealy bug and Stem weevil infestation are more
6.	Peraiyur	Madurai	4	Bt Cotton	
7.	T. Kallupatti	Madurai	3	Bt Cotton	
8.	V. Ammapatti	Madurai	4	Bt Cotton	
9.	Paraipatti	Madurai	2	Bt Cotton	
10.	Gopalsamypuram	Madurai	2	Bt Cotton	
11.	Alagapuri	Virudhunagar	3	Bt Cotton	*Alternaria* leaf blight and *Myrothecium* leaf spot – minimum disease incidence. No TSV disease incidence. Mealy bug infestation is more.
12.	Nathampatti	Virudhunagar	1	Bt Cotton	
13.	Muvaraiventran	Virudhunagar	2	Bt Cotton	
14.	Krishnankovil	Virudhunagar	5	Bt Cotton	
15.	Meenaskhipuram	Virudhunagar	2	Bt Cotton	
16.	Muthulingapuram	Virudhunagar	1	Bt Cotton	
17.	Rajapalayam	Virudhunagar	4	Bt Cotton	
18.	Kothainachiyarpuram	Virudhunagar	1	Bt Cotton	
19.	Ramalingapuram	Virudhunagar	2	Bt Cotton	
20.	Mudhukudi	Virudhunagar	2	Bt Cotton	
21.	Sholapuram	Virudhunagar	3	Bt Cotton	*Alternaria* leaf blight
22.	Desigapuram	Virudhunagar	3	Bt Cotton	
23.	Velathapuram	Tirunelvelli	3	Bt Cotton	Mealy bug infestation is more.
24.	Sholaisari	Tirunelvelli	3	Bt Cotton	
25.	Perumalpatti	Tirunelvelli	3	Bt Cotton	
26.	Karivalamvantha-nallur	Tirunelvelli	2	Bt Cotton & variety	*Alternaria* leaf blight and *Myrothecium* leaf spot
27.	Alagunachiyarpuram	Tirunelvelli	1	Bt Cotton & variety	
28.	Sankarankovil	Tirunelvelli	2	Bt Cotton & variety	
29.	Muthukrishnapuram	Tirunelvelli	3	Bt Cotton & variety	
30.	Veerakeralampudur	Tirunelvelli	4	Bt Cotton & variety	
31.	Kurukalpatti	Tirunelvelli	8	Bt Cotton & variety	
32.	Kuvalakanni	Tirunelvelli	3	Bt Cotton & variety	*Alternaria* leaf blight and Bacterial leaf blight
33.	Panavadalichaitram	Tirunelvelli	2	Bt Cotton & variety	
34.	Vannikonanthal	Tirunelvelli	3	Bt Cotton & variety	
35.	Alagiyapandiyapuram	Tirunelvelli	2	Bt Cotton & variety	Mealy bug infestation is more.
36.	Erankattur	Erode	3	Bt Cotton & variety	*Alternaria* leaf blight and grey mildew diseases
37.	Thottampalayam	Erode	4	Bt Cotton & variety	
38.	TNAU	Coimbatore	25	Bt Cotton & variety	*Alternaria* leaf blight (3.0PDI), Grey mildew (2.0PDI) (non Bt-Cotton) and *Tobacco streak virus* (3.0PDI) (ratoon cotton).
39.	Keeranatham	Coimbatore	5	Bt Cotton	*Alternaria* leaf blight wilt, root rot and stem weevil incidence
40.	Pallipalayam	Coimbatore	3	Bt Cotton	*Alternaria* leaf blight
41.	Vaiyampalayam	Coimbatore	3	Bt Cotton & variety	*Alternaria* leaf blight incidence is severe (3.0 PDI)
42.	Kondampalayam	Coimbatore	5	Bt Cotton & variety	*Alternaria* leaf blight, wilt, root rot diseases and stem weevil incidence

Path 1 (b) Disease progress in relation to weather factor

NORTH ZONE

Table 13: Disease progress on F846 in relation to weather factors at Faridkot (Punjab)

SMW	Temperature (ºC)			Relative humidity (%)			Rainfall (mm)	Wind speed Km/hr	BSS (hr)	CLCuD (PDI)	CLCuD incidence	% Increase in CLCuD	(DI)	Fungal foliar leaf spot (DI)			WF/ 3 leaf
	T max	T min	T mean	Rh mr	Rh eve	Rh mean							BB	ALS	MLS	CLS	
25	37.2	29.0	33.1	75.6	51.7	63.6	32.0	8.7	5.2	0.00	0.0	0.0	0.0	0.0	0.0	0.0	1.6
26	37.9	29.6	33.8	74.0	49.6	61.8	0.0	4.0	5.7	0.00	0.0	1.2	0.0	0.0	0.0	0.0	2.2
27	35.7	27.8	31.8	80.0	59.4	69.7	23.0	3.5	3.3	1.20	5.0	2.1	0.0	0.0	0.0	0.0	4.4
28	35.3	28.2	31.7	81.0	64.4	72.7	24.8	2.8	3.7	3.30	10.8	3.3	0.0	0.0	0.0	0.0	5.8
29	34.6	27.3	30.9	84.7	67.7	76.2	35.3	2.5	4.8	6.60	22.5	8.0	0.0	0.0	0.0	0.0	7.4
30	35.3	28.0	31.7	80.1	66.4	73.3	8.6	3.3	4.7	14.60	39.0	3.4	0.3	0.0	0.0	0.0	8.8
31	34.7	27.2	30.9	84.3	61.4	72.9	0.0	1.8	6.7	18.00	41.0	4.0	0.4	0.0	0.0	0.0	14
32	33.9	27.6	30.8	85.9	78.0	81.9	53.6	1.1	3.6	22.00	47.5	10.3	0.7	0.1	0.0	0.0	15.2
33	35.2	26.4	30.8	84.4	62.4	73.4	11.0	0.5	5.0	32.30	51.8	7.3	0.9	0.3	0.1	0.0	22.2
34	33.5	26.4	29.9	86.1	72.7	79.4	37.8	0.6	1.0	39.60	57.8	24.7	1.7	0.6	0.4	0.1	47.2
35	31.5	25.2	28.4	90.9	75.7	83.3	88.5	0.5	3.1	64.33	78.5	0.0	1.8	0.9	1.0	0.1	47.8
36	34.0	24.9	29.4	83.4	59.1	71.3	0.0	0.3	5.5	64.30	79.0	7.0	2.0	1.2	1.3	0.2	50.6
37	34.8	25.2	30.0	78.9	55.4	67.1	0.0	0.2	7.2	71.30	89.8	5.7	2.1	1.4	1.6	0.6	61.8
38	34.8	25.8	30.3	83.7	59.0	71.4	0.0	0.0	5.8	72.00	100.0	1.5	2.2	1.8	1.8	0.9	29
39	34.2	24.7	29.5	85.3	57.3	71.3	0.0	0.3	5.8	73.50	100.0	1.7	2.3	2.1	2.0	1.3	18.4
40	35.2	24.6	29.9	88.9	53.1	71.0	0.0	0.1	2.6	75.00	100.0	0.3	2.4	2.2	2.2	1.5	13.6
41	34.7	19.9	27.3	84.9	35.1	60.0	0.0	0.1	7.3	76.00	100.0	1.0	2.4	2.3	2.3	1.8	10.6
42	34.5	15.6	25.0	87.4	27.3	57.4	0.0	0.0	6.9	78.00	100.0	0.3	2.6	2.4	2.4	2.1	4.6
43	32.7	16.7	24.7	89.1	32.3	60.7	0.0	0.0	4.8	78.30	100.0	0.3	2.6	2.5	2.5	2.3	1.8
44	30.2	19.2	24.7	89.7	41.1	65.4	0.0	0.0	1.4	78.60	100.0	0.3	2.8	2.6	2.5	2.3	1.2

Table 14: Disease progress in relation to weather factors at Sriganganagar (Rajasthan)

S. No.	Date of Observation	Std. week No.	Disease incidence (%)	Rain fall (mm)	Temperature (^{o}C)		RH (%)	
					Max	Min	8.30 am	17.30 pm
1	02.07.16	27	0.7	8.6	40.1	28	67.6	49.0
2	09.07.16	28	2.43	13	40.5	28.1	68.7	57.1
3	16.07.16	29	5.61	1.5	39.8	27.7	67.4	46.4
4	23.07.16	30	21.93	90.6	39.2	23.6	68.1	58.3
5	01.08.16	31	49.78	13.1	37	26	82.9	66.7
6	07.08.16	32	75.24	49.8	35.8	25.8	82.6	69.7
7	14.08.16	33	97.72	7.3	38.2	25.8	73.9	55.9
8	21.08.16	34	100.0	29.4	35.5	25.3	85.7	75.6

Table 15: Disease progress in relation to weather factors at Hisar (Haryana)

Std. Met. Week	Period	Temp. ^{0}C		RH %		WS Km/hr	Bright sun hours/day	Rain fall (mm)	WF/3 leaves	CLCuD (%)	CLCuD Difference (%)	CLCuD Index	BLB
		Max.	Min.	M	E								
22	28.5.16- 03.6.16	38.7	25.0	71	40	8.3	8.0	22.6	0.9	00.00	00.00	00.00	00.00
23	04.6.16 - 10.6.16	42.6	28.4	57	31	7.8	9.8	0.0	6.4	00.00	00.00	00.00	00.00
24	11.6.16- 17.6.16	38.5	26.1	77	50	10.0	5.9	75.6	7.6	00.00	00.00	00.00	00.00
25	18.6.16- 24.6.16	39.1	28.5	77	43	9.7	8.5	0.0	11.3	05.33	05.33	01.33	00.00
26	25.6.16 - 01.7.16	38.1	28.2	76	59	6.3	6.4	13.0	19.9	18.00	12.67	05.99	00.00
27	02.7.16 - 08.7.16	34.6	26.4	90	74	5.6	5.9	93.5	23.3	33.60	15.60	10.99	00.00
28	09.7.16 - 15.7.16	36.1	26.9	88	75	5.5	6.9	19.0	21.4	84.60	51.00	21.49	00.00
29	16.7.16 - 22.7.16	34.1	25.2	90	68	5.6	5.2	58.3	13.9	99.66	15.06	30.48	00.00
30	23.7.16 - 29.7.16	35.7	25.7	92	74	6.1	6.7	74.0	15.1	100.00	00.34	33.32	00.00
31	30.7.16 - 05.8.16	33.0	25.4	91	72	5.4	5.5	4.3	10.3	100.00	00.00	37.15	00.00
32	06.8.16- 12.8.16	33.8	25.9	93	76	6.9	4.8	0.8	07.2	100.00	00.00	45.81	00.00
33	13.8.16- 19.8.16	35.2	25.0	86	59	4.8	6.7	5.3	14.0	100.00	00.00	46.48	00.00
34	20.8.16- 26.8.16	34.2	26.3	87	61	6.2	6.3	6.8	14.2	100.00	00.00	48.14	00.00
35	27.8.16 - 02.9.16	32.7	25.2	95	78	4.7	5.4	63.2	9.1	100.00	00.00	48.81	00.00
36	03.9.16- 09.9.16	34.6	23.5	86	58	6.1	9.7	0.0	34.1	100.00	00.00	52.31	00.00
37	10.9.16 -16.9.16	35.7	23.6	85	52	4.7	9.5	0.0	36.2	100.00	00.00	54.48	00.00
38	17.9.16 - 23.9.16	36.0	25.1	87	54	5.3	8.5	0.0	19.8	100.00	00.00	56.31	00.00
39	24.9.16- 30.9.16	35.4	24.4	85	49	4.0	8.1	2.8	14.0	100.00	00.00	60.88	00.00
40	1.10.16- 7.10.16	35.0	24.5	91	56	3.1	5.4	12.0	21.9	100.00	00.00	63.80	00.00

Table 16: Disease progress in relation to weather factors at Sirsa (Haryana)

SMW	% CLCuD incidence	Whitefly/3 leaves	MAX Temp °C	MIN Temp °C	RH (%) M	RH (%) E	RAIN FALL (Mm)
24	1.76	1.75	40.2	27.1	66.4	44.6	7.4
25	7.36	3.08	40.0	28.8	78.7	35.3	0
26	55.57	8.00	39.7	30.1	76.7	41.4	0
27	77.35	8.75	30.5	25.4	76.7	47.1	119.2
28	82.39	4.00	35.9	27.6	78.3	58.7	0.0
29	86.10	5.58	36.9	28.1	80.7	58.3	2.4
30	92.37	5.83	38.1	29.8	79.9	61.9	0.0
31	96.64	14.33	36.6	29.1	81.9	62.1	0.0
32	99.08	11.33	34.1	27.2	87.1	67.4	7.8
33	100	9.33	34.2	27.6	79.1	61.9	12
34	100	11.50	32.7	26.3	85.3	69.1	36.2
35	100	6.50	33.3	26.5	91.1	73.9	9.2
36	100	9.17	31.5	26.0	79.1	55.3	0.0

CENTRAL ZONE

Table 17: Disease progress in relation to weather factors at Rahuri (Maharashtra)

Met. Week	Period	Temp. Max	Temp. Min	Humidity Mor.	Humidity Eve.	Sun shine Hrs.	RF(mm)	Rainy Days	PDI ALB
31	30 July -8 Aug	28.3	22.7	82	72	1.57	50.6	4	0.0
32	6-12 August	30.1	23.1	70	65	3.44	1.0	0	0.0
33	13-19 August	30.6	22.0	72	59	5.23	0.0	0	3.8
34	20-26 August	31.8	22.2	72	55	6.46	0.0	0	4.6
35	27 Aug.-2 Sept	31.7	22.8	74	56	3.73	1.6	0	4.9
36	3 -9 Sept	30.9	20.3	70	53	5.37	0.0	0	9.2
37	10-16 Sept	31.4	21.9	76	58	2.63	62.0	2	13.9
38	17-23 Sept	28.8	22.3	83	77	2.21	163.6	4	20.7
39	24-30 Sept	30.1	22.2	82	65	4.67	60.8	5	23.4
40	1-7 Oct.	28.5	21.7	87	71	3.86	110.6	3	27.6
41	8-14 Oct.	31.6	20.6	73	53	7.14	0.0	0	26.5
42	15-21 Oct.	31.8	17.1	67	38	8.06	0.0	0	22.8
43	22 - 28 Oct	31.3	16.4	66	36	9.09	0.0	0	17.4
44	29 Oct -04 Nov	30.1	13.4	51	41	9.54	0.0	0	11.9
45	05 - 11 Nov	29.6	11.7	52	25	9.50	0.0	0	8.3
46	12-18 Nov	29.5	12.6	64	41	7.53	0.0	0	6.6
47	19-25 Nov	28.7	10.1	56	27	9.31	0.0	0	5.8
48	26-02 Dec	30.9	10.5	62	26	9.54	0.0	0	4.3
49	03 – 09 Dec	28.9	11.2	64	34	8.63	0.0	0	4.3

ALB- *Alternaria* leaf blight

Table 17a: Simple correlation values for Alternaria leaf blight of cotton at Rahuri

Variable	**Disease correlation matrix** ALB
Maximum Temp.	-0.055
Minimum Temp.	0.155
Morning Humidity	0.467
Evening Humidity	0.250
Sunshine hours	-0.072
Rainfall	0.536*
Rainy days	0.576*

Table 18: Disease progress in relation to weather factors at Nanded (Maharashtra)

Grey mildew 2003-04 to 2016-17														
S.M.W.	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
37				5.00					1.50	1.00	5.00			
38			5.00	5.00					1.50	1.00	5.75			
39	5.00		5.95	10.95					1.75	1.50	8.50			
40	25.00	5.00	10.25	12.95				7.25	1.50	1.50	11.15			
41	30.00	10.00	15.00	20.00				7.50	1.00	1.00	15.5			
42		20.00	20.57	25.00		3.00		10.5	1.00	2.00	17			
43		20.00	25.57	35.05		3.00		12.5	0.00	0.00	20.5			
44		25.00	35.00	35.00		3.50		15.5	0.00	0.00	27.75	7.5	0.00	
45		35.00		35.00	3.00	3.50		15.5	0.00	1.00	29.5	11	0.00	0.25
46		40.00		30.00	3.50	3.50		16	0.00	0.00	30	18.25	0.00	1.35
47		40.00		30.00	10.00	5.00		19	0.00	0.00	30.5	18.9	0.00	2.77
48				20.25	15.20	5.00		19.25	0.00	0.00	30	19.75	0.00	1.95
49				15.00	20.00	5.00	1.5	20.5	0.00	0.00	29.5	20.5	0.00	1.67
50				15.00	30.25	3.50	1.5	21.5	0.00	0.00	25	18.75	0.00	1.07
51				5.00	30.00	3.00	0.5	22.75	0.00	0.00	24	15.25	0.00	0.93
52					25.05	3.00	0.5	20.75	0.00	0.00	24	13	0.00	0.77
Peak	**30.0**	**40.0**	**35.0**	**35.1**	**30.3**	**5.0**	**1.5**	**22.8**	**1.8**	**2.0**	**30.5**	**20.5**	0.00	**2.77**
First app (SMW)	**29**	**40**	**38**	**37**	**45**	**42**	**49**	**40**	**37**	**37**	**37**	**44**	0.00	**45**
Peak (SMW)	**41.0**	**40.0**	**44.0**	**43.0**	**50.0**	**47.0**	**49.0**	**51.0**	**39.0**	**42.0**	**47.0**	**49.0**	0.00	**47.0**
Sowing week (SMW)	**27.0**	**27.0**	**28.0**	**26.0**	**26.0**	**30.0**	**28.0**	**27.0**	**29.0**	**29.0**	**25.0**	**29.0**	**25.0**	**26.0**
crop age at First	**14.0**	**91.0**	**70.0**	**77.0**	**133.0**	**84.0**	**147.0**	**91.0**	**56.0**	**56.0**	**84.0**	**105.0**	0.00	**140.0**
Crop age at peak	**98.0**	**91.0**	**112.0**	**119.0**	**168.0**	**119.0**	**147.0**	**168.0**	**70.0**	**91.0**	**154.0**	**140.0**	0.00	**154.0**

