

RESEARCH HIGHLIGHTS

CROP IMPROVEMENT

National Trials

- Nine National Trials (conducted in all the three zones), five North Zone trials, nine Central Zone trials and seven South Zone trials were conducted during the year in 221 locations.
- In irrigated national trials, *G. hirsutum* cultures viz., LH 2170 (2966 kg/ha) was promising in North zone, whereas, GSHV (1640 kg/ha) and TSH 0250 (1850 kg/ha) were promising in Central and South zones, respectively.
- In the preliminary intra *hirsutum* hybrids trial, the hybrids LHH 1403 (2662 kg/ha), GTHH 193 (2690 kg/ha) and MRC 7377 (1944 kg/ha) ranked first respectively in North, Central and South Zone.
- All the 14 *barbadense* cultures recorded higher seed cotton yield over the common check variety Suvin in both Central and South zone locations. The entries viz., DB 12 (1176 kg/ha) and GSB 40 (1242 kg/ha) occupied first rank in Central zone and South zone, respectively.
- In the preliminary interspecific hybrids (*G. hirsutum* x *G. barbadense*) trial, the hybrids SHHB 1002 (1827 kg/ha) and MCHB 7945 (1870 kg/ha) were promising in Central and South Zone, respectively.
- Promising *G. arboreum* genotypes like LD 949 (2483 kg/ha), PA 710 (1444 kg/ha) and GAM 162 (1173 kg/ha) have been identified for promotion in different zone which were found better than the check varieties in terms of seed cotton yield.
- Similarly desi hybrids like FMDH 23 (2769 kg/ha), AKDH 91 (1973 kg/ha) and AAH 2 (1514 kg/ha) showed promise in different zones.
- In Central zone locations, the *G. hirsutum* genotype P 2151 (1370 kg/ha) was promising and occupied the top rank under rainfed situations, whereas in South Zone locations, BGDS 802 (1301 kg/ha) was the best culture.
- In the preliminary intra *hirsutum* hybrids trial under rainfed conditions, the hybrid MRC 7385 (1406 kg/ha & 1945 kg/ha) was promising in both Central and South Zone locations.



Zonal Trials

North Zone

- In the *G. hirsutum* Preliminary Varietal Trial, seven cultures were superior to the best check variety and F 2228 recorded the highest yield of 2395 kg/ha.
- In the Coordinated Varietal trial, LH 2108 (2620 kg/ha) was the best culture followed by LH 2107 (2396 kg/ha).
- In the Coordinated Hybrids trial, FHH 200 (2660 kg/ha) was the best hybrid followed by LHH 1350 (2513 kg/ha).
- *G. arboreum* genotypes viz., RG 587 (2757 kg/ha) and RG 585 (2471 kg/ha) were promising.

Central Zone

- Under irrigated situation, culture MR 786 (2013 kg/ha) was the best in the Preliminary Varietal Trial and the genotype BS 279 (2149 kg/ha) was superior in the Coordinated varietal trial. Similarly, in rainfed trials, BS 30 (1358 kg/ha) and NDH 1938 (1287 kg/ha) were promising in various trials.
- In the Coordinated hybrid trial, the hybrid RAHH 259 (2379 kg/ha) was superior in intra hirsutum category while RAHB 972 (1789 kg/ha) was the best in interspecific (*G. hirsutum* X *G. barbadense*) hybrid category under irrigated conditions.
- Under rainfed situations, the hybrid ARCHH 3028 (1593 kg/ha) was the best in the intra hirsutum hybrid category, and MRDC 235 (1687 kg/ha) was the best in *desi* hybrid group.

South Zone

- The *G. hirsutum* genotype, MR 786 (1959 kg/ha) was the best in Preliminary Varietal Trial and BS 279 (1753 kg/ha) was superior in Coordinated Varietal Trial under irrigated situations.
- In interspecific hybrid category, the highest seed cotton yield was recorded in RAHB 301 (1969 kg/ha).
- Under rainfed situation, CPD 168 (1649 kg/ha) was the best in the Preliminary *G. hirsutum* varietal trial.
- In *desi* category, *G. arboreum* variety ARBa 0849 (1354 kg/ha) and the hybrid NACH 18 (1705 kg/ha) were the best performing entries.



