

ALL INDIA COORDINATED COTTON IMPROVEMENT PROJECT

Crop Improvement

National Trials

- Ten National Trials, seven for the improvement of *G. hirsutum* varieties and tetraploid hybrids and three for the improvement of *Desi* varieties and hybrids were conducted during the year 2005-06.
- In the Initial Evaluation Trial of *G. hirsutum* varieties under irrigated conditions, entry LH 2076 was adaptable to all the three zones and came with in first three ranks in mean seed cotton yield. Entry ADL 903 recorded the highest yield in both Central and South Zones.
- Under rainfed situation in Central Zone, entries NH 630, KH 155 and GTHV 0/35 were the three best entries for seed cotton yield. In South Zone, only CPD 818 was better than the Zonal check.
- Among the conventional intra-*hirsutum* hybrids under irrigated conditions, FHH 136 was the best hybrid in North Zone. Tulasi 27 was found to be adaptable to both Central and South Zone and occupied the second rank in both the zones. Under Rainfed conditions BSSCH 29 occupied the first rank in both Central and South Zones.
- Among the male sterile based hybrids tested under irrigated conditions, six hybrids were better than the Zonal check in Central Zone. Under rainfed conditions, only one hybrid recorded higher seed cotton yield over the Zonal check in South Zone.
- In the inter specific (*G. hirsutum* x *G. barbadense*) hybrid trial, four hybrids viz., JKCHB 214, USHB 25, RAHB 170 and ARBHB 943 occupied the first four ranks in both Central and South Zones and were superior to DCH 32, the check hybrid.
- In the trial on *G. arboreum* genotypes,

several high yielding genotypes have been identified in all the three zones. LD 875, CISA 2R, and LD 876 were promising in North Zone. KWA 227 and KWA 225 were suitable for both Central and South Zones. CINA 333 recorded the highest yield in South Zone.

- Several intra *arboreum* hybrids superior to AAH-1 (C) have been identified. Performance of CISSA 7 was promising in all the three zones. Hybrids LMCH 28 and AAH 22 were the best in North Zone. Hybrids GGCH 7 and JKCDH 501 were suitable for both Central and South Zones. GGCH 81 recorded the highest fibre strength in all the three zones
- Among the *G. herbaceum* cultures tested, GSHV 93/2001 and GSHV 109/2001 were better than the Zonal check variety *G. Cot 23*.

North Zone Trials

- Entries F 2036 and CSH 7106 among *G. hirsutum* genotypes and hybrids HHH 386, HHH 270, JKCH 1050 and USHH 11 among intra *hirsutum* hybrids were promising.
- *G. arboreum* genotypes LD 861, CISA 614, LD 866 and FDK 103 were higher yielding than the Zonal check. Intra *arboreum* hybrids superior to the Zonal check hybrid AAH -1 have been identified.

Central Zone Trials

- *G. hirsutum* genotypes GSHV 01/1338 and CCH 510-4 under irrigated conditions were superior to LRA 5166 in yield and also had better quality. Under rainfed situations, GSHV 01/26 and HAG 1009 were superior to LRA 5166 (Zonal check) in yield and were on par with it in quality.
- Eight intra *hirsutum* hybrids superior to Ankur 651 (Zonal check) in seed cotton

yield under irrigated condition have been identified. Fibre quality wise, PMCH 99 was the best.

- All the hybrids evaluated under rainfed conditions were better than the Zonal check NHH 44. Eight hybrids were superior to the local check hybrids
- Among the inter specific hybrids JKCHB 212 and PSCHB 901 showed better yield and fibre quality parameters as compared to DCH 32 (check).
- Eleven *G. arboreum* genotypes superior to both zonal and local checks have been identified.

South Zone Trials

- Fifteen *G. hirsutum* genotypes were superior to Surabhi (Zonal check) in mean seed cotton yield. Quality wise CCH 510-4 was the best.
- Sixteen intra *hirsutum* hybrids were superior to Bunny (Zonal check) in seed cotton yield. Quality wise, Tulasi 117 was superior to Bunny. Indam 178 and ARCHH 9770 were on par with Bunny in fibre quality.
- Under rainfed situations, 18 hybrids were superior to the zonal check Bunny but with variable fibre qualities.
- Even though all the inter specific hybrids evaluated were superior to DCH 32. Quality wise HAGHB 1042 and JKHB 212 were good.
- Among the *G. arboreum* genotypes tested, entry KWA 23 and ARBHA 35 were promising.