Table 18a: Per cartage Predictability

Obs.	GM	p	Residual	Predictability (%)
1.	33.1975	33.7402	-0.5427	98.3652
2.	39.2157	30.6812	8.5345	78.2370
3.	36.2566	39.8571	-3.6005	90.0693
4.	36.3166	33.3029	3.0137	91.7015
5.	33.3848	31.1304	2.2544	93.2472
6.	12.9158	9.2748	3.6410	71.8097
7.	7.0321	3.8446	3.1875	54.6721
8.	28.5103	25.5028	3.0075	89.4511
9.	7.7072	12.6129	-4.9057	36.3491
10.	8.1268	12.7165	-4.5897	43.5239
11.	33.5093	32.5185	0.9908	97.0432
12.	26.9107	34.8749	-7.9642	70.4050
13.	5.7369	9.2950	-3.5581	37.9787

(Mean Predictability: 73.2964)

Table 18b: WI based regression model for prediction of Grey mildew on cotton

Character	Model(Regression equations)	Model R^2
Maximum severity	(Y) = -8.42722 + 0.60043*Z41+ 0.00687*Z231	0.78
Where Z41= Weighted evening relative humidity Z231=Weighted interaction of minimum temperature and morning relative humidity		

For model development data from 2003-2013 is utilized and validation was carried out using observed value of the year 2014, 2015 and 2016.

Table 19: Disease progress in relation to weather factors at Akola (Maharashtra)

Met.Week	Period	Rainy days	Rainfall in mm	Temperature ^{0}C		R. Humidity %		Sunshine hours	Per cent disease intensity						
									LRA 5166			Bunny Bt			AKA-8
				Max.	Min.	Morn.	Even	BSH	BLB	MLS	GM	BLB	MLS	GM	GM
30	23-29	6.0	104.5	29.8	23.6	91	72	2.5	3.33		-	0.33	Traces	-	-
31	30-5 Aug	4.0	65.3	29.4	23.9	86	71	2.3	5.7		-	1.2	Traces	-	-
32	6-12	2.0	10.5	30.4	24.0	84	66	3.6	6.8	1.6	-	3.9	Traces	-	-
33	13-19	0.0	0.0	31.0	23.4	85	58	5.3	8.8	2.08	-	4.8	Traces	-	-
34	20-26	2.0	13.7	30.0	23.4	83	64	5.8	8.3	-	-	5	Traces	-	-
35	27-2 Sep	1.0	6.5	31.9	24.5	85	62	4.5	9.0	-	-	5.5	Traces	-	-
36	3-9	0.0	1.5	31.3	22.6	85	47	8.5	7.35	-	-	5.1	Traces	-	-
37	10-16	3.0	28.5	31.8	23.6	86	59	3.4	5.65	-	-	4.6	Traces	-	-
38	17-23	3.0	62.9	30.9	23.3	94	70	4.3	4.3	-	-	3.9	Traces		
39	24-30	1.0	30.3	30.8	23.0	92	71	6.0	4.5	-	-	3.1	-		
40	1-7 Oct	4.0	61.5	29.1	22.8	92.1	73	4.6	1.6	-	-	1.6	-		
41	8-14	1.0	29.0	31.2	21.3	89.9	59	7.6	0.83	-	-	1.6	-		
42	15-21	0.0	0.0	32.9	16.5	80.4	28.9	8.9							
43	22-28	0.0	0.0	32.4	15.8	80.4	33.7	8.4							1.66
44	29-4 Nov	0.0	0.0	31.4	14.3	80.9	34.1	8.7							2.33
45	5-11	0.0	0.0	31.4	11.2	77.3	26.9	8.6							5.72
46	12-18	0.0	0.0	30.3	11.9	84.1	33.1	8.3							6.86
47	19-25	0.0	0.0	30.7	9.7	85.3	32.0	8.4							6.86
48	26-2 Dec	0.0	0.0	31.9	10.9	85.3	31.3	8.9							6.59
49	3-9	0.0	0.0	30.1	10.7	87.9	35.1	8.0							5.95
50	10-16	0.0	0.0	30.1	10.7	79.4	32.3	8.0							5.70
51	17-23	0.0	0.0	29.2	8.6	84.6	35.1	8.5							5.62
52	24-31	0.0	0.0	29.8	8.1	83.7	29.1	8.4							4.84

N.B.: BLB- Bacterial leaf blight, MLS-*Myrothecium* leaf spot GM- Grey Mildew

Table 20: Disease progress in relation to weather factorsat Surat (Gujarat)

Sr. No.	Standard Week	Period	BLB PDI	Weather parameter						
				Temp °C		Humidity %		Sunshine hour	Rainfall (mm)	Rainy days
				Max	Min	Morn	Even			
1	25	17/06/2016	0.0	30.1	25.3	84.0	78.0	3.8	45	1
2	26	24/06/2016	0.0	27.9	24.0	91.0	82.0	4.3	24.4	2
3	27	01/07/2016	0.0	28.1	24.4	90.0	86.0	1.6	205.2	6
4	28	08/07/2016	0.0	28.3	24.3	91.0	86.0	0.6	3.2	2
5	29	15/07/2016	0.0	28.0	24.0	94.0	81.0	1.3	67.6	6
6	30	22/07/2016	0.0	27.6	23.6	92.0	84.0	1.1	157.4	3
7	31	29/07/2016	0.5	27.1	24.4	91.0	85.0	0.3	14.4	3
8	32	05/08/2016	1.0	27.0	22.9	94.0	81.0	0.2	154.2	7
9	33	12/08/2016	2.0	27.5	24.5	91.0	79.0	0.0	0	0
10	34	19/08/2016	2.5	26.4	24.4	97.0	83.0	0.0	35.8	2
11	35	26/09/2016	3.5	26.6	24.3	98.0	80.0	2.3	3.4	1
12	36	02/09/2016	4.0	26.0	23.1	82.0	77.0	2.3	53	3
13	37	09/09/2016	6.5	26.9	24.0	86.0	75.0	3.8	0.0	0
14	38	16/09/2016	9.0	25.5	22.3	97.0	85.0	0.3	89.6	5
15	39	23/09/2016	13.5	26.3	23.9	94.0	80.0	2.5	10.2	1
16	40	30/10/2016	19.5	26.7	23.8	92.0	88.0	0.7	192.6	3
17	41	07/10/2016	20.0	25.5	22.4	96.0	81.0	1.1	14.6	1
18	42	14/10/2016	15.5	26.1	23.0	85.0	63.0	6.7	0.0	0
19	43	21/10/2016	12.5	24.8	21.1	82.0	56.0	7.5	0.0	0
20	44	28/10/2016	10.0	24.8	20.9	81.0	42.0	7.3	0.0	0
21	45	04/11/2016	9.5	19.4	15.0	82.0	45.0	5.6	0.0	0
22	46	11/11/2016	8.0	19.0	17.1	85.0	49.0	6.4	0.0	0
23	47	18/11/2016	5.5	19.0	17.4	82.0	48.0	6.6	0.0	0
24	48	25/11/2016	3.5	19.1	16.6	80.0	64.0	7.8	0.0	0
25	49	02/12/2016	1.5	19.9	15.9	86.0	51.0	8.0	0.0	0
26	50	09/12/2016	0.5	19.9	15.5	73.0	52.0	7.9	0.0	0
27	51	16/12/2016	0.0	19.1	15.0	88.0	51.0	8.0	0.0	0
Correlation matrix				**-0.0710**	**0.0016**	**0.0453**	**-0.1056**	**0.0613**	**-0.0410**	**-0.2510**

*****significant at 5 % (r=0.381) and ** 1% (r=0.487) level of significance at n-2 degree of freedom

Table 21: Disease progress in relation to weather factors at Junagadh (Gujarat)

(2016-17)	Percent disease incidence (PDI)			Temperature ºC		Relative Humidity(%)		Rain Fall (mm)	No. of Rainy Days
Std. Week	ALS	BLB	GM	Mean Max.	Mean Min.	M	E		
23	0	0	0	40.5	26.1	76	44	0.0	0
24	0	0	0	37.0	26.5	85	57	0.0	0
25	0	0	0	35.5	25.4	84	60	30.0	1
26	0	0	0	32.2	24.9	85	86	43.2	3
27	0	0	0	31.7	25.2	89	78	28.3	4
28	0	0	0	31.3	24.5	88	80	27.2	2
29	0	0	0	31.0	23.4	90	76	54.5	5
30	0	0	0	33.0	24.0	86	70	59.0	1
31	0	0	0	28.4	23.5	96	92	223.5	6
32	0	1	0	28.4	24.4	94	90	83.0	6
33	0	1	0	31.4	25.3	87	68	0.0	0
34	0	1	0	31.8	24.7	89	73	46.0	1
35	0	2.6	0	30.3	24.8	91	84	107.1	5
36	0	3.3	0	31.9	23.8	85	61	5.4	1
37	1	4.1	0	33.7	24.8	81	56	6.8	1
38	1.7	5.7	0	30.3	23.6	91	79	258.0	5
39	2	6.5	0	32.1	23.7	84	66	0.0	0
40	3	7.8	0	31.0	24.1	76	79	141.4	3
41	5	9.3	0	32.1	23.0	89	63	11.6	1
42	7.3	10	0	34.1	20.8	80	38	0.0	0
43	8	12	0	33.0	19.2	80	39	0.0	0
44	8.7	13	0	34.7	16.9	71	25	0.0	0
45	10	9.4	0	33.9	15.2	73	24	0.0	0
46	12	7.8	0	33.2	15.0	70	33	0.0	0
47	13	6	0	33.9	14.2	72	27	0.0	0
48	13.4	5	0	33.6	13.9	76	29	0.0	0
49	15.3	4.5	0	34.0	14.1	70	26	0.0	0
50	14.2	4	0	32.3	15.0	72	28	0.0	0
51	13.7	3.6	0	32.1	12.6	81	29	0.0	0
52	10.3	3.6	0	31.9	11.7	74	23	0.0	0
1	8.5	3	0	30.7	12.4	84	33	0.0	0
2	7.3	2.5	0	27.3	10.2	60	23	0.0	0

M= Morning, E= Evening,ALS-Alternaria leaf spot, BLB-Bacterial leaf bli*g*ht &GM-Gray mildew (Gray mildew was not observed during the season)

Table 21a: Correlation values between weather parameters cotton disease at Junagadh.

Sr No	Particulars	Temperature ^{0}C		Relative Humidity (%)		Rainfall mm	Rainy Days
		Maxi	Mini	Morning	Evening		
1	Alternaria leaf spot	0.103	-0.905	-0.720	-0.857	-0.410	-0.560
2	Bacterial leaf blight	0.116	-0.390	-0.436	-0.492	-0.170	-0.370
('r') values * Significant at 5 % (P at 0.05) : 0.433 ; ** Significant at 1 % (P at 0.01): 0.549							

Table 22: Disease progress in relation to weather factors at Khandwa (Madhya Pradesh)

Month	MSW	BLB		MLB		GM	
		Max. grade	PDI	Max. grade	PDI	Max. grade	PDI
24-30 June	26	1	Traces	1	Traces		
1-7 July	27	1	Traces	1	Traces	-	-
8-14 July	28	1	Traces	1	Traces	-	-
15-21 July	29	1	2.33	1	2.77	-	-
22-28 July	30	1	4.33	1	4.33	-	-
29 July to 4 August	31	1	6.12	1	4.67	-	-
5-11 August	32	1	8.53	2	9.67	-	-
12-18 August	33	2	8.24	2	11.17	-	-
19-25 August	34	2	9.74	2	12.83	-	-
26 August to 1 Sept	35	2	10.16	3	12.50	-	-
2-8 September	36	3	16.77	3	14.67	-	-
9-15 September	37	3	15.70	3	15.17	-	-
16-22 September	38	2	13.73	2	12.83	-	-
23-29 September	39	2	8.87	2	10.67	-	-
30 Sept. to 6 Oct.	40	2	5.73	2	7.33	1	2.33
7-13 Oct.	41	1	4.45	1	7.17	1	5.67
14-20 Oct.	42	1	3.00	1	6.33	2	7.33
21-27 Oct.	43	1	3.67	1	5.67	2	8.67
28 Oct. To 3 Nov.	44	1	3.33	1	5.33	2	12.67
4-10 Nov.	45	1	2.33	1	3.33	2	9.83
11-17 Nov.	46	1	2.33	1	3.33	2	9.83
18-24 Nov.	47	1	2.00	1	2.33	2	7.67
25 Nov. To 1 Dec.	48					1	6.33
2 -8 Dec.	49					1	4.67
BLB : Bacterial Leaf Blight MLB : Myrothecium leaf blight GM : Grey Mildew							

SOUTH ZONE

Table 23: Disease progress in relation to weather factors at Dharwad (Karnataka)

Sl. No	Std Met Weeks	V1 Abhadita				V2 Jayadhar			V3 Bunny Bt				V4 Dr. Brent Bt			
		AB	BB	GM	Rust	AB	GM	Rust	AB	BB	GM	Rust	AB	BB	GM	Rust
1	31	08.20 (16.62)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	07.60 (15.95)	0.00 (0.00)	0.00 (0.00)	07.90 (16.32)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	07.70 (16.14)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2	32	08.60 (17.06)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	08.20 (16.66)	0.00 (0.00)	0.00 (0.00)	08.70 (17.19)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	08.00 (16.36)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
3	33	09.10 (17.59)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	08.20 (16.66)	0.00 (0.00)	0.00 (0.00)	08.90 (17.37)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	07.80 (16.19)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
4	34	08.30 (16.78)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	07.60 (16.04)	0.00 (0.00)	0.00 (0.00)	08.30 (16.78)	02.20 (8.46)	0.00 (0.00)	0.00 (0.00)	07.10 (15.41)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
5	35	10.10 (18.53)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	09.00 (17.42)	0.00 (0.00)	0.00 (0.00)	12.20 (20.43)	02.60 (9.34)	0.00 (0.00)	0.00 (0.00)	07.50 (15.85)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
6	36	10.40 (19.85)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	10.40 (18.76)	0.00 (0.00)	0.00 (0.00)	10.30 (18.76)	02.30 (8.67)	0.00 (0.00)	0.00 (0.00)	08.90 (17.36)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
7	37	18.30 (25.29)	03.00 (9.98)	0.00 (0.00)	0.00 (0.00)	15.60 (23.28)	08.20 (16.67)	0.00 (0.00)	17.90 (25.03)	03.00 (9.95)	0.00 (0.00)	0.00 (0.00)	18.80 (25.67)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
8	38	20.70 (27.09)	04.10 (11.70)	0.00 (0.00)	0.00 (0.00)	19.30 (26.01)	12.10 (20.39)	0.00 (0.00)	20.60 (26.99)	30.90 (11.43)	0.00 (0.00)	0.00 (0.00)	19.50 (26.24)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
9	39	20.50 (26.90)	05.80 (13.89)	06.00 (14.11)	0.00 (0.00)	19.50 (26.20)	20.00 (26.51)	0.00 (0.00)	23.40 (28.94)	06.70 (15.04)	06.30 (14.48)	0.00 (0.00)	21.90 (27.49)	06.50 (14.72)	06.50 (14.72)	0.00 (0.00)
10	40	27.40 (31.57)	07.00 (15.33)	06.10 (14.26)	0.00 (0.00)	25.00 (30.02)	26.00 (30.67)	0.00 (0.00)	28.00 (31.98)	08.10 (16.47)	07.60 (15.90)	0.00 (0.00)	26.30 (30.82)	07.40 (15.78)	07.40 (15.78)	0.00 (0.00)
11	41	32.90 (35.02)	08.10 (16.52)	08.70 (17.09)	0.00 (0.00)	28.30 (32.13)	26.20 (30.76)	0.00 (0.00)	28.80 (32.48)	08.20 (16.60)	06.90 (15.28)	0.00 (0.00)	28.20 (32.05)	07.70 (16.11)	07.90 (16.29)	0.00 (0.00)
12	42	33.40 (35.28)	09.10 (17.57)	09.00 (17.41)	0.00 (0.00)	28.60 (32.34)	28.30 (32.14)	0.00 (0.00)	31.50 (34.15)	07.50 (15.86)	08.50 (16.97)	0.00 (0.00)	32.10 (34.52)	08.20 (16.65)	08.80 (17.22)	0.00 (0.00)
13	43	40.80 (39.67)	09.00 (17.41)	09.40 (17.80)	0.00 (0.00)	29.30 (32.76)	32.30 (34.60)	0.00 (0.00)	35.80 (36.79)	09.00 (17.42)	09.80 (18.24)	0.00 (0.00)	35.90 (36.83)	09.10 (17.59)	10.50 (18.93)	0.00 (0.00)
14	44	41.80 (40.26)	10.40 (18.85)	10.40 (18.85)	10.70 (19.06)	35.10 (36.33)	33.30 (35.21)	08.40 (16.85)	38.60 (38.43)	09.60 (18.06)	08.20 (16.65)	10.60 (19.01)	36.20 (36.95)	09.90 (18.37)	07.20 (15.51)	09.90 (18.37)
15	45	39.00 (38.61)	09.40 (17.80)	09.80 (18.23)	17.80 (24.98)	30.70 (33.65)	33.00 (35.06)	14.70 (22.50)	33.40 (35.32)	09.30 (17.88)	08.60 (17.06)	16.00 (23.57)	34.20 (35.79)	11.20 (19.50)	08.40 (16.85)	15.20 (22.98)
16	46	46.10 (42.79)	10.20 (18.63)	09.70 (18.16)	21.60 (27.71)	35.60 (36.65)	35.00 (36.29)	17.20 (24.51)	42.10 (40.43)	09.70 (18.18)	10.00 (18.40)	18.80 (25.71)	38.40 (38.27)	08.80 (17.21)	09.40 (17.83)	17.50 (24.74)

