**Proceedings of the Annual Group Meeting of AICRP on Cotton held at Tamil Nadu Agricultural University, Coimbatore through Hybrid mode during 6-8th April, 2022.**

# All India Coordinated Research Project on Cotton
# COIMBATORE

# Proceedings of the AICRP on Cotton Annual Group Meeting 2022
# 6th and 8th April 2022

The Annual Group Meeting of AICRP on Cotton was held from 6-8th April, 2022 through Hybrid mode., while the meeting for the physical meeting was Tamil Nadu Agricultural University, Coimbatore. The first day was totally dedicated to commemorate the "Fifty years of Hybrid Cotton Technology" and the second and third day on technical session and finalization of program for 2022-23.

## "FIFTY YEARS OF COTTON HYBRID TECHNOLOGY"

The programme on "Fifty years of Cotton Hybrid Technology and ICAR- AICRP on Cotton Annual Group Meeting" organized by ICAR-All India Coordinated Research Project (AICRP) on Cotton, Coimbatore in collaboration with Tamil Nadu Agricultural University (TNAU), Coimbatore and Indian Society for Cotton Improvement (ISCI), Mumbai was inaugurated on 06-04-2022 at Anna Auditorium, TNAU, Coimbatore by distinguished guests in the presence of galaxy of cotton researchers and other stake holders from seed and textile industries. The gathering was welcomed by Dr.A.J. Shaikh, Chairman, ISCI, Mumbai and the programme was inaugurated by Dr.V. Geethalakshmi, Vice Chancellor, TNAU, Coimbatore.

Dr C.D. Mayee in his introductory remarks highlighted about the sequence of events leading to development of hybrid cotton. The world's first commercial intra-hirsutum cotton Hybrid 4 (H4, or Sankar4) was developed by Dr C.T. PATEL at the Main Cotton Research Station, Surat (Gujrat) in 1970. The technology revolutionized cotton farming due to the genetic phenomena of HETEROSIS and breeding becoming popular as hybrid technology. The then paltry yields of 122 kg lint per ha in 1970-71 rose to 290 kg lint per ha in 1992-93. The technology also led to a mini-employment boom in rainfed areas in the 80's with 25 million people, mostly women joining the labor-intensive seed industry for pollination, cotton picking to seed packing. It also gave rise to a strong Private Sector investment in seed production and supply chain. Two years after the first intra-hirsutum hybrid, the world's first inter-species hybrid using G. hirsutum and *G. barbenense* was released from Dharwad, Karnataka under the name 'VARALAXMI'. With the release of these hybrids 'Heterosis Breeding' got full momentum not only in cotton but also in other crops and several hybrids in tetraploid and a few in diploid cottons were subsequently released.

In her inaugural address, Hon'ble Vice Chancellor Dr (Mrs) Geetalakshmi, specified the importance of cotton crop and the role of hybrid cotton in yield improvement. She further

emphasized that thefuture prospects of cotton must include the technology revolution like ICT based technologies with low input and maximum use efficiency and the gap existing between scientist and farmers should to be addressed. The presidential address was given by Dr.Trilochan Mohapatra, Secretary, DARE & Director General, ICAR, New Delhi and he insisted about the achievement of cotton cultivation by using GM based cotton hybrids. He further detailed about the development of disruptive technologies for high density planting, single picking, suitable for mechanized harvest and Genomics assisted breeding. He urged upon the cotton scientists to dwell deep into aspects of cotton breeding, production and protection technologies and come out with solutions for improving the cotton productivity.

Dr.T.R.Sharma, DDG (CS), ICAR, New Delhi has delivered the introductory remarks and he insisted upon developing pre-breeding lines for genetic divergence and the inclusion of "Product Profile" in breeding objectives of cotton.Dr.R.K.Singh, ADG (CC), ICAR,New Delhi delivered special address to the gathering and he pointed out the importance of innovative technologies and its significant role in cotton yield improvement. He also stressed on Introgression breeding as an option to impart new traits in the existing germplasm however, Linkage-drag reduces the yield, lint quality, distributes several gene regulatory systems, and creates chromosomal abnormalities, hybrid run-out and genome assortments. To break such linkage-drag, chromosomal segment introgression lines (CSILs) concept has to be employed in introgression programs.