Crop Production

- Conventional practice adopted by farmers

gave significantly high seed cotton yield (2167 kg/ha) over that of control and lower doses of pendimethalin (@ 0.50 and 0.75 kg a.i. /ha +one hoeing at 35 DAS) but it was statistically at par with combined application of pendimethalin @1.5 or 1 kg a.i. /ha along with one hoeing at 35 DAS at Sriganganagar. Lower number of weeds and weed dry matter was recorded in these treatments.

- 50% recommended dose of NPK +10 t FYM + foliar spray of nutrients gave significantly highest seed cotton yield (2858 kg/ha) over rest of the treatments at Ludhiana. Similar results were also recorded at Faridkot, where combined application of 10 t FYM/ha along with 50% RDF and foliar spray produced highest seed cotton yield (2824 kg/ha) and yield attributes such as number of bolls per plant, while other indices viz., boll weight and GOT were not influenced by INM treatments. In Kanpur, highest seed cotton yield was observed in RD of NPK + 10 t FYM /ha which was significantly superior over rest of the treatments.
- Combined application of recommended dose of fertilizer with FYM @ 10 t/ha produced higher seed cotton yield at Khandwa and Rahuri, whereas 50% RD of NPK + 10 t FYM/ha at Indore and FYM @ 5 t/ha + 100% RDF at Akola are recommended for higher yields.
- At Lam, Guntur, application of FYM @ 10 t/ha along with 50 % of recommended dose of chemical fertilizer was found efficient to sustain cotton yield and soil health under rainfed condition, while at Nandyal and Srivilliputtur, RD of NPK + 10 t FYM / ha gave higher seed cotton yield and RD of NPK + 5 t FYM per ha was optimum at Siruguppa

- Foliar application of urea (2 %) at flowering and DAP (2 %) at boll development phase helped in getting higher seed cotton yield at Khandwa and Rahuri.
- Four sprays of 2% KNO₃ resulted in higher seed cotton yield at Nanded and Siruguppa, whereas four sprays of 3% KNO₃ seemed beneficial at Surat.
- Different organic fertilizers did not influence seed cotton yield under rainfed condition; however, *in situ* incorporation of green manures led to higher yield at Nandyal.
- Application of 60 kg N/ha + 40 kg S/ha along with 10 t FYM /ha was found more remunerative as compared to other treatments at Indore.
- At Akola and Nanded, seed cotton yield was significantly higher with recommended plant protection measures than protection with biopesticides only; whereas reverse trend was seen at Indore. Recommended dose of fertilizer recorded higher seed cotton yield than other treatments in which organic manures were used as source of nutrient at all locations.
- Narrow spacing of 60 x 30 cm gave significantly higher seed cotton yield (2381 kg/ha) over wider row spacing.
- Maximum seed cotton yield of 2171 kg/ha was obtained due to detopping at 65 DAS and lowest (1579 kg/ha) was recorded under control at Khandwa.
- The flat surface of the soil either raised or normal had the tendency to result in more yields as could be seen in growth and yield attributing parameters, though not significantly. Among the different soil cover management, farm waste and paper cover improved the yield by reducing weed problem at Coimbatore.
- Drip irrigation at 60% ET under paired row gave higher seed cotton yield (3979 kg/ha) as compared to other planting techniques.
- Fertigation with 125% recommended dose of N & K applied as 10% basal with remaining 90% from 30 - 120 days in 9 splits recorded significantly higher seed cotton yield (3982 kg/ha) as compared to control with recommended manual fertilizer application, but was at par with other fertigation doses and splits at Nandyal.
- *Hirsutum* variety H-1226 at Hisar and RS-2013 at Kanpur gave significantly higher seed cotton yield over different *hirsutum* hybrids and *arboreum* varieties. However, RS-2013 was statistically at par with *hirsutum* hybrid LHH-144 and RG-8 at Sriganganagar.
- Nutrient application in Hisar and Sriganganagar led to significantly higher yields due to N,P,K,S and Zn over other treatments, whereas at Kanpur, application of NPK and S gave significantly higher seed cotton yield over control, NP and NPK.
- Preceding cotton varieties had no significant effect on wheat grain yield at Hisar and Sriganganagar, whereas lesser yield was recorded after Omshankar at Kanpur. Residual effect of nutrients on wheat crop were not recorded in Sriganganagar and Kanpur, whereas grain yield was affected significantly at Hisar by the application of N and P to cotton crop only. Further application of K, S and Zn in cotton did not have significant effect over N and P treatment.
- At Rahuri, highest seed cotton yield, highest B:C ratio and net monetary return were obtained from the treatment FYM @ 5 t/ha + green manuring of *dhaincha in situ* + Azotobactor + Azospirillum + PSB (seed treatment).