* Figures in parentheses indicate angular transformed values

Table 23a: Disease progress in relation to weather factors at Dharwad (Karnataka)

Sl. No	Date	Temperature °C		RH Morning (%)	RH Evening (%)	Weekly Rainfall (mm)	Av. Rainfall (mm)	Rainy Days
		Max	Min					
1	30th July -05th Aug	24.7	20.4	92.9	83.9	21.2	3.0	3
2	6th Aug – 12th Aug	26.1	20.9	94.0	79.6	20.1	2.9	3
3	13th Aug – 19th Aug	26.6	20.7	91.4	74.4	14.7	2.1	2
4	20th Aug – 26th Aug	27.1	20.3	91.7	75.3	11.4	1.6	1
5	27th Aug – 02nd Sep	27.5	20.5	93.0	71.9	28.2	4.0	2
6	03rd Sep – 09th Sep	27.4	19.7	86.9	62.9	0.0	0.0	0
7	10th Sep - 16th Sep	27.2	20.0	89.9	71.3	27.2	3.9	1
8	17th Sep – 23rd Sep	25.6	20.0	91.4	78.3	11.6	1.7	2
9	24th Sep – 30th Sep	27.7	20.5	91.7	72.9	15.2	2.2	1
10	01st Oct – 07th Oct	27.3	19.5	91.0	67.1	8.1	1.2	1
11	08th Oct – 14th Oct	28.9	20.2	90.9	61.6	27.2	3.9	1
12	15th Oct – 21st Oct	30.8	16.3	59.9	31.4	0.0	0.0	0
13	22nd Oct –28th Oct	31.1	18.5	62.0	29.7	0.0	0.0	0
14	29th Oct - 04th Nov	31.5	18.4	66.3	43.1	1.8	0.3	0
15	05th Nov – 11th Nov	30.3	12.6	46.1	25.1	0.0	0.0	0
16	12th Nov -18th Nov	31.0	17.2	70.6	40.6	0.0	1.9	1

Table 23b: Correlation values for foliar diseases of cotton with weather parameters 2016-17(Dharwad)

Sn	r'values weather parameters	V1 Abhadita				V2 Jayadhar			V3 Bunny Bt				V4 Dr.Brent Bt			
		AB	BB	GM	Rust	AB	GM	Rust	AB	BB	GM	Rust	AB	BB	GM	Rust
1	Max. Temp	0.872	0.765	0.853	0.622	0.838	0.776	0.621	0.855	0.799	0.833	0.627	0.836	0.833	0.823	0.626
2	Min. Temp	-0.673	-0.600	-0.628	-0.718	-0.646	-0.614	-0.723	-0.633	-0.577	-0.613	-0.715	-0.659	-0.642	-0.600	-0.718
3	RH Morning (%)	-0.763	-0.660	-0.715	-0.666	-0.717	-0.674	-0.668	-0.719	-0.618	-0.695	-0.668	-0.743	-0.715	-0.683	-0.670
4	RH Evening (%)	-0.843	-0.731	-0.805	-0.613	-0.798	-0.747	-0.614	-0.805	-0.731	-0.792	-0.614	-0.815	-0.797	-0.786	-0.615
5	Total Rainfall	-0.464	-0.394	-0.462	-0.332	-0.449	-0.415	-0.334	-0.433	-0.431	-0.470	-0.339	-0.457	-0.477	-0.456	-0.340
6	Rainy Days	-0.673	-0.630	-0.656	-0.353	-0.662	-0.634	-0.354	-0.654	-0.781	-0.645	-0.359	-0.663	-0.656	-0.641	-0.360
Critical Values of the Pearson Product-Moment Correlation Coefficient (df:n-2) = 0.497																

Table 24: Disease progress in relation to weather factors at Guntur (Andhra Pradesh)

SMW	Month & Date	Temperature (^{0}C)		Relative Humidity (%)		Rain Fall (mm)	Rainy days	Sun shine hours	Wind speed km/h	Evaporation	PDI		
											Alternaria leaf spot	Grey mildew	
		Max	Min	I	II						Jadoo BG II	BT var. 223	Bt var. 205
36	3-9 Sept	35.29	24.79	79.86	59	0.1	0	8.1	6.2	3.7			
37	10-16	32.1	23.4	85.86	77	27.2	4	0.5	6.4	2.5	5		
38	17-23	30.79	24.14	81.43	68.57	85.9	4	0.9	5.4	3.2	9		
39	24-30	31.97	23.43	83	76.14	13.3	2	1.4	5.1	3.1	15		
40	Oct.1-7	32.9	22.9	83.4	77.71	120.7	4	3.6	4.1	3.6	14.75		
41	8-14	33.14	22.57	82.71	61.43	33.8	2	7.1	3.6	4.4	12		
42	15-21	33.93	20.71	79.43	65.14	0	0	6.9	3.4	4.6	17.5		
43	22-28	35.25	18.86	78.71	62	0	0	7.7	3.5	4.3	25		
44	29- 4 Nov	34.51	20.5	80	59.14	0	0	7.1	9.9	4	28.5		
45	5-11	34.6	17.93	79.43	55.29	0	0	6.5	4	4.4	20.75		
46	12-18	33.76	18.79	79.86	64	0	0	7	3.2	4.29	12.25		
47	19-25	32.7	15.43	76.71	57	0	0	6.87	2.71	3.86	9.75	10	8
48	26- 2Dec	32.9	16	78.29	53.14	0	0	6.89	2.33	3.79	7.25	17	14
49	3-9	32.46	17.86	75.86	53.86	0	0	6.44	4.36	3.21	12.75	11	7
50	10-16	26.59	17.86	80.71	70.43	9	1	4.8	4.54	3.21	14.5	14	11
51	17-23	32.04	13.07	80.86	54	0	0	6.94	2.8	3.5	25.25	17	15
52	24-30	31.89	14	79.25	52.5	0	0	7.68	3.22	3.71	28.5	25	20
1	1-7 Jan	31.33	15.86	76	55.86	0	0	8.3	2.8	3.57	39.25	20	15
2	8-14	31.56	16.36	77.29	55	0	0	8.14	3.44	3.57	38	15	10
3	15-21	31.87	14.14	80	52.29	0	0	8.07	4.13	3.79	38.75	10	8
4	22-28	32.21	17.21	75.57	56.57	0	0	6.6	4.13	3.7	35	4	3

Table 25: Disease progress in relation to weather factors at Coimbatore (Tamil Nadu)

Std. metrological week	Std. Week No.	Foliar diseases						Soil borne disease		
		Alternaria Leaf blight (PDI)			Bacterial leaf blight (PDI)			Root rot(%)		
		MCU13	RCHBGII	SVPR-4	MCU13	RCHBGII	SVPR-4	MCU13	RCHBGII	SVPR-4
Aug11-17 2016	**33**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug 18-24	**34**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-31	**35**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sep1-7	**36**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-14	**37**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-21	**38**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22-28	**39**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29-Oct5	**40**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-12	**41**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-19	**42**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-26	**43**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27-Nov2	**44**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nov3-9	**45**	**2.0**	**2.0**	**2.0**	0.0	**2.0**	0.0	0.0	0.0	0.0
10-16	**46**	**3.0**	**3.0**	**3.0**	0.0	**2.0**	0.0	0.0	0.0	0.0
17-23	**47**	**3.0**	**3.0**	**3.0**	0.0	**2.0**	0.0	0.0	0.0	0.0
24-30	**48**	**3.0**	**3.0**	**3.0**	0.0	**2.0**	0.0	0.0	**5.0**	0.0

Path. 1 (C) : Studies on variability on cotton pathogen Alternaria leaf spot.

Table 26: Alternaria species in cotton leaf spot samples collected by Guntur center (2016)

S. No.	Date	Place	Hybrid / variety	Presence of Alternaria spores
1	19.08.16	RARS, Lam	Jadoo (F No.17)	+
2	30.09.16	Bhimavaram	Jadoo	+
3	30.09.16	Makkapeta	ATM	+
4	20.10.16	RARS, Lam	Bt varieties (F No 10)	+
4	25.10.16	Chevuturu	ATM	+
5	25.10.16	Mylavaram	Bhakthi	+
6	25.10.16	Badava	Jadoo	+
7	25.10.16	Anigandlapadu	Bhakthi	+
8	27.10.16	Dharanikota	RCH 659	+
9	27.10.16	Krosur	ATM	+
10	31.10.16	Visadala	ATM	+
11	31.10.16	Medikonduru	Jadoo	+
12	31.10.16	Bodalaveedu	Jadoo	+
13	01.11.16	RARS, Lam	Jadoo	+
14	03.11.16	RARS, Lam	1b Jadoo (F No 10)	+
15	17.11.16	RARS, Lam	2a entries (F. No. 2)	+

Table 27: Symptomatology of Alternaria spp., infecting cotton genotypes at Coimbatore

S. No.	Genotypes	Symptoms of *Alternaria* leaf blight	
		Regular necrotic dark brown spots with concentric rings	Irregular necrotic dark brown patch without concentric rings
1.	704	+	-
2.	706	-	+
3.	708	+	-
4.	709	+	-
5.	618	+	-
6.	535	+	-
7.	735	-	+
8.	6551	-	+
9.	6554	-	+

Path 1 (d):Survey and Epidemiology of TSV

CENTRAL ZONE

Table 28: Occurrence of TSV from major cotton growing areas of Maharashtra(Rahuri)

Locations	Variety/hybrids	TSV
Rahuri	Bhakti	7.44
	Ajit 199	19.33
	Ajit 155	21.65
	MRC 7351	14.42
	Jadoo(Kaveri)	14.60
Pathardi	Ajit 199	15.83
	Ajit 155	18.13
	Chamatkar	11.87
	Mallika Bt	13.54
Shevgaon	MRC 7351	12.56
	Ajeet 199	19.14
	Chamatkar	9.29
	NCH 954	11.24
Sangmner	Chanakya	12.31
	Bt No. 228	8.08
	Ajit 199	7.37
Dhule	Rashi 2	11.13
	Jadoo(Kaveri)	11.80
	Trinetra	12.09
	Mallika	14.05
	MRC 7351	13.48
Jalgaon	MRC 7351	7.05
	Jadoo (Kaveri)	3.00
	Ajit 199	10.42
	Chamatkar	11.06
Nandurbar	MRC 7347	8.00
	Ajit 199	11.74
	MRC 7351	9.45
	Mallika	10.23
	Pancham	9.21

Table 29: Occurrence of TSV from major cotton growing areas of Maharashtra (Nanded)

Sr. No.	Treatment	TSV(PDI)
1	Aurangabad	0.00
2	Parbhani	0.00
3	Nanded	0.00
4	Hingoli	0.00
5	Latur	0.00
6	Jalna	0.00
7	Usmanabad	0.00
8	CRS NED, LRA 5166	0.00

SOUTH ZONE

Table 30: Occurrence of TSV from major cotton growing areas of AP *(Guntur)

Month	Hybrids (BG II)	Incidence of TSV (%)
July 2016	Jadoo, RCH 659, Bhakthi, ATM	0 to 0.9
August 2016	Bhakthi, Jadoo, Veera, ATM, RCH 659, Kohinoor, Ajit 155, Sadananda,	0 to Traces
September 2016	Jadoo, ATM	0
October 2016	Jadoo, ATM, Ujjwala, Bhakthi, RCH 659, Superb, Raja, Legend	0 to Traces
November 2016	Jadoo, ATM, Ujjwala, RCH 659, Vardhini, Ajit 155	0
December 2016	Lotus, Superb, RCH 659, ATM, Jadoo, Bhakthi, Police	0
January 2017	Jadoo, Bhakthi, RCH 659, ATM	0

***Krishna,Guntur and Prakasham districts**

Table 30a: Occurrence of TSV on Cotton at RARS, Lam, Guntur (Andhra Pradesh)

Variety	TSV (%)	Variety	TSV (%)	Variety	TSV (%)
L 387	1	L 799	1	BBGH 1	0
L 603	1	L 1060	0	BBGH 3	0
L 604	0	LK 861	0	BBGH 26	0
L 755	0	LRH 516	0	HyPS - 152	0
L 761	1	LPS 141	1	LHDP 1	1
L 762	0	MCU 5	1	LHDP 2	0
L 763	0	NDLH 1938	0	LAHH 5	0
L 765	0	NA 1325	1	LAHH 7	0
L 766	0	Suraj	0	LAHH 25	0
L 770	0	Suvin	0	LAHH 26	0
L 788	0	BS 37	0	LAHH 27	0

Table 30b: Occurrence of TSV on RCH 2 BG II at Guntur (Andhra Pradesh)

SMW	Month & Date	Tobacco Streak Virus Disease	
		RCH 2 BG II	
		(%)	PDI
36	3-9 Sept.	1.38	0.35
38	17-23 Sept.	3.46	0.87
40	1-7 Oct.	5.19	1.30
42	15-21 Oct.	12.46	4.41
44	29 Oct-Nov.4	11.76	3.63
46	12-18 Nov.	10.92	3.37
48	26 Nov-Dec.2	1.04	0.23
50	10-16 Dec.	0.56	0.17
52	24-30 Dec.	0.35	0.09

Table 31: Occurrence of TSV at Coimbatore (Tamil Nadu)

S. No.	Location	Area (acre)	TSV (%)
1.	Dharapuram (RCH BGII)	2	-
2.	Dindigul (RCH BGII)	3	1.0
3.	Palladam (RCH BGII)	1	-
4.	Madurai (Bt cotton)	21	-
5.	Tirunelvelli (Bt Cotton and variety)	40	-
6.	Virudhunagar(Bt cotton)	30	-
7.	Coimbatore (TNAU)	20	10.0
8.	Coimbatore (Keeranatham, Vaiyampalayam, Pallipalayam and Kondampalayam) – Bt cotton & variety	20	-

Path. 2(a): Screening of breeding lines for disease reaction
NATIONAL TRIALS

Table 32: Br. 02a - IET- *G. hirsutum* (IRRIGATED)