The guests of honour Dr.P.K.Chakrabarthy, Member, ASRB, New Delhi, Dr.C.D.Mayee, President, ISCI, Mumbai and Dr.S.A.Patil, former Vice Chancellor, UAS, Dharwad and former Director, ICAR-IARI, New Delhi, delivered the introductory remarks.Dr Y.G. Prasad, Director, ICAR-CICR, Nagpur, Dr. (Mrs.) Sujata Saxena, Director, ICAR-CIRCOT, Mumbai, Dr. (Mrs.) G. Hema Prabha, Director, ICAR-SBI, Coimbatore and Dr. K.S. Subramanian, Director of Research, TNAU also graced the function. Dr.A.H.Prakash, Project Coordinator, AICRP on Cotton, CICR-Regional Station, Coimbatore proposed formal vote of thanks.

## Session 1: Special Lectures- Cotton hybrids: Historical Perspective

The session was Chaired by Dr. S. Geetha, Director, CPBG. TNAU, Coimbatore and Co-Chaired by Dr. M.V. Venugopalan. In this session, Dr V. Kumar, Retd., Professor, NAU, Surat presented a detailed chronology of "History of Hybrid technology: Tribute to father of Hybrid cotton- Dr. C.T. Patel. The second lecture on Changes in fibre quality traits brought by Hybrids was delivered by Dr. P.K. Madhyan, Principal Scientists, CIRCOT, Mumbai.

## Session 2: Cotton Hybrids: Challenges and Opportunities- Panel Discussion:

Cotton Hybrids: Challenges and Opportunities - Panel Discussion at 12.15 to 13.30 on 06.04.2022. The session was chaired by Dr. B. M. Khadi, Former Director of Research, UAS, Dharwad and co-chaired by Dr. Sujatha Saxena, Director, ICAR- CIRCOT, Mumbai and

Dr. V.N.Waghmare, Head (Crop Improvement) ICAR-CICR, Nagpur. The panelists'were Dr. Y.G. Prasad, Director, ICAR-CICR, Nagpur, Dr. M.S.Kairon, Former Director, ICAR- CICR, Nagpur, Dr. (Mrs) S. Geetha, Director, CPBG, TNAU, Coimbatore, Dr. R. Ramasami, President, FSSI, Dr. R. H.Balasubramanya, Former Head, CBPD, ICAR-CIRCOT, Mumbai, Mr. Pares Verma, Bioseeds and Mr. Venkata Ramachandrappa, SIMA CRDA. In this session, Dr. A. Manivannan, Senior Scientist, ICAR CICR, RS, Coimbatore acted as rapporteur. Following points emerged in the panel discussion.

- Dr. R. Ramasamy highlighted the technology intervention such as hybrid technology and GM in cotton for historical improvement of cotton production in this country. Presently, the yield hasattained plateau in cotton.For breaking the yield plateau, we have to breed genotypes with high input responsiveness, big boll size and insect resistance. There is an urgent need to widen the genetic base of the germplasm through active germplasm exchange programme among public and private institutes. Wide hybridization, which produces the transgressive segregants, would be useful for bringing the unadaptive gene pool into cultivated gene pools. Demarcation of cotton cultivation areas based on their productivity as high, medium and low productivity areas with in the zone for region specific targeted improvementof yield. More demonstration of HDPS among farmers for easier adaptation would improve the yield levels. Increasing the awareness GOT for better lint yield and changing the attitude of farmers towards GOT oriented yield in cotton, will increase the lint production.

- Mr. Paresh Verma, Bioseeds highlighted the breeding for climate resilient cotton crop especially tolerance towards abiotic stresses and use of genome edited traits for yield improvement. Mechanization in cotton for reducing the cost of cultivation has to be promoted. Yield barrier in cotton could be broken by improving the source sink relationship. Cotton has to be popularized as multifaceted commodityapart from fibre as oil and protein source.