CROP PRODUCTION

- Agronomic requirements like spacing and optimum fertilizer dose for intra-hirsutum hybrid CSHG -1862 were worked out in North Zone locations.
- Similarly, agronomic requirements were also worked out for intra-hirsutum hybrids viz., NHH 206 and JKCH 1305 in Central Zone locations.
- In South zone also, agronomic requirements were also worked out for hirsutum variety ARBH 813, intra-hirsutum hybrid – NHH 59 and interspecific hybrids viz., JKCHB 216, under irrigated conditions and for *desi* varieties like AKA 0110 and CNA 1003 in rainfed situations.
- For optimization of nutrient requirement and plant geometry for Bt cotton, RCH –134 Bt was used at Sirsa and Sriganaganagar. The normal spacing with 100% RDF was optimum.
- In Central Zone, for RCH –2 Bt normal spacing seems to be optimum at all the locations, except Surat and Rahuri, with 100% RDF at Surat and Akola, Khandwa, Indore, Nanded and Rahuri, whereas 150 % RDF was suitable at Banswara.
- For Bunny Bt in South Zone, normal spacing with 125% RDF was seen optimum.
- When different Bt hybrids were tested at several locations in North Zone, MRC 7017, RCH 134 II and MRC 7361 out yielded the rest at Sriganaganagar, Sirsa and Faridkot, respectively.
- In Central Zone Jai II, MRC 6301, Ajeet 155 II and NHH -44Bt out yielded the rest at Khandwa, Indore, Nanded, Akola and Junagarh, respectively.
- Similarly, in South Zone Tulsi 4 Bt gave the highest seed cotton yield at Coimbatore, Srivilliputtur and Lam, whereas Mallika and Bunny out yielded the rest at Dharwad and Nandyal, respectively.
- Foliar feeding trials with micronutrients showed that spraying of $MgSO_4 @ 1.0% + ZnSO_4 @ 0.5%$ at Faridkot, $MgSO_4 @ 1.0%$ at Ludhiana, $FeSO_4 @ 0.5%$ at Bathinda and $FeSO_4 @ 0.5% + ZnSO_4 @ 0.5%$ at Sriganaganagar gave significantly higher seed cotton yield.
- In Central zone and South Zone locations, spraying of $MgSO_4 @ 1.0% + ZnSO_4 @ 0.5%$ gave significantly higher seed cotton yield at all the locations except Siruguppa where $MgSO_4 @ 1.0%$ seems to be optimum
- In a study with foliar application of KNO_3 to increase yield and yield attributes in Cotton, four sprays of 2% KNO_3 at Kanpur, three sprays of 3% KNO_3 at Nanded, four sprays of 3% KNO_3 at Rahuri and two sprays of 1% KNO_3 at Siruguppa gave significantly higher seed cotton yield.
- Through nutrition management strategies, the control of leaf reddening in Bt cotton has been worked out in both Central and South zones.
- The experiment for developing technology for organic cotton was initiated in south zone locations viz., Lam, Nandyal, Dharwad, Siruguppa, Coimbatore and Srivilliputhur.



- The plant height, RWC, Stomatal conductance, transpiration rate, boll weight and yield g/plant were significantly reduced under stress, whereas root length, photosynthesis rate, biomass, number of bolls and harvest index were not affected significantly.
- Significantly higher number of bolls, more biomass and high seed cotton yield was recorded in Bt hybrids when compared to counterpart non Bt hybrids.
- Optimum time and dose of ethylene application for effective defoliation was being standardized at Surat, Khandwa, Lam, Dharwad, Hisar, Sirsa and Ludhiana.
- At Dharwad, based on the three years data, the genotypes viz., MRC-7351 Bt and NHH-44 Bt was found to perform relatively better under soil salinity as they recorded more root length and total dry matter even under saline conditions.
- Free amino acid and proline content were higher in the leaf under rainfed condition as compared to irrigated condition, while reducing sugar and protein were declined under rainfed condition. The higher amount of free amino acid and proline have helped in building the osmotic potential for the tolerance.
- The concentration of chlorophyll decreased with increase in salinity level from 2.77 to 8.61 dS/m. This indicated that some level of salt concentration is required for the biosynthesis of chlorophyll in cotton plants.
- For the past two years, it has been observed that the Nitrate reductase activity increased with increase in salt concentration up to 1.20 dS/m EC level. Higher salt concentration of 2.48 to 7.92 dS/m EC has drastically decreased the activity of the Nitrate reductase enzyme, which is an important nitrogen fixing enzyme.
- Under crop canopy management studies, narrow spacing of 60 x 30cm combined detopping after 55 DAS recorded higher seed cotton yield at Khandwa.
- Various genotypes differed widely in their response to salinity and different genotypes may have different adaptation against salinity/drought stress.