Code	Entry	CLCuD(reaction)			BLB (GRADE)		FFLS
		FKT	HSR	SRS	FKT	SRT	FKT
601	PBH 47	S	MS	**HS**	2	0	1
602	WGCV 79	HS	S	HS	2	0	2
603	H 1489	MS	MS	HS	2	0	2
604	AR-9108	S	MS	S	2	0	2
605	ZC (F 2228/ RHC 0717/Suraj)	HS	MS	HS	1	0	2
606	F 2462	HS	MS	HS	2	0	2
607	L 799	HS	HS	HS	2	0	2
608	TSH 327	HS	HS	HS	2	2	1
609	BS 1	HS	HS	HS	2	0	2
610	RAH 1071	S	S	S	2	0	2
611	RHC – 1217	HS	HS	HS	2	0	2
612	CSH 3269	HS	HS	HS	2	3	2
613	CPD-1602	HS	HS	HS	2	0	1
614	RB – 616	HS	HS	HS	2	0	2
615	RAH 1070	HS	HS	HS	2	0	2
616	CCH 16-1	HS	HS	HS	2	0	2
617	SIMA 5	HS	HS	HS	2	0	2
618	GJHV-518	HS	HS	HS	1.96	2	2
619	HS 297	HS	S	HS	2	0	2
620	GISV 310	MR	R	MS	2	0	2
621	PBH 42	HS	MS	S	2	0	2
622	RS 2835	MS	MS	MS	2	0	2
623	CCH 16-2	S	HS	HS	2	0	2
624	CNH 39	HS	S	HS	2	0	2
625	Quality Check(F 2164/Suraj/Suraj)	HS	MS	HS	2	2	2
626	CSH 2811	HS	MR	HS	2	0	2
627	GSHV 185	S	S	S	2	0	2
628	BGDS 1072	HS	S	HS	2	0	2
629	TSH 324		HS	HS		0	
630	Sartaj	MR	HS	S	1	0	1
631	CNH 108	HS	S	HS	2	0	1
632	RHC – 1202	HS	S	HS	2	0	2
633	ARBH-1601	S	HS	HS	2	0	2
634	TCH 1199	MR	HS	HS	2	0	2
635	Local Check	S	S	S	2	0	2
636	L 1384	HS	S	HS	2	0	2
637	GJHV-477	S	HS	HS	2	0	2
638	BS 2	HS	HS	HS	2	0	2
639	RB - 617	HS	S	HS	2	0	2
640	F 2453	HS	MR	HS	2	0	2
641	HS 298	HS	HS	HS	2	0	2
642	CPD-1601	HS	HS	HS	1	0	2
SC	RST9(FKT)	HS			2		2
	HS6 (HSR)		HS				
	(HS6) SRS			HS			
	RCH 2 BG II (CBE)						
	LRA 5166 (RAH)						
	RCH 2 BG II (GUN)						
	Jadoo BG II (GUN)						

Code	Entry	ALB/ALS				GM	RUST
		RAH	SRT	GUN	CBE	GUN	GUN
601	PBH 47	2	1	2	3	1	0
602	WGCV 79	2	0	3	3	1	0
603	H 1489	1	0	2	3	1	0
604	AR-9108	2	0	3	3	1	1
605	ZC (F 2228/ RHC 0717/Suraj)	3	0	3	3	1	1
606	F 2462	1	0	2	3	1	0
607	L 799	1	0	2	3	1	0
608	TSH 327	1	1	3	3	1	0
609	BS 1	3	0	2	3	0	0
610	RAH 1071	2	0	3	3	1	1
611	RHC – 1217	1	1	3	3	1	0
612	CSH 3269	2	0	3	3	1	0
613	CPD-1602	1	0	3	3	1	1
614	RB – 616	0	1	3	3	1	0
615	RAH 1070	0	1	2	3	1	1
616	CCH 16-1	1	0	2	3	1	1
617	SIMA 5	1	0	2	**2**	1	0
618	GJHV-518	3	0	2	3	1	1
619	HS 297	1	0	2	**2**	1	0
620	GISV 310	1	0	3	**2**	1	0
621	PBH 42	3	0	3	**2**	1	0
622	RS 2835	1	0	2	3	1	2
623	CCH 16-2	2	0	2	3	1	1
624	CNH 39	3	1	3	3	1	0
625	Quality Check(F 2164/Suraj/Suraj)	2	0	3	3	1	0
626	CSH 2811	1	1	2	3	1	1
627	GSHV 185	1	1	2	3	1	0
628	BGDS 1072	3	1	2	3	1	1
629	TSH 324	3	0	2	3	0	1
630	Sartaj	1	0	2	3	1	0
631	CNH 108	2	1	2	3	1	0
632	RHC – 1202	1	0	3	3	1	0
633	ARBH-1601	4	0	3	3	1	1
634	TCH 1199	1	0	3	3	1	1
635	Local Check	2	1	2	**2**	1	0
636	L 1384	1	0	2	3	1	0
637	GJHV-477	2	0	3	3	1	1
638	BS 2	3	1	3	3	1	0
639	RB - 617	1	0	3	3	1	1
640	F 2453	3	0	3	**2**	1	1
641	HS 298	2	0	3	**2**	1	0
642	CPD-1601	2	3	3	3	1	0
SC	RST9(FKT)						
	HS6 (HSR)						
	(HS6) SRS						
	RCH 2 BG II (CBE)				3		
	LRA 5166 (RAH)	3					
	RCH 2 BG II (GUN)			1		1	2
	Jadoo BG II (GUN)			3		3	2

Table 33: Br. 02 b – IET- *G. hirsutum* (RAINFED)

Code	Entry	AB	BB	GM	Rust
		DWD	DWD	DWD	DWD
651	WGCV 48	4	2	1	1
652	NDLH – 2027	4	1	1	1
653	BS 2	4	2	1	1
654	IH 11-2	4	2	1	2
655	RB – 611	4	1	1	1
656	ZC (NH 615/ NDLH 1938)	4	1	1	1
657	RAH 1070	4	2	1	1
658	TKH 1185/1/3	4	1	1	1
659	PH 1071	4	1	1	1
660	CPD-1651	4	2	1	1
661	Quality Check (Suraj)	4	2	1	2
662	GBHV-184	4	2	1	2
663	L 1060	4	1	1	2
664	CNH 1125	4	1	1	1
665	CNH 09-77	4	1	1	1
666	AKH-1301	4	1	1	1
667	H 1489	4	1	1	2
668	RAH 1071	4	1	1	1
669	CNH 7012	4	1	1	1
670	CPD-1652	4	2	1	2
671	BS 1	4	3	1	2
672	BGDS 1072	4	2	1	2
673	TKH 0250/2	4	1	1	2
674	GBHV-185	4	2	1	2
675	Local Check	4	1	1	1
676	CCH 16-3	4	1	1	1
677	IH 11-12	4	1	1	1
678	RB – 610	4	2	1	1
679	NDLH - 2030-2	4	1	1	1
680	ARBH-1651	4	1	1	2
SC	Jayadhar	4	-	4	3
	Abhadita	4	4	1	3

Table 34: Br. 06 a – IET of Compact genotypes under irrigated condition

Code	Entry	CLCuD (PDI)		ALS			GM	RUST
		FKT	HSR	FKT	GUN	CBE	GUN	GUN
701	RS 2827	S	MS	3	3	3	1	0
702	RHC-1312	HS	HS	0	3	3	0	0
703	DSC-1601	S	S	2	3	3	1	0
704	RAHC 1021	HS	MS	0	3	3	1	1
705	GJHV 522	MR	HS	3	3	3	1	0
706	GISV 298	S	S	1	3	3	1	1
707	F 2639	S	MS	1	3	3	1	0
708	BS 30	S	HS	3	3	3	1	1
709	Local Check	MS	HS	1	3	3	1	1
710	CSH 5640	S	MS	2	3	3	1	0
711	TCH 1819	S	S	2	3	3	1	0
712	CCH 16-5	S	S	0	3	3	1	1
713	TCH 1873	S	HS	1	3	3	0	0
714	RS 2818	S	S	2	3	3	1	0
715	ARBC-1601	MS	HS	3	3	3	1	1
716	RHC-1333	S	HS	2	3	3	1	0
717	RAHC 1020	S	S	3	3	3	1	1
718	H 1506	S	S	1	3	3	1	0
719	CSH 31292	S	MS	1	3	3	1	0
SC	F2383 (NS) (FKT)	MS						
	F2228 (FKT)	S						
	HS6 (HSR)		HS					
	LRA 5166 (RAH)			3				
	L 604 (Gun)				3		2	3
	CRCH 2 BG II (Gun)				2		1	2
	Jadoo BG II (Gun)				3		3	2
	Suraj (CBE)					3		
	RCHBGII (CBE)					3		

Table 35: Br. 06 b – Initial Evaluation of Compact genotypes under rainfed condition

Code	Entry	BLB (GRADE)		ALS		GM	Rust
		SRT	DHW	SRT	DHW	DHW	DHW
751	CNH 15	0	2	0	4	1	1
752	DSC-1651	0	1	0	4	1	1
753	LHDP 2	0	1	1	4	1	1
754	ARBC-1651	0	1	1	4	1	2
755	RAHC 1020	0	1	0	4	1	1
756	Local Check	0	1	0	4	1	1
757	CNH 09-4	0	1	1	4	1	1
758	AKH-13-55	0	1	1	4	1	1
759	CCH 16-7	0	1	0	4	1	1
760	CNH 1123	0	1	1	4	1	1
761	CNH 75	0	1	1	4	1	1
762	CCH 16-8	0	1	2	4	1	1
763	BS 30	0	2	1	4	1	1
764	CNH 09-62	0	1	1	4	1	1
765	RAHC 1021	0	1	1	4	1	2
766	CNH 1122	0	2	1	4	1	2
SC	G. Cot.20 (SRT)	0		1			
	Jayadhar (DHW)		-		4	4	2
	Abhadita (DHW)		3		4	1	3

Table 36: Br 12 a. IET OF *G. barbadense*

Code	Entry	BB (GRADE)		ALB/ALS					GM		Rust		TSV
		SRT	DHW	RAH	SRT	DHW	GUN	CBE	DHW	GUN	DHW	GUN	CBE
801	DB-1601	2	2	1	0	4	2	2	1	1	1	1	1
802	CCB 51	2	1	0	0	4	2	3	1	1	1	0	-
803	RHCb-1014	2	2	2	0	4	2	3	1	0	2	0	-
804	Suvin (CC)	3	1	1	0	4	2	3	1	1	2	1	-
805	SB SG 1-5	2	2	1	0	4	2	3	1	1	2	0	-
806	CCB 143	3	2	1	0	4	2	3	1	0	2	0	-
807	DB-1602	2	2	3	1	4	2	3	1	0	2	0	-
SC	LRA 5166(RAH)			3									
	Jayadhar (DHW)		-			4			4		2		
	Abhadita (DHW)		3			4			1		3		
	RCH 2 BG II (GUN & CBE)						2	3		1		2	-
	Jadoo BG II (GUN)						3			3		2	

Table 37: Br. 15 a - PHT- Interspecific -Hybrid (hir x barb)

Code	Entry	BB (GRADE)	ALB/ALS				GM		RUST	
		DHW	RAH	DHW	GUN	CBE	DHW	GUN	DHW	GUN
811	DHB-1601	1	1	4	2	3	1	1	2	0
812	CCHB 20	1	0	4	2	3	1	1	2	0
813	DCH 32 (CC)	1	2	4	2	3	1	1	1	0
814	Local Check	1	1	4	2	3	1	1	2	1
815	ARBHB-1601	1	0	4	1	**2**	1	1	1	1
816	LAHB- 1	1	3	4	2	**2**	1	1	2	0
817	DHB-1602	1	2	4	2	3	1	1	2	1
818	ARBHB-1602	1	1	4	2	**2**	1	1	2	0
SC	LRA 5166 (RAH)		3							
	Jayadhar (DHW)	-		4			4		2	
	Abhadita (DHW)	3		4			1		3	
	RCH 2 BG II (GUN)				3	3		1		2
	Jadoo BG II (GUN)				3			3		2

Table 38: Br. 22 a/b IET-*G. arboreum*

Code	Entry	BB (GRADE)		ALS	FFLS	GM	RUST	Root rot (grades)
		FKT	DHW	DHW	FKT	DHW	DHW	SRS
851	DWDa-1602	1	-	3	2	4	1	4
852	JLA-1110	1	-	3	2	3	1	4
853	PBD 10	1	-	3	2	4	1	4
854	CNA 1032	1	-	3	2	2	1	4
855	FDK 272	1	-	3	2	4	1	4
856	GAM 236	1	-	3	2	4	1	2
857	Local Check	1	-	3	2	4	1	4
858	JLA-1122	1	-	3	2	4	1	4
859	CISA 333	1	-	3	2	4	1	0
860	PA 828	1	-	3	2	3	1	2
861	RG 804	2	-	2	2	2	1	4
862	ZC (FDK 124/AKA 7/DLSa 17)	1	-	3	2	4	1	4
863	HD 521	1	-	3	2	4	1	4
864	RAAS 602	1	-	4	2	4	1	4
865	RG 801	1	-	3	2	4	1	4
866	PBD 20	1	-	3	2	3	1	4
867	CNA 1031	2	-	3	2	4	1	4
868	AKA-2013-21	1	-	3	2	4	1	4
869	FDK 265	1	-	2	2	2	1	3
870	RAAS 601	1	-	3	2	3	1	4
871	CNA 2030	1	-	3	2	3	1	4
872	GAM 223	1	-	4	2	4	1	3
873	MBDCV1604	1	-	3	2	3	1	4
874	CISA 1793	1	-	4	2	4	1	3
875	DWDa-1601	1	-	3	2	3	1	3
876	PA 810	2	-	4	2	4	1	2
SC	RG8 (FKT)	2			2			
	LD1026(FKT)	2			2			
	FDK124 (FKT)	1			2			
	FMDH9 (FKT)	1			2			
	LD1019 (FKT)	1			2			
	LD949 (FKT)	1			2			
	CISA 614 (SRS)							4
	CISA 310 (SRS)							4
	Jayadhar (DHW)		-	4		4	3	
	Abhadita (DHW)		3	4		1	3	

Table 39: Br. 22 a/b IET - Long linted *G. arboretum*

Code	Entry	BB (GRADE)		ALS		GM	RUST	Root rot (grades)
		SRT	DHW	SRT	DHW	DHW	DHW	SRS
881	PA 793	0.0	-	0.0	2	3	1	2
882	ZC (FDK 124/AKA 7/DLSa 17)	0.0	-	0.0	4	4	1	4
883	PAIG 77	0.0	-	0.0	3	4	1	4
884	PA 781	0.0	-	0.0	3	4	1	3
885	PAIG 326	0.0	-	0.0	4	4	1	4
886	PA 827	0.0	-	0.0	4	4	1	3
887	PAIG 373	0.0	-	0.0	3	4	1	4
888	PAIG 368	0.0	-	0.0	3	4	1	4
889	PA 255	0.0	-	0.0	3	4	1	4
890	PA 778	0.0	-	0.0	4	4	1	4
891	PA 363	0.0	-	0.0	3	4	1	4
892	PA 760	0.0	-	0.0	3	4	1	4
893	PA 788	0.0	-	0.0	3	4	1	4
894	PA 08	0.0	-	0.0	4	4	1	4
895	Local Check	0.0	-	0.0	3	4	1	4
896	PA 796	0.0	-	0.0	4	4	1	3
897	PA 808	0.0	-	0.0	4	4	1	4
898	PA 741	0.0	-	0.0	3	4	1	4
SC	CISA310 (SRS)							4
	CISA 614 (SRS)							2
	Jayadhar (DHW)		-		4	4	2	
	Abhadita (DHW)		3		4	1	3	

Table 40: Br. 25 a/b PHT - Desi Hybrid

Code	Entry	BB (GRADE)	FFLS	Root rot (grades)
		FKT	FKT	SRS
901	KR-111	1	2	4
902	GSGDH 528	1	2	4
903	AKDH-102	1	2	4
904	KR-116	1	1	4
905	NACH 461	1	2	2
906	Local Check	1	2	4
907	BDAA 029	2	2	4
908	CISAA 162	1	2	2
909	AJAH-101	1	2	2
910	CISAA 161	1	2	4
911	ZC (KR 64-NZ; NACH 12-CZ)	1	2	4
SC	FDK 124 (FKT)	2	2	4
	CICR 2 (SRS)			3