- Dr. Kairon reiterated the historic second AGM on AICRP on cotton held at Mumbai and he remembered Dr. C.T. Patel's lecture on hybrid technology in cotton. He put forth his viewpoint of pink bollworm menace, soil health degradationand long durations in cotton crop are the major impediments in cotton production. Increasing the genetic variability by germplasm introduction and encouraging the area for *Gossypium arboreum* and *Gossypium herbaceum* cultivation to the tune of minimum 10 to 20% among the total area for preserving the buffer species diversity.

- Dr. Sujatha expressed her concern over the imbalance in fibre length category as of heavy shortage for Extra Long Staple and Short staple cotton. GOT has to be given top-notch weightage and the premium price has to be fixed for high GOT category. She stressed the Indian cotton impurities and their probable damage in yarn production. She urged the cleanliness of cotton fibre and premium price policy for clean cotton in order to practise the cleanliness in cotton among farmers.

- Dr. Y.G. Prasad emphasised the product development, product profiling and product commercialization of public sector research in cotton. He pointed out the tailoring of

plant genotypes suitable for HDPS and mechanized harvesting, use of genomics assisted breeding for developing novel genotypes and breeding for climate resilient cotton varieties.

- Dr. Geetha emphasized thatthe specific AICRP centres should be identified for markers assisted genotype testing in cotton. Development of location specific varieties, varieties suitable for exclusive denim production, varieties for mechanical harvesting, and custom-based hiring facility for mechanical pickers to encourage the mechanized harvesting among farmers are the need of the hour.

- Dr. R. H.Balasubramanya proposed the idea of developing modern delinting and dehulling ginneries for producing more usable cottonseed hulls for extraction ample cottonseed oils and use those as potential cotton seed meal as a source of protein.

- Mr. Venkata Ramachandrappa stressed up on the development of high yielding and short duration varieties in the Bt Cotton and high GOT along with high yielding varieties in non Bt cotton varieties for increasing the lint production.

- Dr. Waghmare highlighted the importance of pre breeding, population improvement programmes, and development of heterotic pools for deriving good combining parental lines for hybrid production, species diversity maintenance and demarcating of microzones within zones based of production potentials.

- Dr. Khadi presented the historical improvement of lint yield and per capita cloth demand from past to future projections. As of now, the per capita cloth availability is 34 square meter and the demand is expected to be47 square meter per capita. For catering the need of per capita cloth demand, HDPS concept would be appropriate. Current HDPS criteria of 6 bolls per plant, 4 gram of boll weight and 35% GOT is producing the lint yield of 750 kg lint per hectare and it has to be improved to 8 bolls per plant, 4 gram of boll weight and 38% GOT for producing 1380 kg lint per hectare to attain the goal of 1380 kg lint per hectare in 2050. This goal could be achieved by combined use of HDPS, Bt varieties and mechanization.

## Session- 3: Future Technologies in Cotton

- The sessions on “Future Technologies in Cotton” and “Cotton Technology Innovations” were held on 6th April, 2022 afternoon under the chairmanship of Dr. T. P. Rajendran, Former ADG (PP), ICAR, New Delhi and co-chaired by Dr. Siwach, Former Director of Research, CCSHAU, Hisar. Dr. R. Raja, Principal Scientist and Dr. K. Shankarganesh, Senior Scientist, ICAR-CICR, Regional Station, Coimbatore acted as rapporteurs of the session. During his opening remarks, the chairman praised the involvement of erstwhile cotton breeders and their hard work culminating in to the concept of hybrid vigour. He pointed out that initially there were no hybrids identified for northern region, but later on through technological intervention and different workshops, suitable hybrids were identified for northern region. He urged the present day cotton breeders to focus on

improving the yield potential as well as fibre quality using the new technologies/ futuristic thoughts and innovations.

