

## RESEARCH HIGHLIGHTS

### CROP IMPROVEMENT

- Among *G. hirsutum* genotypes tested under irrigated condition, HS 298, CPD 1602 and RHC 1217 gave the highest seed cotton yield and under rainfed situation, CPD 1652 in both central and south zones. For fibre quality, BS 1, CCH 16-1, SIMA 5 and TSH 324 were promising in irrigated trials and TKH 0250/2 in rainfed trials.
- Compact genotypes RS 2818 (3659 kg/ha), BS 30 (2268 kg/ha) and GISV 298 (2895 kg/ha) were promising in irrigated trials, while, ARBC 1651 (2263 kg/ha) and DSC 1651 (2316 kg/ha) were promising in rainfed trials.
- Promising ELS *G. barbadense* genotypes combining both yield and quality like DB 1602 have been identified in both central and south zone states in initial evaluation trials.
- Of the interspecific ELS hybrids evaluated in irrigated situation, ARBHB 1601 and ARBHB 1602 were promising in both the zones.
- In North zone, the average yield potential of *G. arboreum* genotypes was 3187 kg/ha in irrigated situation, whereas, it was 1519 kg/ha in central zone and 1521 kg/ha in south zone under rainfed conditions.
- A separate trial was conducted with 16 long linted *arboreums*, which indicated the maximum UHML of 31.2 mm (PAIG 373) and strength of 32.3 g/tex (PA 781).
- Apart from the above, a separate trial of seven long linted *arboreums*, which have already been tested in AICRP trials have been evaluated in HDPS with RCH 2 BG II as the check hybrid under recommended spacing at ICAR-CICR, Coimbatore. In this trial, all the entries out yielded check hybrid and were having comparable fibre quality parameters.
- Among the desi hybrids, the yield potential was 3050 kg/ha (KR 111) in North Zone and 2000 kg/ha (BDAA 029) in Central Zone in preliminary hybrid trials.
- None of the herbaceum test cultures were superior to local check varieties in Central zone locations.
- For the first time, all the entries in IET of *G. arboreum* and *G. herbaceum* were screened for Sodium and Potassium content in leaf tissue ( $\mu\text{molg}^{-1}$  DW) and K/Na Ratio in leaf tissue.
- In Zonal trials, RS 2815 (2938 kg/ha), GSHV 172 (2483 kg/ha) and BGDS 1033 (3224 kg/ha) were the top ranking genotypes in PVT under irrigated condition in North, Central and South zone, respectively. Similarly, in CVT, GSHV 177 (3123 kg/ha) was the best genotype in South Zone.
- The genotype ARBH 1551 (2183 kg/ha in Central Zone and 1784 kg/ha in South Zone) was the best in PVT, whereas, SCS 1061 (1924 kg/ha) was the best in CVT under rainfed situation.
- Among the compact cultures, RS 2814, DSC 1501 and LHDP 1 were the best in zonal trials under irrigated conditions, whereas, GSHV 180 and GTHV 13/32 were the best in rainfed trials.
- ARBB 1502 (in PVT of both Central and South Zones) and ARBB 1401 (in CVT of Central zone) were identified as the superior ELS *barbadense* cultures in zonal trials.
- The evaluation of interspecific ELS hybrids in zonal trials indicated superiority of RHB 1008 (1868 kg/ha and 2032 kg/ha) in both the central and south zones.
- Among the desi cultures evaluated in zonal trials, CSA 1028 (1467 kg/ha) and ARBa-1501 (1175 kg/ha) were the high yielding cultures in Central and South Zone, respectively. However, in all the three zones, PA 812 showed superiority for fibre quality.
- Of the desi hybrids evaluated in zonal trials, BDAA 011 was the best hybrid in Central zone recording 1774 kg/ha.