Table 41: Br. 32b IET of *G. herbaceum*

Code	Entry	BLB (GRADE)			ALS			GM	Rust
		SRT	BRH	DHW	SRT	BRH	DHW	DHW	DHW
951	RAHS 804	0.0	0	-	0.0	0	4	4	2
952	GShv 367/12	0.0	0	-	0.0	0	4	4	1
953	GShv 371/12	0.0	0	-	0.0	0	3	4	1
954	RAHS 801	0.0	1	-	0.0	0	3	4	1
955	GBhv-304	0.0	1	-	0.0	0	3	4	1
956	GBhv-307	0.0	0	-	0.0	0	3	4	2
957	ANGh-1601	0.0	0	-	0.0	0	4	4	2
958	GShv 362/12	0.0	0	-	0.0	0	3	4	1
959	Local Check	0.0	0	-	0.0	1	3	4	2
960	DWDh-1602	0.0	0	-	0.0	0	3	4	2
961	RAHS 802	0.0	1	-	0.0	0	4	4	1
962	ANGh-1602	0.0	0	-	0.0	0	4	4	1
963	RAHS 803	0.0	0	-	0.0	0	4	4	2
964	GShv 385/12	0.0	0	-	0.0	0	4	4	1
965	ZC (G Cot 23/DDhc 11)	0.0	0	-	0.0	0	3	4	1
966	GBhv-302	0.0	0	-	0.0	0	4	4	2
967	DWDh-1601	0.0	0	-	0.0	0	4	4	2
968	GBhv-305	0.0	0	-	0.0	0	4	4	2
SC	LRA 5166 (BRH)		2			3			
	1027 ALF (BRH)		0			0			
	Digvijay (BRH)		0			0			
	Jayadhar (DHW)			-			4	4	2
	Abhadita (DHW)			3			4	1	3

NORTH ZONE TRIAL

Table 42: Br-03 a

Code	Entry	CLCuD (PDI)				BB (GRADE)		FFLS	
		FKT	BTH	SRG	HSR	FKT	BTH	FKT	BTH
6001	F 2501	S	MS	MR	S	2	0	2	1
6002	HS 294	S	MS	MR	MR	2	1	2	1
6003	RS 2815	MS	R	MR	S	2	0	2	0
6004	ZC (F 2228)	MS	MS	MS	MR	2	0	2	1
6005	Shakti Sultan (SSGR105)	MS	MR	MS	S	2	0	2	0
6006	Local Check	S	MS	MS	HS	2	0	2	0
6007	RS 2765	MS	R	S	S	2	0	2	0
6008	Quality Check (F 2164)	HS	MS	S	MS	2	1	2	2
6009	HS 296	HS	S	S	S	2	2	2	2
SC	RS 2013 (FKT)	HS				2		2	
	LH 2108 (FKT)	S				2		2	
	RST 9 (FKT) & (SRG)	HS		HS		2		2	
	LC HS6 (HSR)				HS				

Table 43: Br-05a

Code	Entry	CLCuD(PDI)					BB (GRADE)		FFLS	
		FKT	HSR	BTH	SRG	SRS	FKT	BTH	FKT	BTH
6011	RAHH 630	HS	S	MS	S	S	2	0	2	0
6012	FHH 269	S	MS	MS	R	HS	2	0	2	0
6013	HHH 497	MS	MS	MS	MS	S	2	1	2	2
6014	FHH 261	MS	MS	MS	MR	HS	2	0	2	0
6015	25D14	S	MS	MS	MS	S	2	0	2	0
6016	GTHH-217	MS	MS	MS	HR	S	2	0	2	0
6017	CSHH 3078	MS	MS	MS	MS	S	2	0	2	0
6018	FHH 298	HS	S	MR	MR	HS	2	0	2	0
6019	Local Check	S	HS	MS	MS	S	2	2	1	2
6020	ZC (CSHH198)	S	S	S	S	HS	2	2	2	2
6021	FHH 272	S	S	MS	MS	HS	2	2	2	2
6022	CSHG 1675	HS	MS	MS	MR	HS	2	0	2	0
6023	HSHH 32	HS	S	MS	MR	HS	2	2	2	2
6024	SVHH-151 (Shakti Vardhak)	HS	MS	MR	MS	HS	2	0	2	0
SC	RS2013(FKT)	S					2		2	
	RST 9(FKT)	HS					3		2	
	HS6 (HSR)		HS							
	RST 9 (SRG)				HS					
	HS6 (SRS)					HS				

Table 44:Br-06a

Code	Entry	CLCuD (PDI)					BB (GRADE)	FFLS
		FKT	BTH	SRG	HSR	SRS	BTH	BTH
6031	RS 2814	MS	MR	MS	MR	MS	1	R
6032	PBH 3	S	HS	MS	R	S	2	MR
6033	RS 2727	R	MR	MS	HS	HS	0	I
6034	Local Check	MS	HS	HS	MS	S	2	R
6035	RS 2734	MS	MS	S	MS	S	1	I
6036	RS 2821	MS	MS	S	MS	S	2	MR
SC	F2381 (FKT)	S						
	F2383 (NS) (FKT)	MS						
	F2228 (FKT)	MS						
	RST 9 (SRG)			HS				
	LC HS6 (HSR)				HS			
	LC HS6 (SRS)					HS		

Table 45:Br-24a

Code	Entry	BB (GRADE)		FFLS		Root rot (grades)
		FKT	BTH	FKT	BTH	SRS
6041	ZC (FDK 124)	1	0	2	0	4
6042	LD 1026	1	0	2	0	4
6043	Local Check	2	0	2	0	3
6044	CISA 6-2	1	0	1	0	3
6045	PA 812	1	0	2	0	3
6046	PBD 17	2	0	2	0	4
SC	RG 8 (FKT)	2		2		
	FDK 124 (FKT)	1		2		
	CISA310 (SRS)					4
	CISA 614 (SRS)					4

Table 46: Br-25a

Code	Entry	BB (GRADE)		FFLS		Root rot (grades)
		FKT	BTH	FKT	BTH	SRS
6051	ZC (KR 64)	MR	0	2	0	2
6052	Swadeshi 9	R	0	2	0	4
6053	AAH 37	R	0	2	0	4
6054	BDAA 011	R	0	2	0	4
6055	Local Check	R	0	2	0	3
6056	CISAA 14-31	MR	0	2	0	1
6057	GSGDH-521	R	0	2	0	4
SC	LD949 (FKT)	MR		2		
	CICR 2 (SRS)					3

CENTRAL ZONE TRIAL

Table 47: Br-03 a

Code	Entry	BLB (GRADE)		ALS/ALB			GM
		SRT	JNG	RAH	SRT	JNG	JNG
6101	GSHV-172	0	2	1	0	1	—
6102	CPD-1501	0	2	2	0	1	—
6103	ZC (RHC 0717)	0	2	2	0	1	—
6104	BGDS 1033	0	1	1	0	1	—
6105	Local Check	0	2	2	0	1	—
6106	GSHV-173	0	2	2	0	1	—
6107	GJHV 510	0	2	0	0	1	—
6108	Quality Check (Suraj)	0	2	1	0	1	—
6109	CCH 15-1	0	1	1	0	1	—
SC	LRA 5166 (JNG)		2			3	
	LRA 5166 (RAH)			3			
Grey mildew disease was not observed in JNG							

Table 48: Br-04 a

Code	Entry	BLB (GRADE)		ALS			GM
		SRT	JNG	RAH	SRT	JNG	JNG
6111	CCH 14-1	0	1	3	1	2	—
6112	ZC (RHC 0717)	0	1	3	0	2	—
6113	Local Check	0	1	2	1	2	—
6114	GJHV 497	0	1	3	0	1	—
6115	SCS 1061	0	1	1	0	2	—
6116	Quality Check (Suraj)	2	1	2	0	2	—
SC	**LRA 5166 (JNG)**		2	3		3	—
	LRA 5166 (RAH)						
Grey mildew disease was not observed in JNG							

Table 49: Br-05 a

Code	Entry	BB (grade)	ALB/ALS	
		SRT	RAH	SRT
6131	GSHH 2759	0	3	0
6132	BGDHH 697	0	1	0
6133	RHH-1215	0	2	0
6134	GTHH-217	0	2	0
6135	GJHH 4	0	1	0
6136	GJHH-8	0	0	0
6137	GTHH 215	0	3	0
6138	Local Check	0	2	0
6131	GJHH-5	0	3	0
6132	GSGHH 641	0	1	0
6133	RHH 1125	0	2	0
6134	MRC 7398 (Mahyco)	0	2	0
6135	NCS 5657	0	1	0
6144	ZC (Ankur 651)	0	3	0
6145	BGDHH 632	0	1	0
6146	GJHH-6	0	2	1
SC	LRA 5166 (RAH)		3	

Table 50: Br-06 a

Code	Entry	ALB/ALS
		RAH
6151	ANGC 1501	3
6152	GSHV 180	3
6153	RAHC 1011	2
6154	GTHV-13/28	4
6155	Local Check	2
6156	GTHV 13/32	3
6157	DSC-1501	2
6158	ANGC 1502	1
6159	ARBC 1501	3
6160	GISV 272	4
6161	CCH 15-5	3
SC	LRA 5166 (RAH)	3

Table 51: Br – 13 a PVT *G. barbadense*

Code	Entry	ALB/ALS
		RAH
6171	ARBB-1502	3
6172	CCB-11a	NG
6173	ZC (Suvin)	2
6174	DB-1502	2
6175	ARBB-1501	3
SC	LRA 5166 (RAH)	3

Table 52: Br. 14 a – CVT *G. barbadense*

Code	Entry	ALB/ALS
		RAH
6181	ARBB 1402	2
6182	ARBB 1401	2
6183	ARBB-1302	1
6184	ZC (Suvin)	1
6185	CCB 29	3
6186	TCB 37	3
SC	LC LRA 5166(RAH)	3

Table 53:Br-15 a

Code	Entry	ALB/ALS
		RAH
6191	RHB-1243	2
6192	RHB-1008	2
6193	Local Check	1
6194	DHB-1501	1
6195	RHB 1122	1
6196	ZC (DCH 32)	2
6197	RHB 1123	2
SC	LRA 5166(RAH)	3

Table 54:Br-03 b

Code	Entry	BLB (GRADE)			MLS	ALS		GM		Wilt
		NAD	AKL	BHR	AKL	NAD	BHR	NAD	AKL	BHR
6201	BGDS 1033	3	1	2	1	2	1	0	1	0
6202	Quality Check (Suraj)	2	2	1	1	2	1	0	1	0
6203	AKH-09-5	2	1	1	1	2	1	0	1	0
6204	NDLH - 2005-4	2	2	1	1	2	1	0	1	0
6205	Local Check	3	1	2	1		1	0	1	0
6206	ZC (NH 615)	2	2	0	1	3	0	0	1	0
6207	ARBH-1551	2	1	2	1	2	2	0	1	0
6208	BGDS 1055	2	1	1	1	2	0	0	1	0
SC	LRA 5166(NAD)	3				3		I		
	LRA 5166(AKL)		3		1				1	
	LRA 5166 (BHR)			2			3			0
	1027 ALF (BHR)			0			0			0
	Digvijay (BHR)			0			0			0

Table 55:Br-04 b

Code	Entry	BLB (GRADE)			MLS	ALS		GM		Wilt
		NAD	AKL	BHR	AKL	NAD	BHR	NAD	AKL	BHR
6211	SCS 1061	2	1	2	1	2	1	0	1	0
6212	ZC (NH 615)	2	2	1	1	2	1	0	1	0
6213	Quality Check (Suraj)	2	1	1	1	2	1	0	1	0
6214	GTHV 13/17	2	2	2	1	1	0	0	1	0
6215	GBHV 183	2	2	1	1	2	1	0	1	0
6216	RAH 1066	2	2	2		2	2	0		0
6217	Local Check	2	1	1		2	1	0		0
6218	SCS 1207	2	2	1		2	1	0		0
SC	LRA 5166 (NAD)	3				3		I		
	LRA 5166(AKL)		3		1				1	
	LRA 5166 (BHR)			2			3			0
	1027 ALF (BHR)			0			0			0
	Digvijay (BHR)			0			0			0

Table 56: Br-05 b

Code	Entry	BLB (GRADE)			MLS	ALS		GM		wilt
		NAD	AKL	BHR	AKL	NAD	BHR	NAD	AKL	BHR
6221	NCS 5657	2	1	1	1	3	0	0	1	0
6222	GTHH 217	2	1	2	1	2	1	0	1	0
6223	CAHH-297	2	1	2	1	2	2	0	1	0
6224	ZC (Ankur 651)	2	2	1	1	2	2	0	1	0
6225	NHH 440	2	1	0	1	3	1	0	1	0
6226	Local Check	2	2	1	1	3	2	0	1	0
6227	ACH 151 (Ajeet Seeds)	2	1	1	1	2	1	0	1	0
6228	GTHH-215	2	1	1	1	3	2	0	1	0
6229	RAHH 630	2	1	2	1	3	0	0	1	
6230	NHH 719	2	1	3	1	3	2	0	1	
SC	LRA 5166(NAD)	3				3		1		
	LRA 5166(AKL)		3		1				1	
	LRA 5166 (BHR)			2			3			0
	1027 ALF (BHR)			0			0			0
	Digvijay (BHR)			0			0			0

Table 57: Br-06 b

Code	Entry	BLB (GRADE)		ALS/ALB	MLS	GM
		AKL	SRT	SRT	AKL	AKL
6241	ANGC 1452	1	2	1	1	1
6242	GISV -272	1	0	0	1	1
6243	ANGC 1451	1	0	0	1	1
6244	GSHV-180	1	0	2	1	1
6245	GTHV-13/32	1	0	1	1	1
6246	Local Check	1	0	0	1	1
6247	RAHC 1019	1	0	0	1	1
SC	LRA 5166 (AKL)	3			1	1
	G.Cot.20 (SRT)		2	1		
	LRA 5166 (SRT)		3	-		

Table 58: Br-24 b

Code	Entry	BLB (GRADE)		MLS	ALS	GM	
		AKL	JNG	AKL	JNG	AKL	JNG
6251	PA 785	1	1	1	2	1	—
6252	ZC (AKA 7)	1	0	1	2	1	—
6253	PA 801	1	1	1	2	1	—
6254	JLA-0906	1	0	1	2	1	—
6255	NDLA 3068	1	1	1	2	1	—
6256	GAM-235	1	1	1	2	1	—
6257	Local Check	1	1	1	2	1	—
6258	GAM-231	1	0	1	2	1	—
6259	JLA 0614	1	1	1	2	1	—
6260	PA 812	1	1	1	2	1	—
6261	CSA 1028	1	1	1	2	1	—
SC	AKA8 (AKL)	1		1		2	—
	LRA 5166 (JNG)		2		3		

Table 59: Br-25 b

Code	Entry	BLB (GRADE)		MLS	ALS	GM
		AKL	JNG	AKL	JNG	AKL
6271	GSGDH-521	1	1	1	2	1
6272	BDAA 011	1	0	1	2	1
6273	Local Check	1	1	1	2	1
6274	PKV DH 1 (ZC)	1	1	1	2	1
6275	AAH 37	1	1	1	2	1
SC	AKA8 (AKL)	1		1		2
	LRA 5166 (JNG)		2		3	

SOUTH ZONE TRIAL

Table 60: Br-03 a

Code	Entry	ALS	GM	Rust
		GUN	GUN	GUN
6501	BGDS 1033	3	1	1
6502	RAH 1069	3	1	0
6503	Local Check	3	1	0
6504	GSHV-173	2	1	1
6505	CPD-1501	2	0	0
6506	ZC (Suraj)	3	1	1
6507	BGDS 1055	2	1	0
6508	RB-602	3	1	1
6509	TCH 1716	3	1	1
6510	CCH 15-1	2	1	0
SC	RCH 2 BG II	1	1	2
	Jadoo BG II	3	3	2

Table 61: Br-04 a

Code	Entry	ALS	GM	Rust
		GUN	GUN	GUN
6511	Shakti Sultan (SSGR105)	2	1	1
6512	GJHV 497	3	1	0
6513	ZC (Suraj)	3	1	0
6514	GSHV 177	3	0	1
6515	Local Check	2	1	0
6516	CCH 14-1	3	1	0
SC	RCH 2 BG II	3	1	2
	Jadoo BG II	3	3	2

Table 62: Br-05 a

Code	Entry	ALS	GM	Rust
		GUN	GUN	GUN
6521	RAHH 690	3	1	1
6522	BGDHH 692	3	1	0
6523	RHH-1215	3	3	1
6524	Local Check	2	1	0
6525	BGDHH 693	2	1	0
6526	LAHH 25	2	1	0
6527	NCS 5657	3	1	0
6528	ARBHH-1601	3	1	1
6529	LAHH 29	2	1	1
6530	RAHH 691	3	1	0
6531	ZC (Bunny)	3	1	0
6532	ARBHH-1602	3	1	1
6533	GTHH-217	3	1	0
6534	MRC 7398 (Mahyco)	2	1	1
6535	LAHH 26	2	1	0
6536	BGDHH 697	3	1	0
6537	DHH-1601	3	1	1
6538	SHH 902	2	1	1
SC	RCH 2 BG II	3	1	2
	Jadoo BG II	3	3	2