- Cotton + Cluster bean (1:1 ratio) fertilized with 125% of RDF produced maximum seed cotton yield and better cost benefit ratio of 1:1.90 at Rahuri.
- Intercropping of one row of sunflower with two rows of cotton or one row of castor with three rows of cotton proved remunerative (1:2.2) over sole crop (1:1.4) and other intercrop combinations at Dharwad.
- High yielding cotton genotypes were characterized physiologically by better assimilation of photosynthates and translocation efficiency.
- Genotypes have been identified for further improvement in physiological attributes with better adaptability under stress.
- Negative correlation was seen between sucking pest incidence and total phenols.
- Cotton genotypes with higher seed protein and oil content have been identified for further use in breeding programme.

Crop Protection

- Cultures tolerant to jassid and moderately tolerant to bollworms were identified from breeders' materials from the three cotton growing zones of India.
- Jassid population crossed ETL during 1st week of June to mid July in Ludhiana and on the last week of September at Hisar. It crossed ETL during 3rd week of September to 2nd week of October in Akola, and from 4th week of August to last week of September in Khandwa. Peak activity was observed during September to December in Guntur, August to October in Dharwad, October to December in Raichur and October in Nandyal.
- Whitefly was at low level in all the centres of South and North zone except at Sriganganagar where it crossed ETL during 1st to 3rd week of September. In Junagadh, it was above ETL level (31 to 37 / plant) throughout November.
- High population of thrips (28 to 64 / plant) was recorded in Junagadh from mid August to mid September and throughout September in Surat (29 to 87 / plant).
- Aphid population was at above ETL during 2nd week of October to 1st week of November at Faridkot, during August and November to end of January in Akola, October to November in Junagadh, throughout November in Khandwa, mid September to early December in Guntur, October to January in Dharwad and October in Raichur.
- Predators were at higher level in Faridkot and Dharwad (October to December), moderate level at Sriganganagar and low level at Hisar.
- *Earias* bollworm was at peak (5 to 19.5 larvae / 5 plants) during mid July to first week of October in Ludhiana, from mid November to 1st week of January in Akola (5 to 10 / 5 plants) and in Khandwa (5 to 7 / 5 plants).
- The bollworm, *Helicoverpa armigera* crossed ETL during second fortnight of August (4 to 6 larvae / 5 plants) at Ludhiana, from last week of August to mid September; October in Akola; September - October in Junagadh and Surat and October November in Khandwa. It was at higher level during October in Dharwad and Nandyal and at moderate level in Lam-Guntur and Raichur.
- Peak activity of pink bollworm was observed during December-January in Lam-Guntur, Dharwad and Raichur while it was at low

level in all the centres of North zone, Nagpur and Nandyal.