## CROP PRODUCTION

- Agronomic requirements of F 2296, Su Flum, HHH 494, & CSHH-2012 in North Zone; CCH 12-3, BGDS 1063, TCH 1777, CCH 12-2, GJHV 516, GSHH-2595, NHH 715, RHH-1007, RHH-1015, GSB 43, RHB-1014, NACH433 in Central Zone; IH -11, HS 292, TSH-04/115, CCH- 13-2, NHH-715, BGDHH-821, RHH-1007, SHH-818, GSB-44, JLA-0603, PA 740, RHB-1014 in South Zone were worked out.
- High Density Planting System (HDPS) was attempted with following compact culture of RS 2718, H 1465, ARBC-1301, DSC-1352, ARBC-1301, DSC-1302, SCS 1206 to work out nutrient and geometry requirements.
- Recommended Bt hybrid + closer spacing (25% less than Rec.) + 125% RDF + Recommended foliar spray + micronutrient (soil application) + location specific measures for control of reddening gave significantly higher seed cotton yield at Akola (2868 kg/ha), Nanded (3090 kg/ha), Junagarh (4729 kg/ha), Indore (3561 kg/ha), Coimbatore (2134 kg/ha), Raichur (3777kg/ha), Nandyal (3595kg/ha) and Chamrajanagar (1113 kg/ha); which were 35.8, 23.2, 85.7, 42.1, 30.1, 31.0, 81.4 and 80.1 per cent higher respectively than control (T1.Bt hybrid with existing practices).
- Application of pendimethalin @ 0.75 kg a.i/ha as pre emergence + one hoeing followed by post emergence application of chlorimuron ethyl @ 4.0g a.i/ha as at 2-4 leaf stage of weeds + one hoeing registered significantly higher seed cotton yield (3903 kg/ha) at Banswara. Application of pendimethalin @ 1.0 kg a.i/ha as pre emergence + one hoeing followed by post emergence spraying of pyriithiobac sodium @ 62.5g a.i/ha + quizalofopethyl 50g a.i/ha at 2-4 leaf stage of weeds + one hoeing registered significantly higher seed cotton yield at Indore (1959 kg/ha) and Chamrajanagar (2216 kg/ha).
- Studies on drip fertigation in Bt hybrids revealed that Irrigation regime of 0.8 CPE recorded significantly better seed cotton yield (3266 kg/ha) than 1.0 CPE (3212 kg/ha). Among nitrogen levels, yield increase was significant only up to 75 %.
- Drip irrigation combined with mulches revealed that polymulching had recorded the highest seed cotton yield at Banswara (4422 kg/ha), Indore (3073 kg/ha) and Junagarh (3591 kg/ha), which were 61.3, 44.2, 78.0 per cent higher than control.
- Organic nutrient management packages including Seed treatment, soil application of recommended bio fertilizers, foliar application of pink pigmented facultative methylotrophs (PPFM) at flowering, soil application of Neem cake @ 250 kg/ha and raising of Sunhemp / fodder cowpea/ black gram between rows incorporated registered significantly higher seed cotton yield at Sriganaganagar (2690kg/ha) and Kanpur (552 kg/ha), Akola (2630 kg/ha), Banswara (2882 kg/ha) and Srivilliputtur (1372 kg/ha) which were 17.8, 46.4, 10.8, 1.6 and 45.2 per cent respectively higher than control (application of RDN through inorganic).
- Cross sub soiling at 1.0m x 1.0 m distance gave significantly higher seed cotton yield at Faridkot (3829 kg/ha) and Bhatinda (2733 kg/ha), which was 33.6 and 33.7 per cent higher than control respectively;
- Evaluation of long linted *arboreum*, recorded the highest seed cotton yield with Phule Dhanvantri at Faridkot, CISA6-2 at SIRSA and Sriganaganagr in North Zone. G COT 15 (1824 kg/ha) and Roja (2062 kg/ha) were observed higher performance at Bhawanipatna.



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- At Akola and Rahuri, genotype Roja; recorded higher yield. CISA 6-2 (1793 kg/ha) and DLSA-17 (1690 kg/ha) recorded higher seed cotton yield at Nanded and Surat respectively.
- Phule Dhanvantri recorded the highest seed cotton yield at Dharwad (1624 kg/ha), Mudhole (2225 kg/ha), LAM (4278 kg/ha) and Nandyal (1278 kg/ha). In Coimbatore, CISA 6-2 (2680 kg/ha) and G COT 15 (2270 kg/ha) were high performing genotypes.
  - Application of Z20 @ 1500g/ha + Fluisan @ 100ml/ha had recorded significantly the highest seed cotton yield (3041 kg/ha) at Sriganganagar.
  - Super absorbent found to increase seed cotton yield significantly over control at Nanded and Surat. Application of Super absorbent @ 12.5 kg/ha was found optimum.
  - The Genotypes viz., L 1060, CPD 1602, CCH 16-3, GISV 310, GISV 185, RS 2835, L 604, CPD 1601 and ARBH 1601 were identified as drought tolerance at Guntur. At surat, RHH-1007, RHH-1015 and TCH-1777 were showed the highest seed cotton yield under water stress condition. Genotypes viz., TSH-327, TCH-1199, AR-9108, RCH-1202, RCH-1217, RB-616 and GSHV-185 are drought tolerance at Khandwa.
  - The genotypes viz., H 1465, H 1481, H 1470, H 1480, RS 2835 and AR 9108 were found salt tolerance at Hisar. At Surat, RHH-1007, TCH-1199 and TSH-327 were found superior for salt tolerance. The genotypes viz., RB 611, RB 617, RH 1217 and GJHV 477 performed better under saline condition
  - Arboreum entries (AKA 2004, AKA 7&Srinandi) and Jaadu BGII did not show any difference under normal and delayed sowing and may be suitable for climate change condition at LAM, Guntur. None of the genotypes performed better under late sowing including arboreum at Khandwa.
  - Seed cotton yield and boll weight was increased significantly by foliar application of Nano Zinc @ 0.13 g per 15 liters of water at 45 DAS & 60 DAS at Sriganganagar. However, foliar application of nano-P or nano-Zn did not have any effect on yield improvement in Suraj cotton variety at Dharwad.
  - Oil contents of different genotypes varied with the range of 13.1 to 19.7 % at Hisar and 13.1 to 19.7 % at Surat. Protein content is varying between the range of 18.87 to 26.61 at Hisar and 10.9 to 24.8 at Surat. The gossypol content is varying with the range of 0.79 to 1.87 (mg %) at Hisar and 0.3 to 1.69 (mg %) at Surat.