Table 63: Br-06 a

Code	Entry	ALS	GM	Rust
		GUN	GUN	GUN
6541	RS 2814	3	1	0
6542	GTHV 13/32	3	1	0
6543	RAHC 1017	3	1	1
6544	DSC-1501	3	1	1
6545	Local Check	3	1	1
6546	RS 2821	3	0	0
6547	LHDP 1	3	0	0
6548	RAHC 1012	3	1	0
SC	RCH 2 BG II	3	1	2
	Jadoo BG II	3	3	2

Table 64: Br – 13 a PVT *G. barbadense*

Code	Entry	BLB	ALS			GM		Rust	
		DHW	DHW	GUN	CBE	DHW	GUN	DHW	GUN
6551	ARBB-1501	3	4	1	3	1	1	2	1
6552	CCB-11a	2	4	2	3	1	1	2	1
6553	DB-1501	1	4	2	3	1	1	2	2
6554	ARBB 1402	1	4	2	3	1	1	2	2
6555	ZC (Suvin)	1	4	2	3	1	1	1	1
6556	ARBB 1401	1	3	2	3	1	1	1	1
6557	CCB 29	2	4	2	3	1	1	2	1
6558	DB-1502	2	4	1	3	1	1	2	2
6559	ARBB-1502	2	4	1	3	1	1	2	1
SC	Jayadhar (DHW)	-	4			4		2	
	Abhadita (DHW)	3	4			1		3	
	RCH 2 BG II (GUN) & (CBE)			2	3		1		2
	Jadoo BG II (GUN)			3			3		2

Table 65: Br-15 a

Code	Entry	BLB	ALS			GM		Rust	
		DHW	DHW	GUN	CBE	DHW	GUN	DHW	GUN
6561	DHB 1012	1	4	2	3	1	1	2	0
6562	ZC (DCH 32)	2	4	2	3	1	1	2	1
6563	DHB-1501	1	4	2	3	1	1	2	0
6564	DHB 1009	1	4	2	3	1	1	2	0
6565	Local Check	2	4	-	3	1	-	2	-
6566	RHB-1008	1	4	2	3	1	1	2	0
6567	RHB 1122	1	4	2	3	1	1	2	0
6568	RHB-1243	1	4	2	3	1	1	1	0
SC	Jayadhar (DHW)	-	4			4		2	
	Abhadita (DHW)	3	4			1		3	
	RCH 2 BG II (GUN) + (CBE)			3	2		1		2
	Jadoo BG II (GUN)			3			3		2
(-) is missing									

Table 66: Br-03 b

Code	Entry	BLB	ALS	GM	Rust
		DHW	DHW	DHW	DHW
6571	NDLH - 2028-2	1	4	1	2
6572	BGDS 1033	1	4	1	2
6573	ZC (Sahana)	2	4	1	2
6574	AKH-09-5	1	4	1	2
6575	GBHV-195	2	4	1	2
6576	QC (Suraj)	2	4	1	2
6577	GTHV 13/17	2	4	1	2
6578	ARBH-1551	1	4	1	2
6579	GBHV 183	1	4	1	2
6580	Local Check	1	4	1	2
6581	SCS 1061	2	4	1	2
SC	Jayadhar (DHW)	-	4	4	2
	Abhadita (DHW)	3	4	1	3

Table 67: Br-05 b

Code	Entry	AB	BB	GM	Rust
		DWD	DWD	DWD	DWD
6601	GTHH-215	4	1	1	1
6602	Local Check	4	1	1	2
6603	DHH-1652	4	2	1	2
6604	ZC (Bunny)	4	1	1	2
6605	ACH-151	4	1	1	2
6606	BGDHH 692	4	1	1	1
6607	RAHH 630	4	1	1	2
6608	NCS 5657	4	1	1	1
6609	DHH-1651	4	1	1	1
6610	GTHH 217	4	1	1	2
6611	ARBHH-1651	4	1	1	2
6612	RAHH 690	4	1	1	1
6613	RAHH 691	4	1	1	1
6614	BGDHH 693	4	1	1	1
SC	Jayadhar (DHW)	4	-	4	2
	Abhadita (DHW)	4	3	1	3

Table 68: Br-06 b

Code	Entry	BLB	ALS	GM	Rust
		DHW	DHW	DHW	DHW
6621	GSHV-180	1	4	1	2
6622	ANGC 1452	3	4	1	2
6623	GTHV-13/32	1	4	1	2
6624	Local Check	2	4	1	2
6625	GISV -272	1	4	1	2
6626	LHDP 1	1	4	1	2
6627	ARBC 1551	2	4	1	2
6628	DSC-1351	2	4	1	2
6629	CCH 15-8	-	4	1	2
SC	Jayadhar (DHW)	-	4	4	2
	Abhadita (DHW)	3	4	1	3
Seeds were not germinated.					

Table 69: Br-24 b

Code	Entry	BLB	ALS	GM	Rust
		DHW	DHW	DHW	DHW
6631	AKA 2008-7	-	3	3	1
6632	DWDa-1501	-	3	4	1
6633	ZC (DLSa 17)	-	3	4	1
6634	PA 801	-	4	4	1
6635	GAM 219	-	3	3	1
6636	Local Check	-	3	4	1
6637	DWDa-1502	-	4	4	1
6638	ARBa-1501	-	4	4	1
6639	PA 812	-	3	4	1
6640	GAM-235	-	3	3	1
SC	Jayadhar (DHW)	-	4	4	2
	Abhadita (DHW)	3	4	1	3

Path.2(b). Confirmation and maintenance of disease resistant lines

NORTH ZONE

Table 70: Conformation and maintenance ofhirsutum entries at Faridkot (Punjab)

S.No	Entries	Cotton leaf curl disease (CLCuD)		Bacterial Blight (BB)		Fungal Foliar Leaf spots (FFLS)	
		PDI	Reaction	Mean Grade	Reaction	Mean Grade	Reaction
1	F2164	35.24	MS	2	MR	2	MR
2	H1471	33.15	MS	2	MR	2	MR
3	SSGR105	44.93	S	2	MR	2	MR
4	RS 2013	50.06	HS	2	MR	2	MR
5	LH 2076	58.98	HS	2	MR	2	MR
6	RS 2727	50.54	HS	2	MR	2	MR
7	CSH 2931	44.46	S	2	MR	2	MR
8	SU-FLUM	29.97	MR	1	R	1	R
9	TSH 0499	46.73	S	2	MR	2	MR
10	LH 2108	41.02	S	2	MR	2	MR
11	LH 2391	54.44	HS	2	MR	2	MR
12	Bihani-251	29.92	MR	1	R	1	R
13	LHH 144	50.92	HS	2	MR	2	MR
14	F 2501	39.67	MS	1	R	2	MR
15	RS 2711	35.09	MS	2	MR	2	MR
16	CSH 3232	43.09	S	2	MR	2	MR
17	RS 2765	37.71	MS	1	R	2	MR
18	P 5629	42.58	S	2	MR	2	MR
19	F 2228	52.25	HS	2	MR	2	MR
20	SCS1061	54.14	HS	2	MR	2	MR
21	MR 68	38.97	MS	1	R	1	R
22	LH 2376	37.37	MS	2	MR	2	MR
23	F 2296	47.28	S	2	MR	2	MR
24	F 2468	51.35	HS	2	MR	2	MR
25	RST9	65.73	HS	3	MS	3	MS

Table 71: Conformation and maintenance of Root Rot tolerant lines atSirsa.

Entry Name	Root Rot %Mortality	Disease Reaction (Root Rot)
A 7262	25.00	MS
AKALA 5615	19.57	MS
AOZN 111	25.76	S
AOZN 112	17.76	MS
AOZN- 80	14.29	MR
AOZN-40-167-103	34.21	S
B-B-1371	15.49	MR
DH 34	27.80	S
DL 1	9.77	MR
F 1861	17.31	MS
F-128	19.64	MS
GRS 6015	13.68	MR
H1117	30.95	S
SPA 243	21.64	MS
SV5 B	29.17	S
TEXAS-34	20.83	MS
CISA 310	21.03	MS
CISA 614	27.19	S
CSH 3075	21.88	MS
CSH 3129	25.00	MS

CENTRAL ZONE

Table 72: Confirmation and maintenance of Alternaria blightresistant breeding lines at Rahuri.

Sr. No.	Trial code	Entry	Disease Grade	Reaction
Central Zone Trial				
1	Br. 03 (a)	SCS 1061	1	R
2	Br. 04 (a)	BGDS 1063	2	MR
3	Br. 06 (a)	RAHC 1011	0	DF
4	Br. 13 (a)	ARBB 1402	1	R
5		ARBB 1401	1	R
6		CCB 29	2	MR
7	Br. 14 (a)	GSB 43	3	S
8		TCB 37	1	R
9	Br. 15 (a)	DHB 1301	1	R
10		ARBHB 1401	0	DF
National Trial				
11	Br. 02 (a)	ARBH 1502	2	MR
12		F 2532	1	R
13		GJHV 517	1	R
14		RAH 1271	1	R
15	Br. 05 (a)	BGDHH 632	2	MR
16		CSH 5038	3	S
17		TCH 1876	3	S
18		RAHC 1017	0	DF
19	Br.12 (a)	DB 1502	1	R
20		ARBB 1501	1	R
21	Br. 15 (a)	ARBHB 1502	2	MR
22		Ankur nandini	1	R
23		CCHB 64	2	MR
		LRA 5166	4	HS

Table 73: Br. 02 (b) Performance of different lines against bacterial blight (epiphytotic condition) (Akola)

Sr. No.	Name of varieties	Bacterial leaf blight	
		Grade	Reaction
	2015-16		
1	P-2151	1	R
2	ADB - 542	1	R
3	BS - 30	2	MR
4	BS - 79	2	MR
5	BGHV -180	2	MR
6	SCS - 793	2	MR
7	AKH- 8828	2	MR
	2016-17		
1	201	1	R
2	BS 40	1	R
3	BS30	1	R
4	BS 79	1	R
5	CPD 168	1	R
6	X -1353	1	R
7	AKH 8828	1	R

Table 74: Confirmation & maintenance of disease resistant lines at NAU, Surat (2016-17)

Sr. No.	Name of Entry	Bacterial blight			Alternaria leaf spot		
		Field reaction	Artificial reaction	Reaction	Fieldreaction	Artificial reaction	Reaction
Pr. Br. 02 (a) IET of *G. hirsutum* -Irrigated							
1	GSHH 2729	0.0	0.0	DF	0.0	0.0	DF
2	GSHV 162	0.0	0.0	DF	0.0	0.0	DF
3	GN Cot. 22	0.0	5.5	MR	0.0	0.0	DF
Pr. Br. 03 (a) PVT of *G. hirsutum*-Irrigated							
4	GSHV 172	0.0	0.0	DF	0.0	0.0	DF
5	GSHV 173	0.0	0.0	DF	0.0	0.0	DF
Pr. Br. 06 (b) Compact genotype							
6	GISV 272	0.0	2.5	MR	0.0	3.0	R
7	GSHV 180	0.0	10.0	MR	0.0	2.5	R
8	G.Cot.20, LC	0.0	3.0	MR	0.0	2.0	R
Pr. Br. 22 a/b IET- *G. arboreum*							
9	951	0.0	0.0	DF	0.0	0.0	DF
10	952	0.0	0.0	DF	0.0	0.0	DF
11	953	0.0	0.0	DF	0.0	0.0	DF
12	954	0.0	0.0	DF	0.0	0.0	DF
13	955	0.0	0.0	DF	0.0	0.0	DF
14	956	0.0	0.0	DF	0.0	0.0	DF
15	957	0.0	0.0	DF	0.0	0.0	DF
16	958	0.0	0.0	DF	0.0	0.0	DF
17	959	0.0	0.0	DF	0.0	0.0	DF
18	960	0.0	0.0	DF	0.0	0.0	DF
19	961	0.0	0.0	DF	0.0	0.0	DF
20	962	0.0	0.0	DF	0.0	0.0	DF
21	963	0.0	0.0	DF	0.0	0.0	DF
22	964	0.0	0.0	DF	0.0	0.0	DF
23	965	0.0	0.0	DF	0.0	0.0	DF
24	966	0.0	0.0	DF	0.0	0.0	DF
25	967	0.0	0.0	DF	0.0	0.0	DF
26	968	0.0	0.0	DF	0.0	0.0	DF
Pr. Br. 32 b IET of *G. herbaceum*							
27	881	0.0	0.0	DF	0.0	0.0	DF
28	882	0.0	0.0	DF	0.0	0.0	DF
29	883	0.0	0.0	DF	0.0	0.0	DF
30	884	0.0	0.0	DF	0.0	0.0	DF
31	885	0.0	0.0	DF	0.0	0.0	DF
32	886	0.0	0.0	DF	0.0	0.0	DF
33	887	0.0	0.0	DF	0.0	0.0	DF
34	888	0.0	0.0	DF	0.0	0.0	DF
35	889	0.0	0.0	DF	0.0	0.0	DF
36	890	0.0	0.0	DF	0.0	0.0	DF
37	891	0.0	0.0	DF	0.0	0.0	DF
38	892	0.0	0.0	DF	0.0	0.0	DF
39	893	0.0	0.0	DF	0.0	0.0	DF
40	894	0.0	0.0	DF	0.0	0.0	DF
41	895	0.0	0.0	DF	0.0	0.0	DF
42	896	0.0	0.0	DF	0.0	0.0	DF
43	897	0.0	0.0	DF	0.0	0.0	DF
44	898	0.0	0.0	DF	0.0	0.0	DF
	LRA 5166 (SC)	20.0	3	MS	0.0	0.0	DF

SOUTH ZONE

Table 75: Confirmation and maintenance of disease resistant lines at Dharwad

Sl. No	Genotypes	Foliar Diseases Grades (0 to 4 Scale)			
		AB	BB	GM	Rust
1	DB-14	2	2	1	2
2	SVA-1118	1	0	0	0
3	GSB-41	4	3	1	2
4	DB-40	2	2	1	2
5	DB-16	3	3	1	2
6	ZC-(Suvin)	4	4	1	2
7	SCS-1206	3	3	1	1
8	RHB-1005	4	4	1	2
9	DB-1302	3	3	1	2
10	GSHB-989	3	4	1	1
11	RG-778	1	0	4	1
12	CISA-123	2	0	4	1
13	HD-524	1	0	4	2
14	JLA-0906	2	0	4	1
15	ARBB-1501	2	2	1	2
16	NDLA-3094	2	0	3	1
17	DB-1501	3	3	1	2
18	DB-1502	3	2	1	2
19	BGDS-1033	4	2	1	2
20	CCH-15-4	4	2	1	2
	Jayadhar	4	-	4	2
	Abhadita	4	3	1	3

Table 76: Reaction of chosen lines to grey mildew, Alternaria leaf spot and rust at RARS, Lam, Guntur during 2016-2017

Variety	Disease Grade (0-4 Scale)		
	Grey mildew	Alternaria Leaf Spot	Rust
L 799	0	1	2
TCM 1716	1	3	2
DB 1502	1	3	1
ARBD 27	1	2	2
GSB 44	1	2	2
GSB 43	1	2	2
Jadoo	3	3	2
RCH 2 BG II	1	2	2

Table 77. Confirmation and maintenance of disease resistant lines at Coimbatore

S. No.	Entries	*Alternaria* Leaf spot	Boll rot	Root rot	Sooty mould	Bacterial Leaf Blight
1.	5513	+	-	-	-	-
2.	5521	+	+	-	+	-
3.	4516	+	-	-	-	-
4.	5548	+	-	-	-	-
5.	5543	+	-	-	-	-
6.	5517	+	-	-	-	-
7.	**710**	**-**	**-**	**-**	**-**	**-**
8.	613	+	-	-	-	-
9.	506	**+**	-	-	-	-
10.	535	+	-	-	-	-
11.	504	+	-	-	-	-
12.	**526**	**-**	**-**	**-**	**-**	**-**
13.	625	+	-	-	-	-
14.	624	+	-	-	-	-
15.	4506	+	-	-	-	-
16.	518	+	-	+	-	-
17.	530	+	-	+	-	-
18.	**RCHBGII**	**+**	**+**	**-**	**+**	**+**
+ Disease incidence			**- No disease incidence**			

Path. 2 (c) Monitoring of breakdown of resistance against CLCuD in cotton.

NORTH ZONE

Table 78. Monitoring of breakdown of resistance against CLCuD in North Zone.

	BTH		SRG		HSR	
	Disease Reaction	PDI	Disease Reaction	PDI	Disease Reaction	PDI
Tolerant variety						
F 2228	HS	54.35	MR	28.71	S	46.64
CSH 3129	MS	39.86	MS	33.84	S	41.64
H 1098(i)	HS	57.67	MR	29.01	MS	39.98
Susceptible variety						
HS 6	HS	66.29	HS	72.95	S	49.98
*F 846	HS	100	HS	72.48	S	40.36
RST 9	HS	68.92	HS	77.33	S	43.31
Hybrid						
BIO 2113 (tolerant)	MS	36.99	MR	21.84	MS	33.32
BIO 6317 (Susceptible)	S	58.07	HS	54.57	MS	38.31

Path 3 a3. Evaluation of TrichoCASH (Trichoderma harzianum) CICR-G 1% WP for cotton root diseases.