- Dr. Suresh P.J. from Bayer Crop Sciences virtually presented the initiatives of Bayer on new cotton production technologies like Bollguard II X Roundup Ready Flex (BG II RRF) Cotton. While the first-generation technology had a limitation of giving protection only up to 30 days, the second-generation technology gives protection upto harvest. Incorporation of multiple traits will help the farmers to overcome the weed problems in later stage of the crop and also cost effective as compare to manual weeding. Development of sucking pest (thrips and mirid bug) tolerant Bt cotton is in pipeline in USA and soon it is going to be launched. Bollguard IV cotton with resistance to all lepidopteron pests of cotton including pink bollworm is under development and 5th generation product will have both insect and herbicide (Glyphosate, Dicamba) tolerance. He informed that for high density planting, Bayer has developed a short stature hybrid which can with stand heavy wind without any lodging. Bayer is also working on combining artificial intelligence, weather data and other machine learning approaches for optimizing plant density for achieving higher productivity.
- Dr. R.S. Sureshkumar, Rasi Seeds presented the Rasi Max approach for Breaking the Plateau with Advanced Agronomy. He pointed out that introduction of Bt Cotton Technology in early 2000s improved the cotton productivity upto 530 kg/ha. However, in recent times, there is stagnation in cotton productivity mainly due to lack of new germplasm material for developing new hybrids and very minimal agronomic interventions by farmers, higher labour dependency and dearth of labour and the problem of pest and diseases like pink bollworm and boll rot.
- He has pointed out that 5.2 m ha of cotton area, spreading across 62 districts of nine states in our country is having low cotton productivity (236 kg/ha) and another 5.2 m ha of cotton area is having medium productivity (340-510 kg/ha). He opined that high density planting system with precise agronomic interventions (Precision in plant to plant spacing, uniform depth of planting with more than 90% germination, early and uniform plant vigor, plant population of 25,000 at harvest) coupled with plant growth regulator application for canopy management will improve the productivity in these areas and this combined with appropriate defoliant application will also enable mechanical harvesting. He also flagged the research need in the area of plant growth regulators dosage and spray timing in different areas and need for new molecules for defoliation purpose. He elaborated the Rasi Max approach involving i) right geography, ii) precision planting, iii) agile crop management & canopy management and iv) manual picking/ machine picking with defoliant application. For achieving higher cotton productivity, he enlisted the key responsibilities of different stakeholders viz., Seed companies (developing hybrids amenable for HDPS and educating agronomy to farmers), Farm equipment manufacturers (developing cost effective planters & harvesters suitable for Indian conditions, post-sale service & spare availability, training the machine operators), Crop

protection companies (new generation PGR's & defoliants to be duly tested & approved by CIBRC), Custom-hiring set-ups (NGO/FPO/FPC & Rural retailers may act as single stop solution for HDPS), Ginners & Spinners (encourage the machine picked cotton by setting up pre-cleaners & price parity) and Government institutions (policy support in Hybrid testing protocols and PGR & defoliants approvals, subsidy to NGO/ FPO/ farmers on planters and harvesters, input subsidy to farmers to encourage HDPS).