- *Spodoptera litura* was at high level (7 to 17 larvae / 5 plants) during mid August to mid September in Sriganaganagar, during October-November in Nandyal and August, November and February in Lam, Guntur.
- One new insecticide, Polo 50SC at 400 and 500 g a.i. / ha was found effective against whitefly and recorded significantly higher yield over control at Sriganaganagar, Khandwa and Junagadh.
- One new seed treatment chemical Thiamethoxam (Cruiser 500FS) was found effective against aphid and jassid upto 63 DAS in Khandwa and Surat. However it recorded significantly higher yield over control at Khandwa only.
- Spinosad new A:D (at 50, 75, 100 g), RIL 042 (at 500, 750, 1000 ml), NNI 001 (at 48, 60 g), E2Y 45, S1812 and E237 were found effective against bollworms and recorded significantly higher yield over control.
- Against pink bollworm, thiodicarb followed by pyrethroids (Lambda cyhalothrin, Beta cyfluthrin, Deltamethrin) were effective in reducing the larval infestation and locule damage. Quinalphos, Chlorpyrifos and Profenophos were moderately effective. Besides offering good protection against pink bollworm, Thiodicarb recorded significantly higher seed cotton yield over control in several centres viz., Guntur, Nandyal, Raichur, Srivilliputtur, Surat and Khandwa.
- Location specific IPM modules were tested with Bt-hybrid, conventional hybrid and variety in all the centres and were found effective in reducing the pest infestation, plant protection cost and in increasing the seed cotton yield. IPM fields had more natural enemies and showed high cost: benefit ratio.
- Cotton leaf curl virus disease continued to be the predominant disease of North Zone with an incidence ranging from traces to 78.0 per cent in Punjab and traces to 90.0 per cent in Rajasthan.
- All the released varieties and hybrids including the Bt cotton hybrids released during the last two years were found to be susceptible to CLCuV, though at various intensities at different locations.
- In Gujarat, bacterial blight was the major disease (PDI of 21.5), whereas, in the other states of Central and South Zones, grey mildew (maximum extent of 30 to 86 per cent) and Alternaria leaf spot (20 to 30 per cent) were the major diseases.
- Forty two entries resistant to CLCuN, 17 for Alternaria leaf spot, 18 for Myrothecium leaf spot, two for grey mildew, five for bacterial leaf blight, 20 for Fusarium wilt and one for root rot have been identified.
- Seed treatment with Vitavax 200 WP (3.0 g/kg of seed) gave the best results and seed treatment with talc formulation of *Trichoderma viride* @ 10 g/kg of seed plus soil amendment @ 2.5 kg/ha gave the next best results in the control of root rot at Sriganaganagar.
- Plant protection with Carbendazim 0.1% (for grey mildew), Copper oxychloride 0.2% + Streptomycin 100 ppm (for other foliar diseases) and/or the biological agent *Pseudomonas fluorescens* (Pf1 and CHAO strains) gave effective control of grey mildew, Alternaria leaf spot, Myrothecium leaf spot and bacterial leaf blight.
- Early onset of CLCuV (before 30 DAS) caused an yield loss of 57.54 per cent.
- Spraying of Carbendazim 0.1% at 50, 65,

80 and 95 DAS gave the best control of grey mildew (7.05 PDI) compared to check (43 PDI) and prevented a yield loss of 32.5 to 44.65 per cent in Nanded and Dharwad.

- Spraying of Propiconazole between 35 and 95 DAS at fortnightly intervals reduced *Alternaria* leaf spot incidence significantly in Rahuri and Lam and prevented a yield loss of 26.33 to 56.25 per cent.

Front Line Demonstrations in Cotton

Two hundred and seventy seven demonstrations were conducted in the states of Punjab, Haryana and Rajasthan in North zone.

Punjab

Improved *G. hirsutum* varieties F 1861 and LH 1556 were compared against the local varieties. The yield increases in the improved varieties were of the order of 23.6 and 7.1 percent, respectively. Similarly, the improved *desi* varieties LD 694, LD 329 and Moti were also superior to the local variety LD 327 by 13.2 to 40.5 percent. Improved package of practices like timely sowing, weed control, plant population and balanced nutrition were superior to the farmers' practice by 7.1 to 55.8 percent. The advantage of timely sowing over delayed sowing was also demonstrated with varieties F 1861, LH 1556 and LD 327. Delayed sowing resulted in 7 to 21 percent reduction in yield.

Haryana

At Hisar, the male sterile based Hybrid AAH-1 recorded a mean seed cotton yield of 1670 kg/ha, as compared to 1196 kg/ha recorded in the local variety. Similarly, *G. arboreum* variety HD 324 (1731 kg/ha) was superior in seed cotton yield to the local varieties (1330 kg/ha) by 30.2 percent. The yield superiority of newly released hybrids HHH 287 and HHH 223 was also demonstrated. At Sirsa, hybrid CSHH 198 and CICR 2 were superior to the local hybrids by

18.5 and 29.7 percent, respectively.