CENTRAL ZONE

Table 79: Effect of TrichoCASH on fusarium wilt of cotton (Pune)

Sr. No.	Name of fungicide/ Bio control Agent	Dose to be used for seed dressing g/ Kg or Lit	Wilt incidence (%) after 45 days	Disease control (%)
1	Control(No ST)	0	100.00	0.00
2	TrichoCASH	5	81.48	18.52
3	TrichoCASH	10	71.85	28.85
4	Thiram	3	**53.33**[a]	**46.67**
5	TrichoCASH)+Thiram	5+3	**50.83**[a]	**49.17**
6	TrichoCASH)+Thiram	10+3	**50.37**[a]	**49.63**
7	Phule Tricho	5	73.33	26.67
8	Phule Tricho	10	75.93	24.07
9	TrichoCASH)+Drenching of TrichoCASH at30DAS	5+5	74.07	25.93
10	TrichoCASH)+ Drenching of TrichoCASH at 30DAS	10+10	72.59	27.41
			S.E. (+)	3.17
			CD (5%)	9.36

Path.3 (c). Developing IDM modules for the management of cotton diseases.

CENTRAL ZONE (Nanded, Akola, Surat, Junagarh, Khandwa)

Table 80: Details of Treatments

Treatment	
T1 : Module 1	ST – *Trichoderma viride* (TV-TNAU) @ 10 g/ kg of seed + SA @ 2.5 kg developed in 250 kg FYM or vermicompost/ ha and foliar spray with *T. viride* @ 1%.
T2 : Module 2	ST – *Bacillus subtilis* (BSC5-TNAU) @ 10 g/ kg of seed + SA @ 2.5 kg developed in 250 kg FYM or vermicompost/ ha and foliar spray with *B. subtilis* @ 1%.
T3 : Module 3	ST – *Pseudomonas fluorescens* (PF-TNAU) + SA @ 2.5 kg developed in 250 kg FYM or vermicompost/ ha and foliar spray with *P. fluorescens* @ 1%.
T4 : Module 4	ST – PF CICR @ 10 g/ kg of seed + Soil Application – *Pseudomonas fluorescens* - PF CICR @ 2.5 kg/ ha in 250 kg of Compost or FYM and foliar spray with *Pseudomonas fluorescens* 1 % – PF.
T5 : Module 5	ST – PF CICR @ 10g / kg of seed + Soil Application of *Trichoderma viride* @ 2.5 kg/ ha TV-TNAU1 FS with Propiconazole 0.1 % for fungal diseases and COC (0.3 %) + Streptocycline (0.01 %) for BLB or Carbendazim 0.1 % for grey mildew on need basis.
T6 : Module 6	ST - PF CICR @ 10 g/ kg of seed + Soil Application of *Trichoderma viride* @ 2.5 kg/ ha TV- TNAU1 in 250 kg of Compost or FYM and foliar spray with Kresoxim methyl (ergon) @ 1 ml/ litre followed by Captan + Hexaconazole @ 1.5 g/ litre for fungal diseases or COC (0.3 %) + Streptocycline (0.01 %) for BLB.
T7: Control	Control

Table 81: IDM modules for the management of bacterial blight and seed cotton yield in different treatments at Akola

Treatment	Germination (%)	*Plant height (cm)	*Root length (cm)	Days to Flowering	*Boll no.	PDI	PDC	Yield Q/ha
T_1	97.35	67.33	39.05	42	20.06	6.43 (2.53)*	37.96	7.65
T_2	98.0	65.06	38.08	42	20.03	6.74 (2.59)	32.54	8.63
T_3	98.89	69.80	39.36	38	21.04	6.64 (2.57)	33.96	8.80
T_4	95.42	64.32	38.22	45	19.06	6.06 (2.62)	29.06	8.03
T_5	95.03	66.66	38.65	39	19.04	6.74 (2.45)	45.90	9.24
T_6	97.30	68.00	39.81	40	20.3	5.98 (2.42)	49.04	9.91
Control	94.09	64.01	36.36	38	16.03	8.49 (2.91)		6.92
S.E ± C.D at 5%						0.092 0.270		0.30 0.94
Figures in parenthesis are square root transformed								

Table 82: IDM modules for the management of cotton diseases at Junagarh (2016-17).

Module	Treatment	Alternaria leaf spot PDI	Bacterial leaf blight PDI	Mortality per cent	Seed cotton Yield Kg/ha
T_1	**ST:** *Trichoderma viride* (TV-TNAU) @10g/kg seed; **SA:** of *T.viride* (TV-TNAU) @2.5kg/ha; **FS:** with *T.viride* (TV-TNAU) @1%	3.24 # (10.48)	1.73 (2.98)	2.92 (8.51)	1910
T_2	**ST:** *Bacillus subtilis* (BSC5-TNAU) @ 10g/kg seed; SA: of *B. subtilis* (BSC5-TNAU) @2.5kg/ha; **FS:** with *B.subtilis* (BSC5-TNAU) @1%	3.38 (11.42)	1.66 (2.77)	3.11 (9.69)	1887
T_3	**ST:***Pseudomonas fluorescens*(PF-TNAU) @10g/kg seed; **SA:** of *P. fluorescens* (PF-TNAU) @2.5Kg/ha; **FS:** with *P. fluorescens* @ 1%	3.85 (14.80)	1.63 (2.66)	3.20 (10.22)	1914
T_4	**ST:***Pseudomonas fluorescens* (PF-CICR) @10g/kg seed; **SA:** of *P.fluorescens*(PF-CICR) @ 2.5 Kg/ha in 250kg of FYM ; **FS:** with *P.fluorescens* (PF-CICR) @ 1%	4.11 (16.92)	1.96 (3.83)	3.15 (9.94)	1886
T_5	**ST:***Pseudomonas fluorescens* (PF-CICR) @10g/kg seed ;**SA:** of *T.viride* (TV-TNAU) @2.5Kg/ha; **S:** with Propiconazole0.1% and COC (0.3%) + Streptocycline (0.01%) for BLB or Carbendazim 0.1% for GM on need basis.	3.12 (9.73)	1.40 (1.97)	2.77 (7.69)	2001
T_6	**ST:** *Pseudomonas fluorescens* (PF-CICR)@ 10g/kg seed; **SA:** of *T.viride* (TV-TNAU) @2.5Kg/ha in 250kg of FYM ; **FS:** with Ergon@ 1ml/lit followed by Taqat @1.5g/lit for fungal diseases or COC (0.3%)+ Streptocycline (0.01%) for BLB	3.05 (9.28)	1.51 (2.28)	2.40 (5.78)	2230
T_7	**ST:***Pseudomonas fluorescens* (PF-JAU) @10g/kg seed; **SA**: of *T.harzianum* (TH-JAU) @2.5 kg/ha in 250 kg of FYM; **FS**: with *Pseudomonas fluorescens* (PF-JAU) 1% for ALS and COC (0.2%) + Streptocycline (0.01%) for BLB on need basis.	**2.86 (8.16)**	**1.17 (1.37)**	**2.11 (4.45)**	**2442**
T_8	**ST:** Carboxin 37.5 % +Thiram 37.5 % DS @3.5 g/ kg of seed; **SA**: Nil; **FS**: (**1)**Captan70% + Hexaconazole 5 % WP 2.0 g/ lit (**2)** COC(0.2%) + Streptocycline (0.01%) **(3)** Carbendazim 12%+ Mancozeb 63% WP 2.5 g/ lit on need basis	3.11 (9.65)	1.57 (2.48)	2.74 (7.49)	1993
T_9	Control	4.38 (19.18)	2.15 (4.64)	3.75 (14.04)	1583
S.Em.±		**0.18**	**0.14**	**0.17**	**96.60**
C.D. at 5%		**0.54**	**0.42**	**0.50**	**290**
C. V. %		**8.98**	**14.94**	**9.97**	**8.44**

#Transformed square root values, Numerals in parenthesis are retransformed value

Table 82a: Germination percentage, days taken for first flowering and plant height in IDM Modules (2016-17).

Sr. No.	Treatment	Germination per cent (Mean)	Plant Height(cm) (Mean)	Days taken for First flowering
T_1	**ST:** *Trichoderma viride* (TV-TNAU)@10g/kg seed; **SA:** of *T. viride* (TV-TNAU) @2.5kg/ha; **FS:** with *T. viride* (TV-TNAU) @1%	92.67	91.67	59
T_2	**ST:** *Bacillus subtilis* (BSC5-TNAU) @ 10g/kg seed; SA: of B. subtilis (BSC5-TNAU) @2.5kg/ha; **FS:** with *B .subtilis* (BSC5-TNAU) @1%	92.33	90.33	59
T_3	**ST:***Pseudomonas fluorescens* (PF-TNAU@10g/kg seed; **SA:** of *P. fluorescens* (PF-TNAU) @2.5Kg/ha; **FS:** with *P. fluorescens* @ 1%	91.00	89.20	57
T_4	**ST:***Pseudomonas fluorescens* (PF-CICR) @10g/kg seed; **SA:** of *P. fluorescens*(PF-CICR) @ 2.5Kg/ha in 250kg of FYM ; **FS:** with *P. fluorescens*(PF-CICR) @ 1%	92.67	89.67	57
T_5	**ST:***Pseudomonas fluorescens* (PF-CICR) @10g/kg seed **SA:** of *T. viride* (TV-TNAU) @2.5Kg/ha; **FS:** with Propiconazole0.1% and COC (0.3%) + Streptocycline (0.01%) for BLB or Carbendazim 0.1% for GM on need basis.	93.67	92.00	57
T_6	**ST:** *Pseudomonas fluorescens*(PF-CICR)@ 10g/kg seed; **SA:** of *T. viride* (TV-TNAU) @2.5Kg/ha in 250kg of FYM ; **FS:** with Ergon @ 1ml/lit followed by Taqat @1.5g/lit for fungal diseases or COC (0.3%)+ Streptocycline(0.01%) for BLB	94.67	94.93	57
T_7	**ST:***Pseudomonas fluorescens* (PF-JAU) @10g/kg seed; **SA**: of *T.harzianum* (TH-JAU) @2.5 kg/ha in 250 kg of FYM; **FS**: with *Pseudomonas fluorescens* (PF-JAU) 1% for ALS and COC (0.2%) + Streptocycline (0.01%) for BLB on need basis.	95.00	94.93	56
T_8	**ST:** Carboxin 37.5 % +Thiram 37.5 % DS @3.5 g/ kg of seed; **SA**: Nil; **FS**: **(1)** Captan70% + Hexaconazole 5 % WP 2.0 g/ lit **(2)** COC(0.2%) + Streptocycline (0.01%) **(3)** Carbendazim12% + Mancozeb 63 % WP 2.5 g/ lit On need basis	93.33	91.93	58
T_9	Control	89.33	87.53	60

Note: The Bacterial leaf spot & anthracnose were not observed up to one month

Table 83. IDM modules for the management of Cotton Diseases at Nanded

Treatment	Blb (PDI)	Alternaria (PDI)	Grey mildew (PDI)	Wilt / R.R (PDI)	Flowering days	Plant Height (cm)	SCY (q/ha)
T1	13.68	16.25	0.00	0.00	60.00	154.67	15.50
T2	15.03	17.02	0.00	0.00	61.33	141.67	16.00
T3	11.23	12.00	0.00	0.00	59.33	157.00	17.16
T4	14.95	17.36	0.00	0.00	60.33	141.33	15.15
T5	16.03	15.43	0.00	0.00	62.00	140.00	16.86
T6	8.64	10.40	0.00	0.00	59.00	165.00	18.66
T7	19.80	21.69	0.00	0.00	63.33	131.67	14.26
SC±	0.42	0.22	0.00	0.00	0.23	1.00	0.38
CD at 5%	1.29	0.68	0.00	0.00	0.72	3.07	1.19
CV (%)	5.13	2.46	0.00	0.00	0.67	1.17	4.13

Table 84: IDM modules for the management of (BLB) and (ALS) & Seed cotton yield at Surat

Sr. No.	BLB (PDI)	Alternaria leaf spot (PDI)	Seed cotton yield (Kg/ha)
T_1	12.50 (20.60)*	6.50 (14.58)*	2118.67
T_2	10.50 (18.79)	8.00 (16.23)	2048.33
T_3	15.50 (23.11)	9.00 (17.16)	1915.00
T_4	13.50 (21.42)	5.50 (13.22)	2311.00
T_5	8.50 (16.82)	4.50 (11.98)	2430.67
T_6	6.50 (14.67)	2.50 (8.78)	2690.00
T_7	18.50 (25.41)	10.50 (18.76)	1710.00
S.Em. ±	1.37	1.86	131.35
C. D. at 5 %	4.23	5.73	404.75
C.V. %	11.82	22.38	10.46
Y X T	*	*	*
*Figure in the parenthesis Arc sin transformed values and those outside are original values.			

Table 85: Developing IDM Modules for the management of cotton diseases at Khandwa

Treatment	Grey mildew %	Bacterial Blight %	Myrotheciu m %	Grey mildew %	Bacterial Blight %	Myrotheciu m %
	PDI after 110 DAS.			PDI after 140 DAS.		
T1 : Module 1	19.33 (25.96)	22.33 (22.47)	14.33(22.15)	23.33 (28.85)	31.66(34.24)	24.00(29.30)
T2 : Module 2	14.33 (22.15)	17.33 (24.57)	18.67(25.25)	19.67 (26.24)	29.33(32.79)	29.67(32.98)
T3 : Module 3	7.67 (15.99)	17.67 (24.70)	15.67(23.27)	12.33 (20.50)	27.66(31.72)	22.67(28.40)
T4 : Module 4	7.33 (15.66)	11.33 (19.47)	13.33 (21.27)	10.33 (18.67)	22.33(28.17)	27.00(31.25)
T5 : Module 5	3.33 (10.34)	8.33(16.69)	7.33(15.66)	5.33(13.27)	15.66(23.24)	12.67(20.82)
T6 : Module 6	4.33 (11.90)	11.67 (19.87)	7.67(16.02)	7.67 (16.02)	19.66(26.27)	14.67(22.50)
T7 Control	28.67 (32.32)	31.67 (34.17)	34.33(35.84)	39.67 (39.03)	48.66(44.23)	51.00(45.58)
SE(m) =	**0.91**	**1.24**	**0.81**	**0.72**	**0.68**	**0.62**
CD(5%) =	**2.79**	**3.82**	**2.51**	**2.22**	**2.11**	**1.92**
CV=	**14.18**	**16.07**	**10.70**	**9.32**	**6.51**	**6.21**

Table 85a: Developing IDM Modules for the management of cotton diseases at Khandwa

S.N.	Treatment	Germination %	Yield (kg/ha)
1	T1 : Module 1	93.75 (75.70)	926.67
2	T2 : Module 2	96.35 (81.02)	1085.07
3	T3 : Module 3	97.4 (82.45)	1090.09
4	T4 : Module 4	96.35 (79.75)	1253.09
5	T5 : Module 5	97.4 (80.82)	1332.00
6	T6 : Module 6	95.31 (78.00)	1251.00
7	T7 Control	93.75 (75.61)	816.67
	SE(m) =	1.29	32.03
	CD(5%) =	3.98	98.71
	CV=	4.91	8.68

Table 85b: Developing IDM Modules for the management of cotton diseases at Khandwa

S.N.	Treatment	Plant Height (cm) 50 Days	Plant Height (cm) 80 Days	Plant Height (cm) 110 Days
1	T1 : Module 1	58.89	76.33	92.67
2	T2 : Module 2	51.44	77.33	96.33
3	T3 : Module 3	54.33	78.00	105.33
4	T4 : Module 4	66.44	83.00	109.67
5	T5 : Module 5	76.11	93.67	118.00
6	T6 : Module 6	62.44	81.33	114.33
7	T7 Control	44.11	71.33	84.00
	SE(m) =	2.88	3.66	5.17
	CD(5%) =	8.88	11.29	15.93
	CV=	14.62	13.71	15.07

SOUTH ZONE

Table 86: Path -3 (c) Developing IDM Modules for the management of cotton diseases 2016-17 (Bunny Bt) (Dharwad)