ENTOMOLOGY

- Cultivars tolerant to jassid and bollworms were identified from the breeding trials of the three cotton growing zones of India. Under controlled condition study, seven entries viz., GSHV – 152, GSHV – 155, GSHV – 97 / 59 (G. Cot20), GISV – 218, GJHV – 358, GJHV – 448 and DHY 286 were identified as tolerant cultures to Jassid (Jassid Injury Grade I) as against grade IV in the susceptible check DCH 32 in Surat. In Lam centre, five cultures viz., GJH 502, CPT 511, GSH 158, GJHV 476 and CIHS 16 were identified as tolerant to jassid (JIG I) as against 3.5 grade in DCH 32.
- **North zone:** Population dynamics study revealed that jassid population was at higher level only in Ludhiana which ranged from 6.1 to 19.8 / 3 leaves. Thrips and whitefly were also below threshold level throughout the season in all the centres.
- *Heliothis armigera* incidence was very low in all the centres (Sriganganagar, Faridkot, Ludhiana and Hisar). Sriganganagar and Faridkot recorded higher population of *Earias* bollworm (5 – 7 & 4 – 9 / 5 plants). Pink Bollworm was at higher level in Sriganganagar (3 – 6 / 20 green bolls), while in Faridkot and Ludhiana almost nil population was recorded.
- **Central Zone:** Almost all the centres recorded moderate to very high population of jassid. It was 7.3 to 23.7 in Akola, 6.9 to 13.6 in Nanded, 6.0 to 15.0 in Rahuri, 7.8 to 18.0 in Junagadh, 6.2 to 23.6 in Banswara, 8.6 to 20.9 in Bhawanipatna and 6.7 to 22.1 in Surat. Whitefly Population was moderate to higher level – 10.8 to 32.3 / 3 leaves in Banswara, 11.2 to 34.8 in Junagadh and 11.2 to 18.3 in Khandwa.
- *H. armigera* population ranged 1.0 to 6.8 / 5 plants in Surat, 1.0 to 6.0 in Akola and 1.2 to 5.8 in Khandwa. In Bhawanipatna and Nanded, it was at very low level 1.0 to 2.9. *Earias* bollworm was at higher level, 5.0 to 6.0 / 5 plants in Banswara and 7.0 to 9.0 in Surat and it was at low level in Khandwa and Junagadh (0.0 to 2.9). Higher population of Pink Bollworm was recorded in Akola 3.0 to 32.0 / 20 green bolls, 3.0 to 18.0 in Surat and 3.0 to 15.0 in Rahuri, while it was at low level in Bhawanipatna and Khandwa (0.0 to 1.2).
- **South Zone:** Jassid population was at higher level 6.5 to 18.2 / 3 leaves in Raichur, 6.2 to 15.3 in Lam and 7.1 to 11.2 in Dharwad. It was at moderate level 6.7 to 9.4 in Nandyal and 6.9 to 10.2 in Coimbatore. Thrips population was at above threshold level 30.0 to 48.2 / 3 leaves from last week of August to second week of October in Dharwad, while it was below threshold level throughout the season in all other centres.
- Mealybug per cent infestation ranged from 4.0 to 32.0 % from third week of October to second week of January in Raichur, while in other centres there was no incidence. Dharwad



centre had higher population of mirid bug 6.7 to 32.1 / 25 squares, while it was at moderate level 1.3 to 5.3 / 10 squares in Raichur.

- Bollworms: Almost nil population of *H. armigera* was recorded in Coimbatore and Lam centres. In Raichur it ranged from 0.4 to 1.9 / 5 plants, while in Dharwad it was at higher level ranging from 2.6 to 13.0 and present almost throughout the cropping season. *Earias* bollworm was almost nil in Raichur, while it was at moderate level 0.2 – 6.1 / 5 plants and present almost throughout the season in Dharwad. Dharwad and Raichur recorded very high population of Pink Bollworm ranging from 4.0 to 24.8 / 20 green bolls, while it was at low level (0.8 to 3.0) in Lam and Coimbatore centres.
- Chemical control of sucking pests through foliar application revealed that the reduction of jassid population was 60.1, 57.7, 57.3 and 57.7 per cent over control in the treatments of Acephate 75 SP at 750 gms, Imidacloprid 200 SL 40 gms and Acephate 95 % SG (562.5 & 750 gms) respectively.
- The impact of sucking pests control on the seed cotton yield revealed that Acephate 95 % SG at 562.5 gm and Acephate 75 % SP at 750 gm recorded higher yield by 53.1 and 48.9 % respectively.
- Evaluation of IGR, Insecticides and fungicide mixtures against Jassid revealed that Acephate 60 % WP @ 750 gm gave highest reduction of 68.0 % followed 67.6 % in Buprofezin + Acephate (250 + 625 gm), 64.5 % in Acephate 50 WP 625 gm and 64.1 % in Buprofezin 20 % 250 gm.
- Bio – effectiveness of IGR, insecticides and fungicides mixture on the impact of seed cotton yield revealed that Acephate 60 % WP, Acephate 60 % WP + Kresoxim methyl 15 % WG and Spinetoram 12 % SC @ 48 gm recorded significantly higher yield by 70.6, 64.3, 62.9 and 61.7 % respectively over control.