Rajasthan

At Sriganganagar, improved varieties RS 2013 and RS 810 were superior to BN, RST 9 and F 846. On an average, improved varieties recorded 29.2 percent higher seed cotton yield over check varieties. Five hundred and eighty eight demonstrations were conducted in the Central Zone states of Gujarat, Madhya Pradesh and Maharashtra.

Gujarat

At Junagadh, RCH2 was superior to check hybrids like NHH 44, Ganga, Mallika and Nav Bharat 151 by 9 to 40 percent. The *G. arboreum* variety AKA 8 and the *G. hirsutum* variety AKH 8828 were preferred over AKA 5 and Rajat respectively due to big boll, non shedding and non lodging habit in AKA 8 and big boll, fluffy opening and high ginning outturn in AKH 8828. The new varieties were also high yielding as compared to AKA 5 and Rajat.

Madhya Pradesh

At Indore, cotton intercropping with Maize (2:1 row ratio) was found to be more remunerative as compared to sole cotton. INM practice (75% RD of NPK and 5 tonnes FYM/ha + *Azospirillum* and PSB seed treatment and PSB soil application) recorded 22 to 37 percent higher yield over farmers' practice.

Maharashtra

Five FLDs were conducted in Nagpur with Surabhi. Anjali was the check variety. The average seed cotton yield of Surabhi ranged from 625 to 875 kg/ha with an average increase of 7 percent over Anjali. Similarly MRC 6301 Bt was demonstrated with NHH 44 as the local check hybrid. The Bt hybrid recorded a mean seed cotton yield of 965 kg/ha as against 865 kg/ha in NHH 44. Foliar application of 2 % DAP with detopping was also demonstrated with yield advantage of 150 kg per hectare.

Advantage of ridges and furrow planting as against flat bed sowing was demonstrated. The yield advantage was of the order of 10 percent. An average yield of 888 kg/ha was obtained in INM practice as against 753 kg/ha in farmer's practice. Additional monetary return of Rs.5199/ha was obtained by adopting intercropping of soybean in cotton.

At Akola, AKA 8 recorded 11.7 percent increased yield over AKA 5 in the FLD plots in farmers' fields. Similarly, the pre release variety AKH 8828 registered 9 percent increased seed cotton yield over Rajat. High ginning out turn and big bolls in AKH 8828 are the additional features in the new variety. Superior performance of AKH 081 in shallow soils was demonstrated with an average yield advantage of 7 percent. Foliar application of 2% urea or DAP resulted in 10 percent yield advantage. At Rahuri, groundnut intercropping in summer cotton gave additional returns of Rs.13620/ha as compared to sole cotton. The B:C ratio of intercrop demonstration worked out to 1.72 which was higher than non intercrop demonstration (1.22).

Two hundred and eighty five demonstrations were conducted in the South Zone states of Andhra Pradesh, Karnataka and Tamil Nadu.

Andhra Pradesh

RCH2 Bt and Bunny Bt were the main hybrids demonstrated with non Bt hybrids for comparison. The magnitude of increased yield in RCH 2 Bt was 30.5 percent with a BC ratio of 1.31. Similarly, Bunny Bt recorded 48.5 percent increased seed cotton over Bunny.

Recommended fertilizer dose, Micronutrient (Zinc, MgSO₄ and Borax) application and recommended spacing are some of the other technologies demonstrated with an average yield increase of 5 to 15 percent.

Karnataka

At Dharwad, DLSa17, DDhc 11, RCH2 Bt and

RAHS 14 were demonstrated in the FLD plots. The technologies on INM, Micronutrient, Plant Growth Regulators and water management were also demonstrated. Participating farmers realized 15 to 18 percent increased yield over the non-adopted farmers. Eleven demonstrations were conducted with RAHS 14, a new *herbaceum* variety. These plots registered 11 to 17 percent increased yield over DB 3012. At Raichur, IPM technologies for Bt cotton hybrids were demonstrated.