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## CROP PROTECTION ENTOMOLOGY

- Genotypes tolerant to sucking pests were identified from national and zonal breeding trials of the three cotton growing zones of India as follows:
  - ✓ From North zone, 61 and 10 entries were identified as tolerant to leafhoppers in National and Zonal trials, respectively.
  - ✓ From Central zone, 18 and 43 entries were identified in National and Zonal trials, respectively against leafhopper.
  - ✓ From South 26 and 18 tolerant entries were identified against leafhopper through National and Zonal trials, respectively.
  - ✓ Through advanced screening of promising entries, 4 from North zone, 32 from Central zones and 8 from South Zone were identified as tolerant/ moderately tolerant against leaf hopper.
- Pest dynamics was recorded in all the three zones under experimental field conditions. In north zone leaf hopper was observed at low level, whitefly population also occurred at low to moderate level throughout the season except in Sriganaganagar where it crossed ETL from 26<sup>th</sup> standard week to 44<sup>th</sup> standard week. Thrips population was higher only in Faridkot and Hisar. Boll worm infestation was negligible and adult moth catches of all the boll worms in pheromone traps were recorded in north zone centres.
- In central zone, among the sucking pests, leaf hopper was the major pest which occurred throughout the cropping season. Infestation of whitefly and thrips occurred at low to moderate level. Activity of natural enemies namely Spiders, *Chrysopa*, *Chryptolaemus*, Syrphids and Coccinellids were observed at all centres. Among the boll worms, pink boll worm *Pectinophora gossypiella* was the prominent pest in all the centres except Banswara and Bhawanipatna. The pest was recorded on *Bt* hybrids in Nanded, Surat and Junagadh. Adult moth catches of all the boll worms were observed.
- In south zone, leaf hopper was the major sucking pest in all the centres, whitefly occurred at low level, thrips infestation was at low to moderate level. Mirid bug and flower bud maggot were noticed at moderate level only at Dharwad. Among the boll worms, *P. gossypiella* was the prominent pest and it occurred on *Bt* hybrids in Guntur and Dharwad. Pheromone trap catches of adult boll worms was also recorded.
- Weekly survey report in farmer's fields in north zone indicated that whitefly crossed ETL in maximum locations followed by leaf hopper. In central and south zones leaf hopper was the major pest followed by pink bollworm and thrips.
- New formulation Pyrifluquinazone (RIL – 125/F (20%WG) @ 75 and 100g a.i /ha) tested against sucking pests in north and central zones were equally effective with the standard insecticides. Population reduction of natural enemies was recorded in the chemical treatments when compared to biopesticides and control.