Sl. No	Treatments	Seedling mortality (%)	AB PDI	Rust PDI	Yield (kg/ha)
			120 DAS**	120 DAS**	
T_1	*Trichoderma viride* (TV-TNAU) @ 10g/kg Seed Soil application @ 2.5 kg/ha foliar spray with *T. viride* @1%	25.00 (29.98)	24.60 (29.75)	11.90 (20.16)	2023.46
T_2	*Bacillus Subtills* (BSC5-TNAU) @ 10g/kg Seed Soil application @ 2.5 kg/ha foliar spray with *B. Subtills* @1%	26.10 (30.75)	24.80 (29.89)	10.20 (18.67)	2000.77
T_3	*Pseudomonas fluorescens* (PF-TNAU) Soil application @ 2.5 kg/ha foliar spray with *P. fluorescens* @1%	24.70 (29.86)	23.90 (29.30)	11.10 (19.49)	2199.85
T_4	Seed Treatment *Pseudomonas fluorescens* (PF-CICR) @ 10g/kg of seed Soil application *Pseudomonas fluorescens* (PF-CICR) @ @ 2.5 kg/ha in 250 kg of Compost or FYM foliar spray with *P. fluorescens* @ 1%(PF-CICR)	21.00 (27.24)	23.80 (29.17)	08.80 (17.28)	2231.64
T_5	*Trichoderma viride* (TV-TNAU) @ 10g/kg of seed Soil application of *Trichoderma viride* @ 2.5 kg/ha(TV-TNAU) foliar spray with Propiconazole 0.1% for foliar diseases and COC 0.3% + Streptocycline 0.01% for BLB or Carbendazim 0.1% for grey mildew on need basis.	22.20 (28.08)	24.40 (29.63)	11.50 (19.85)	2155.71
T_6	*Pseudomonas fluorescens* (PF-CICR) @ 10g/kg of seed Soil application of *Trichoderma viride* @ 2.5 kg/ha(TV-TNAU) in 250kg of Compost or FYM foliar spray with Ergon @ 1ml/lit followed by Taqat @ 1.5g/lit for Fungal diseases or COC 0.3% + Streptocycline 0.01% for BLB	24.60 (29.71)	23.70 (29.13)	08.20 (16.63)	2238.89
T_7	Seed Treatment*Trichoderma viride* (UASD)10g/kg of seed	20.00 (26.59)	25.90 (30.59)	10.70 (19.11)	2009.30
T_8	Seed Treatment *Pseudomonas fluorescens* (UASD)10g/kg of seed	24.30 (29.54)	26.10 (30.73)	11.30 (19.65)	2031.79
T_9	Untreated control	27.40 (31.55)	36.30 (37.05)	16.40 (23.92)	1971.30
	SEm±	**0.36**	**0.58**	**0.68**	**124.416**
	CD at 5%	**1.08**	**1.754**	**2.027**	**372.999**

Path 3 (e). Innovative interventions for the management of CLCuD.

NORTH ZONE

Table 87: Innovative interventions for the management of CLCuD in North Zone

		CLCuD (PDI)					
No.	**Treatments**	**FDK**	**BHT**	**HSR**	**SRS**	**SNG**	**Avg.**
1	Butter Milk @ 5%	54	76.98	49.98	45.15	27.3	50.68
2	Cow Urine @ 6.6%	61.25	76.35	46.64	47.43	27.2	51.77
3	Neem Oil @ 1%	55.5	74.38	47.48	47.97	25.8	50.22
4	Mustard Oil @ 3%	61.58	74.38	47.48	47.31	26.2	51.39
5	Calcium Nitrate @ 0.5%	55.5	72.81	49.14	46.36	25.4	49.84
6	Cow Urine + Calcium Nitrate	64.5	67.6	49.98	45.66	27.6	51.06
7	Cow Urine + Butter Milk	61.25	76.15	49.14	45.51	28	52.01
8	Butter Milk+ Calcium Nitrate	62.08	69.48	49.98	47.06	26.9	51.1
9	Lachesis 30 @ 0.1%	56.08	77.29	33.32	46.15	25.8	47.72
10	Digitalis 30 @ 0.1%	69.33	73.02	49.98	46.98	28.5)	53.56
11	Apis Mallifera 30 @ 0.1%	62.67	62.81	37.48	47.31	27.1	47.47
12	Bryonia 30 @ 0.1%	68.5	69.69	48.31	45.45	25.7	51.53
13	Natrum Mure 30 @ 0.1%	66.33	68.02	37.48	46.57	27.1	49.1
14	Polo @ 0.1% @ 0.1%	55	63.13	44.98	47.07	28.6	47.75
15	Salicyclic Acid @200ppm (single spray)	71.08	58.02	49.98	46.82	28.8	50.94
16	Control (Unsprayed)	73.58	100	49.98	50.97	29.7	60.84
	CD at 5 %	NS	16.35	0.774	N/A	1.9	
	CV	6.63	12.74	—	2.52	—	

Table 87a: Yield in Innovative interventions for the management of CLCuD in North Zone

	Yield (q/ha)					
Treatments	**FDK**	**BHT**	**HSR**	**SRS**	**SNG**	**Avg.**
Butter Milk @ 5%	27.89	41.37	34.63	31.89	24.28	32.01
Cow Urine @ 6.6%	25.15	39.32	32.4	29.34	23.64	29.97
Neem Oil @ 1%	32.92	36.93	38.92	28.06	24.23	32.21
Mustard Oil @ 3%	31.77	37.37	42.18	29.39	25.72	33.28
Calcium Nitrate @ 0.5%	35.43	41.78	31.03	29.07	23.87	32.23
Cow Urine + Calcium Nitrate (6.6%+0.5%)	34.06	44.38	36	35.77	24.2	34.88
Cow Urine + Butter Milk (6.6%+5%)	36.45	38.19	36.34	27.72	24.39	32.61
Butter Milk+ Calcium Nitrate (5%+0.5%)	29.94	38.08	34.8	26.54	27.16	31.30
Lachesis 30 @ 0.1%	16.68	33.04	36.51	31.17	27.55	28.99
Digitalis 30 @ 0.1%	38.18	36.71	37.71	30.96	23.46	33.40
Apis Mallifera 30 @ 0.1%	34.29	41.92	31.37	34.13	27.44	33.83
Bryonia 30 @ 0.1%	35.43	37.75	34.46	28.94	27.37	32.79
Natrum Mure 30 @ 0.1%	38.4	38.74	34.63	27.12	24.28	32.63
Difenthiuron @ 0.1% @ 0.1%	29.94	31.1	32.06	29.67	25.66	29.68
Salicyclic Acid@200ppm (single spray)	32.23	38.68	33.09	32.7	25.1	32.36
Control (Unsprayed)	26.97	30.68	38.92	28.55	23.19	29.66
CD at 5 %	N/A	N/A		N/A	2.5	
CV	9.1	14.904		4.54	—	

Table 87b: Whitefly (per three leaves) in Innovative interventions for the management of CLCuD in North Zone

Treatment	Population of Whitefly/ 3 leaves and reduction (%)														
	Sirsa			Hisar			Sriganganagar			Faridkot			Bathinda		
	Pre	7 DAS	R (%)	Pre	7 DAS	R (%)	Pre	7 DAS	R (%)	Pre	7 DAS	R (%)	Pre	7 DAS	R (%)
T1: Butter milk	10.47	9.60	8.28	11.62	14.71	-26.59	7.78	5.74	26.22	12.17	9.73	20.00	7.85	7.45	5.10
T2: Desi cow urine @6.6 %	10.70	9.87	7.79	12.63	14.02	-11.01	7.86	5.34	32.06	12.70	10.00	21.26	7.80	7.95	-1.92
T3: neem oil @ 1 %	12.03	8.07	32.96	12.44	14.00	-12.54	6.92	3.41	50.72	7.53	6.13	18.58	8.45	3.45	59.17
T4: mustard oil @ 3 %	10.37	7.90	23.79	12.51	14.20	-13.51	8.06	5.38	33.25	12.70	9.57	24.67	9.75	8.95	8.21
T5: Fertilizer (calcium nitrate) @ 0.5 %	12.00	10.40	13.33	12.35	14.53	-17.65	7.62	5.69	25.33	12.57	10.37	17.51	8.90	9.25	-3.93
T6: cow urine + calcium nitrate (6.6%+0.5%)	11.27	8.30	26.33	12.33	14.59	-18.33	8.16	4.78	41.42	12.47	10.03	19.52	8.90	9.20	-3.37
T7: cow urine + butter milk(6.6%+5%)	13.13	10.93	16.75	12.93	14.98	-15.85	7.92	5.12	35.35	13.47	9.83	26.98	10.95	10.25	6.39
T8: butter milk + calcium nitrate(5%+0.5%)	11.13	9.17	17.66	12.62	15.51	-22.90	7.94	5.00	37.03	12.90	9.63	25.32	10.40	10.55	-1.44
T9: lachesis 30 @ 1ml/ litre	11.50	8.93	22.32	12.25	14.38	-17.39	7.72	4.78	38.08	13.33	10.10	24.25	11.45	10.85	5.24
T10: Digitalis 30 @ 1ml /litre	12.40	9.47	23.66	11.81	14.06	-19.05	7.94	4.94	37.78	13.83	10.27	25.78	11.20	11.35	-1.34
T11: Apis mallifera 30 @1ml/litre	10.83	8.37	22.77	13.20	14.38	-8.94	8.18	5.44	33.50	13.70	10.33	24.57	10.10	10.70	-5.94
T12: Bryonia 30 @1ml/litre	12.47	10.43	16.31	12.61	14.32	-13.56	7.9	5.74	27.34	13.17	10.03	23.80	8.45	9.55	-13.02
T13: Natrum Mure @ 1ml/litre	14.47	12.60	12.90	13.07	14.68	-12.32	8.64	5.86	32.18	13.63	10.03	26.41	10.40	10.60	-1.92
T14: Difenthiuron @ 0.1 %	13.30	5.40	59.40	13.13	14.98	-14.09	6.54	2.26	65.44	4.97	2.87	42.28	9.95	4.40	55.78
T15: Jasmonic acid @ 200ppm at only 30DAS	13.20	11.57	12.37	12.70	15.49	-21.97	9.98	10.88	-9.02	13.80	10.00	27.54	11.20	6.65	40.63
T16: unsprayed control	13.60	13.70	-0.74	13.03	16.10	-23.56	9.34	8.48	9.21	13.93	10.17	27.03	11.70	18.45	-57.69

*** Sirsa- Data based on five sprays, Hisar-Data based on five sprays, Sriganganagar-Data based on five sprays, Faridkot-Data based on three sprays, Bathinda- Data based on two sprays**

Path.4(e). Crop loss estimation due to CLCuD and distribution pattern of CLCuD in north zone.

Expt.1.To work out relationship between disease index and yield reduction due to CLCuD.

NORTH ZONE

Table 88: Seed cotton yield (%) reduction disease grade wise in different Bt hybrids in North Zone.

	Bioseed 6588 BGII				RCH650 BGII				Ankur 3028 BGII				MRC 7017 BGII			
Grades	**HSR**	**FDK**	**SGR**	**Avg.**	**HSR**	**FDK**	**SGR**	**Avg.**	**HSR**	**FDK**	**SGR**	**Avg.**	**HSR**	**FDK**	**SGR**	**Avg.**
1	-	4.15	-	**4.15**	-	5.15	-	**5.15**	-	3.40	-	**3.40**	-	4.00	-	**4.00**
2	-	21.31	7.44	**14.38**	-	10.30	6.84	**8.57**	-	20.17	-	**20.17**	-	9.78	-	**9.78**
3	24.77	24.82	21.56	**23.71**	18.29	21.57	26.49	**22.11**	29.68	25.09	4.4	**19.72**	29.95	21.25	13.61	**21.60**
4	46.3	30.94	31.65	**36.29**	40.47	34.34	35.83	**36.87**	48.95	28.67	28.88	**35.50**	50.94	28.98	39.47	**39.79**
5	38.94	37.06	-	**38.00**	54.75	40.74	-	**47.75**	78.03	32.19	40.4	**50.20**	67.97	35.80	55	**52.92**
6	-	51.48	-	**51.48**	-	48.02	-	**48.02**	-	47.26	-	**47.26**	-	46.34	-	**46.34**
Mixed	36.7	28.29	20.2	**28.40**	37.83	26.69	23.1	**29.21**	52.22	26.13	24.5	**34.28**	49.62	24.36	36	**36.66**

Table 89: Path.4(e). Expt.2. Study on distribution pattern of cotton leaf curl virus disease on local popular Bt hybrid at farmer'sin Punjab, Rajasthan and Haryana field.

Punjab		Rajasthan		Haryana	
Districts	**Mean PDI**	**Districts**	**Mean PDI**	**Districts**	**Mean PDI**
Faridkot	48.1	Sriganganagar	10.2	Sirsa	1.74
Fazilka	49.96	Hanumangarh	5.3	Fatehabad	3.4
Muktsar	42.28			Hisar	7.77
Bathinda	20.3			Jind	2.33
Mansa	8.67			Bhiwani	4.08
				Rohtak	4.55
				Sonipat	4
				Mohindergarh	3.75
				Palwal	4
				Jhajjar	6.5

Path.4 (e). Expt. 3. Study of CLCuD progress and yield estimation (Sirsa)

NORTH ZONE

Table 90: Incidence (%) of CLCuD in different Bt hybrids

Hybrid			50DAS	65DAS	80DAS	95DAS	110DAS	125DAS	140DAS
YUVA-841-2BGI	Tolerant	2015	0	0.18	0.35	1.23	1.58	2.98	4.2
		2016	0	0	4.61	6.46	9.41	14.58	14.58
		Avg.	0	0.09	2.48	3.845	5.495	8.78	9.39
BUNTY 2113-2	Tolerant	2015	0	1.72	1.03	6.02	8.09	9.12	14.11
		2016	0	0	13.37	21.53	24.01	33.91	39.8
		Avg.	0	0.86	7.2	13.775	16.05	21.515	26.955
ANKUR JAI Bt	S	2015	2.08	15.47	16.98	22.08	26.6	42.08	48.68
		2016	0	15.22	92.17	99.57	99.57	100	100
		Avg.	1.04	15.345	54.58	60.825	63.085	71.04	74.34
		2015	3.96	7	22.68	30.44	43.53	56.62	57.08
Ankur 3028 II	S	2016	0	19.44	85.07	94.09	98.6	100	100
		Avg.	1.98	13.22	53.9	62.27	71.07	78.31	78.54

Table 90a: PDI of CLCuD in different Bt hybrids

Hybrid			80DAS*	110DAS	140DAS
YUVA-841-2BGI	Tolerant	2015	0.01	1.3	1.4
		2016	0.8	2.03	5.84
		Avg.	**0.405**	**1.665**	**3.62**
BUNTY 2113-2	Tolerant	2015	0.6	4.2	4.8
		2016	2.27	4.58	12.67
		Avg.	**1.435**	**4.39**	**8.735**
ANKUR JAI Bt	S	2015	5.4	11.2	22.7
		2016	17.54	28.55	64.34
		Avg.	**11.47**	**19.875**	**43.52**
Ankur 3028 II	S	2015	9	24.4	30.9
		2016	20.61	18.92	50.81
		Avg.	**14.81**	**21.66**	**40.86**

Table 90b: Average Seed cotton yield and percent reduction in different Bt hybrids (2015 & 16)

Seed Cotton yield reduction %				
Hybrid	**80DAS***	**110DAS**	**140DAS**	**Yield (q/ha)**
YUVA-841-2BGI	**32.0**	**21.06**	**19.67**	**19.11**
BUNTY 2113-2	**20.29**	**13.17**	**9.31**	**34.81**
ANKUR JAI Bt	**27.0**	**15.74**	**0.0**	**9.30**
Ankur 3028 II	**60.70**	**58.20**	**45.1**	**22.72**

Path7: Screening of diploid cotton genotypes of *G. arboreum* and *G. herbaceum* against wilt caused by *Fusarium oxysporum* f.sp. *vasinfectum*.

Table 91: Vascular discoloration and disease reaction in Adult Plant Resistance Test at Pune

		Seedling Resistance Test		Adult Plant Resistance Test		Remark
Sr. No.	**Entry-Genotype**	**Wilting %**	**Disease Reaction**	**Root discoloration**	**Disease Reaction**	
1	PBD20/2016	14.7	MR	35.71	R	R
2	DWDa1601	2.2	R	35.71	R	R
3	CNA1031	13.3	MR	28.57	R	R
4	DWDa1602	13.9	MR	42.85	R	R
5	ANGH 1602	9.3	MR	14.29	R	R
6	GShv 385/12	11.1	MR	7.14	R	R
7	GShv 367/12	12.5	MR	21.43	R	R
8	GBhv 307/12	10.8	MR	0	R	R
9	GShv 362/12	14.5	MR	64.28	S	S
10	GBhv 304	12.5	MR	0	R	R
11	JLA 1102	9.6	MR	64.28	S	S
12	JLA1227	13.9	MR	71.42	S	S
13	DH2	82.2	S	100	S	S