Tamil Nadu

At Coimbatore, Surabhi under irrigated conditions and Sumangala under rainfed conditions performed well in comparison to check variety LRA 5166 with an yield increase of 10 to 17 percent. Intercropping of cotton with vegetables like Radish, Carrot and Beans fetched an additional return of Rs. 5000 per acre.

FLD on Integrated Pest Management

A total of 20 FLDs on IPM, encompassing six demonstrations in North zone, 10 in Central Zone and 4 in South zone were conducted during the year 2005-06. The main IPM components used were seed treatment with Imidacloprid/thiomethoxan @ 5 g/kg seed, stem application (1:4 Monocrotophos or 1:20 Imidacloprid) at 20,40 and 60 DAS, border crops viz., Sorghum/Maize, trap crops viz., Marigold for *Helicoverpa*, castor for Spodoptera, bird perches 10/acre, use of Pheromone traps for pest monitoring, use of Neem seed kernel extract (NSKE), deep ploughing in summer, clean cultivation practices like burning crop stubbles, trimming bunds and destruction of weeds. Detopping at 70-90 DAS, hand picking of grown up larvae and destruction and handpicking of larvae in rosette flowers.

At Faridkot, IPM demonstrations recorded higher seed cotton yield than the non IPM check

plots. The percent increase in seed cotton yield varied from 11 to 17 percent depending on the variety used. At Sirsa, an overall net return of Rs.5565/acre and increase in yield of 4.20% over non IPM fields were realized. At Sriganaganagar, it was found that boll and locule damage were comparatively lower in IPM plots as compared to non-IPM plots. The mean population of *Chrysopa*/plant was higher in IPM (0.76) as compared to Non IPM crop fields (0.31). Beneficial insects like Coccinellid beetles, spiders etc., were found in abundance ranging between 0.88 to 1.45 in IPM fields as against 0.25 to 0.68 of Non IPM fields.

At Akola, Bt cotton was included as one of the IPM components. In the IPM plot, an average of 3.62 applications/ plot were taken and plant protection cost was 1.13 times less with 13.33 per cent higher seed cotton yield over farmer's practice (FP)/non-IPM plots. Considering the total income and expenditure incurred on IPM and non IPM fields, more profit (1:1.27) by using IPM technology was realized than farmer's practice (Non IPM) (1:0.64)

At Dharwad, in DHH 1, IPM interventions were effective in controlling the pest incidence, which resulted in higher yield of seed cotton over recommended insecticide schedule (RPP). Returns for every rupee of investment was more from IPM blocks due to lesser cost of protection compared to RPP blocks. In DHH 11, under IPM practice, a mean seed cotton yield of 1860 kg/ha was realized. With an overall expenditure of Rs. 10,502, the BC ratio realized was 1:4.43. As against this, the non IPM plot yielded 1757

kg/ha. With an expenditure of Rs.11,204 per hectare, the BC ratio was 1:3.92. At Coimbatore, there was an increased yield of 18% in the IPM fields as compared to Non IPM fields.

FLD on Implements

Sixteen FLDs on implements were taken up during the year. Advantage of implements like cotton planter, Disc harrow and Aeroblast sprayer were demonstrated at Faridkot. At Sirsa, deep plough and use of rotavator were demonstrated. The farmer got 1010 kg/ha while using deep plough and rotavator against farmer's practice (930 kg/ha). At Sriganaganagar, the demonstration of aeroblast sprayer was conducted at farmer's field and it was compared with knapsack sprayer, commonly used by the farmers. Due to uniform spray and good control of pests, the seed cotton yield under aeroblast sprayer plots was 1980 kg/ha as against 1675 kg/ha in the plots where spray was done through knapsack sprayer.

At Akola, a new implement viz., Two row under root cutter was demonstrated in farmer's field. The new implement was compared with tractor drawn "V" pass. The new implement requires 5 litre diesel/ha and "V" pass requires 7.5 litre diesel/ha. The operation of under root cutter also requires less time than "V" pass.

At Guntur, the Thaiwan sprayer showed better efficiency of spraying without spray drift, which ultimately reduced cost and improved chemical impact on pest attack by covering more surface area with fine spray.