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- New combination insecticide molecules viz., Spinetoram + Sulfaxaflor 40 %WG @ 120 and 140 g a.i., / ha and Pyriproxyfen 5% EC + Fenpropathrin 15% EC@ 37.5 + 112.5 g a.i., / ha and its individual molecules were effective in reducing the sucking pest population in all the three zones.
  - Among the different pheromone traps evaluated, higher number of moth catches with lower larval infestation and locule damage with maximum good opened bolls were recorded in Pherosensor TM-SP and TM-BB sleeve traps at densities 20 and 8 followed by PCI delta traps with replacement of sticky liner (season long).
  - Whitefly adult suction trap performed better at moderate crop growth stage and at moderate to higher infestation level with the population reduction of 31.42 to 33.33%.
  - Sequential application of chemical insecticides recorded significantly minimum boll and locule damage and highest seed cotton yield which was on par with application of mating disruption pheromone.
  - Infestation of pink bollworm, boll and locule damage were significantly low in insecticides treated plots which was on par with *Trichogramma bactrae* released plots.
  - Population of sucking pests and boll worm damage were significantly lower in the treatment D3N3 (90 x 10 cm plant density and 75% RDF) of HDPS trial.
  - Evaluation of various seed treatments against cotton pests under organic cotton production technology indicated that the population of sucking pests, square, open boll and locule damages were significantly lower in the treatment of seed treatment and soil application of recommended bio-fertilizer and foliar application of PPFM + neem cake 250 kg /ha + intercropping with green gram/black gram/ ground nut/ soya bean.



## CROP PROTECTION PATHOLOGY

- Cotton leaf curl virus in north zone, *Alternaria* leaf blight, bacterial blight and tobacco streak virus in central zone and *Alternaria leaf blight*, bacterial blight, grey mildew and rust in south zone were the major diseases reported during 2016-17 crop season.
- Cotton leaf curl virus disease (CLCuD) appeared in the 24<sup>th</sup> standard meteorological week at CICR regional station, Sirsa & 25<sup>th</sup> week at Hisar in Haryana; 26<sup>th</sup> week (SMW) at Faridkot in Punjab and 27<sup>th</sup> week in Sriganganagar in Rajasthan.
- 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.
- The occurrence of Tobacco streak virus (TSV) was observed from first fortnight of July on most of the Bt cotton hybrids sown on farmers fields in Maharashtra. Maximum incidence of the virus i.e. 22 per cent was recorded in Rahuri area. Tobacco Streak Virus disease incidence was very low in Andhra Pradesh (< 1% only). The incidence of TSV was found to be minimal in all the cotton growing tracts of Tamil Nadu. However, the maximum incidence (10.0%) was recorded in Coimbatore.
- In confirmation and maintenance of disease resistant entries trial in north zone, two entries viz., Su-Flum and Bihani-251 showed moderately resistant reaction against CLCuD at Faridkot. In central zone at Rahuri, three entries namely RAHC 1011, ARBHB 1401 and RAHC 1017 showed disease free reaction against *Alternaria* blight under artificial inoculation. Among 14 genotypes tested at Akola during 2015 & 2016 under epiphytotic conditions, 9 genotypes showed resistance to bacterial blight (P-2151, ADB – 542, 201, BS 40, BS30, BS 79, CPD 168, X -1353, AKH 8828). In south zone, the genotypes DB-14, DB-40 and ARBB-1501 were found to be resistant against *Alternaria* blight, Bacterial blight and Grey mildew and Rust at Dharwad. At Guntur, 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. Nine *G. arboreum* cultures out of the 42 screened against *Fusarium* wilt disease at Pune center were found resistant based on seedling resistance and adult plant resistance tests.
- At Pune center, TrichoCASH @10g/kg seed + Thiram @3g/kg showed maximum (49.6%) disease control followed by TrichoCASH @5g/kg seed + Thiram @3g/kg (49.2%) and Thiram @3g/kg (46.7%).
- Integrated disease management (IDM) trials at different locations (Akola, Nanded, Junagarh, Surat, Khandwa and Dharwad) where bio-based and bio-based + chemicals



modules were tested, the best results were obtained by the module where treatment of seed with *Pseudomonas fluorescens* (PF-CICR) @ 10g/kg, Soil application of *Trichoderma viride* @ 2.5 kg/ha(TV-TNAU) and foliar spray with Ergon @ 1ml/lit followed by Taqat @ 1.5g/lit for Fungal diseases or COC 0.3% + Streptocycline 0.01% for BLB were used .

- Pooled results of five sprays of different interventions at Hisar, Sirsa, Sriganaganagar, Faridkot and Bhatinda showed lowest CLCuD PDI in *Apis mellifera* (1ml/L) followed by Lachesis (1 ml/L) and Difenthiuron (0.1%) treatments. Highest seed cotton yield was observed in treatment Cowurine+Calcium (6.6%+0.5%) nitrate followed by *Apis mellifera* (1 ml/L) and Digitalis(1 ml/L) treatments.
- Pooled data of Hisar, Faridkot and Sriganaganagar showed that seed cotton yield reduction due to CLCuD in different Bt hybrids was 26.7, 27.3, 32.2 and 33.7 percent respectively in Bioseed 6588 BG II, RCH 650 BG II, Ankur 3028 BG II and MRC 7017 BG II.