PLANT PATHOLOGY

- Cotton leaf curl viral disease (CLCuD), bacterial blight (Bb) and fungal foliar leaf spots (FFLS) were reported in different districts of Punjab, Haryana and Rajasthan.
- Pre monsoon period was dry with high temperature and with high whitefly population resulted in the outbreak of CLCuD leading to severe yield losses. The incidence of CLCuD varied from traces to 100.00% with 0-IV grade severity.
- The bacterial blight, grey mildew, *Myrothecium* leaf spot and *Alternaria* and bacterial blight were the major diseases reported in Central Zone. The other foliar diseases appeared in traces late in the season.
- The Bt cotton sown in the month of April-May was heavily affected by para wilt and leaf reddening.
- *Alternaria* leaf spot, bacterial blight, grey mildew, root rot, *Verticillium* wilt, and rust were the diseases recorded in cotton growing districts of Andhra Pradesh, Karnataka and Tamil Nadu.
- *Corynespora* and *Curvularia* spores were observed to some extent in Andhra Pradesh.
- The incidence of TSV and LCV was observed to an extent of 2% in Coimbatore.
- Disease progress in relation to weather factors were arrived for CLCuD, bacterial blight, fungal foliar leaf spots (caused by *Myrothecium*, *Alternaria* and *Cercospora*) in North zone, Bacterial blight, *Myrothecium* leaf spot, grey mildew, *Alternaria* leaf blight in Central Zone and bacterial blight, *Alternaria* blight, grey mildew, *Cercospora* leaf spot and seedling rot in South Zone states.
- Different centres in Central and South Zone collected *Alternaria* samples and observed presence of *A. macrospora* and *A. alternata* as the causal agents.
- In Andhra Pradesh, TSV was also recorded in cotton. Upto 20 thrips per leaf were recorded in the affected fields. Symptoms were confined to few leaves at the growing point to four to five twigs/branches.
- Genotypes sponsored in AICCIP breeding trials have been screened and tolerant / resistant genotypes have been identified in both national and zonal trials.
- The lines showing resistant/moderately resistant reaction consecutively for two years with one year under epiphytotic conditions for particular diseases were identified and were maintained for further use.
- Based on pooled data of four locations, Tetraconazole 11.6 % w/w ME-0.900 ml/ha showed the minimum disease index with the maximum seed cotton yield/ha, which was 25.7% higher over control



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- Minimum PDI of Fungal foliar spots and grey mildew was observed in Kresoxim methyl (Ergon 44.3 %) 500 ml/ha followed by Kresoxim methyl (Ergon 44.3 %) 400 ml/ha and Kresoxim methyl (Ergon 44.3 %) 300 ml/ha. No phytotoxicity was observed in 500, 1000 and 1500ml /ha of Ergon 44.3% spray.
 - Fungal foliar spots, grey mildew and *Myrothecium* leaf spots showed the minimum PDI in Kresoxym methyl 15% WG (187.5ai/ha) treatment.
 - Minimum PDI of bacterial blight was observed in Acephate 60%WP + Kresoxym methyl 15% WG 65.
 - Minimum CLCuD incidence was noted in case of Spinetorum 12% followed by Buprofezen 20% + Acephate 50%WP.
 - Significant reduction in PDI of bacterial blight, *Alternaria*, Grey mildew and rust through SAR chemicals was observed as compared to control.
 - Pooled data indicated that yield loss due to Grey mildew was loss upto 31.3%.
 - Yield loss due to bacterial blight was estimated upto 18.48%.
 - Yield loss due to CLCuD ranged from 41.4 to 44.5% at Hisar and Faridkot, when the DI was 70 or 100.0%. Similarly all the quality parameters like mean length, strength and micronaire value were affected.
 - There was increase in severity of disease in North Zone as compared to 2009-10 crop season.
 - Yield loss due to rust was estimated to be 28.05 at Dharwad and 43.66 at Lam.
 - Six cotton genotypes showed resistant reaction and 20 others showed moderately resistant reaction in Seedling Resistance Test for Fusarium wilt at Pune.
 - The genotypes viz., PA-182, GBhv 270, and GBhv 274 showed resistance at both seedling as well as at adult stage for Fusarium wilt at Pune.
 - Similarly, the entries viz., GBhv 229, 256, 259, 270, 271, 274, AKA 7, JLA 102, 302, 3396, LAS 5, G 352, G. COT 19, PA 182 and Digvijay are found to be promising against wilt.