- Dr. T. M. Manjunath, Member, Programme Advisory and Monitoring Committee of AICRP on Cotton made a presentation on Genetic options for IPM of cotton pests besides Bt (What after Bt in Hybrid cotton?). He mentioned that the first generation Bt was developed by incorporating Cry1 Ac gene and the second generation Bt by incorporating Cry 1Ac and Cry 2Ab genes. However, the third generation Bt will be with Cry 1Ac+Cry 2Ab and Vegetative Insecticidal Protein Gene-3 (VIP-3). He also opined that there is a scope for gene editing technology for weakening the R gene in male through RNAi and CRISPR-CAS technology. In SIT- Male moths were sterilized and released in to the nature and sterilized male compete with natural male and thereby reducesthe pest population. In case of CRISPR-CAS silencing / altering the receptor gene in male to become sterile will help in mating disruption technology which was successfully carried out in Punjab for pink bollworm. He emphasized the need for empowering biocontrol agents by utilizing the genetic tools and encouraging farmers to mass multiply bio-control agents. He concluded by saying that IPM is the right choice as every technology has its own merit and no one technology will solve all the problems.
- Dr. Bhagirath Choudhary of Project Bandhan highlighted three key cotton innovations viz., i) Biotechnological namely, stacked trait (cry, EPSPS gene), Gene pyramiding (Cry, VIP) ii) Genome Editing (Exemption of SDN1/SDN2 from GMO regulatory system, access to patented CRISPR approaches) and iii) Pheromone technology (Monitoring, Mass Trapping & Mating Disruption). He discussed about Mating Disruption of Pink Bollworm (PB knot technology) in Cotton under Project Bandhan by PI Foundation &Rasi Seeds (2021-22) and explained the steps taken to increase cotton productivity by providing eco-friendly pink bollworm management technology to cotton farmers. Under Project Bandhan, field experiment on Mating Disruption of Pink Bollworm was conducted by tagging PBKnot dispensers (~180 dispensers per acre of gossyplure @25g a.i./acre) at 45 DAS (squares and flower formation stage). This was carried out in 300 acres area in 5 clusters covering 3 villages (Wardha, Adasa and Panjari of Katol&Kalmeshwar taluka, Nagpur) and the Mating Disruption technology for controlling PBW was successfully demonstrated. Dr. Vijay and Dr. Ajay Gupta of PI Industries also explained about the PB knot technology.
- Dr. A. R Sharma delivered a talk on "Breaking the Yield barriers in Cotton" and he advised to follow the concept of Right dose, Right choice of variety/inputs and Right time. He also deliberated on use of sensor-based technology from planting to harvest in cotton production and use of robotics and Artificial Intelligence (AI) technology for improved cotton production and maximum yield gain.

- Dr. Selvaraj, SIMA emphasized the need for maximum utilization of available genetic resources to improve the cotton yield potential and fibre quality parameters. Dr. Ashwin Kashirkar stressed upon marker assisted breeding and informed that they have developed a hybrid between *G. hirsutum x G. arboreum* cross and use of artificial intelligence and machine learning approach to identify the off-types in hybrid development. Dr. Divankar emphasized the need for diversifying the germplasm and requested that lint yield should be considered as the main criteria for hybrid release.

# Technical session of AICRP on cotton- 7th and 8th April 2022

## Session I: Review of Results of AICRP on Cotton Trials

The session was chaired by Dr. T. R. Sharma, Deputy Director General (Crop Science), ICAR and co-chaired by Dr C.D. Mayee, Chairman, Programme Advisory & Monitoring Committee and Dr. R. K. Singh, ADG (CC), ICAR, New Delhi. Chairman, Co-chair along with Programme Advisory & Monitoring Committee members Dr B. M. Khadi and Dr A.R. Sharma reviewed the results of AICRP trials. Dr. P. K. Chakrabarty, Member, ASRB also participated in the session. Dr. A. H. Prakash, Project Coordinator (Cotton) presented the national and international status of cotton research. Dr. S. Manickam, Principal Investigator (PI), Plant Breeding presented the achievements of breeding trials conducted during the crop season 2021-2022 followed by Dr. K. Sankarnarayanan, PI (Agronomy) on Agronomy trials, Dr. Rishi Kumar, PI (Entomology) on Entomology trials, Dr. S. K. Sain, PI (Plant Pathology) on Plant Pathology trials and Dr. P K Mandhyan, PI (Quality Evaluation) on fiber quality research.

**Dr. T. R. Sharma (DDG-Crop Sciences) suggested the following points for incorporation**

DDG-Crop Sciences emphasized the need for change in the reviewing of Annual AICRP activities and programmes. The researchers to seek the inputs from programme advisory and monitoring committee to formulate innovative programmes in AICRP system.

- Location specific varieties are to be released for increasing the yield in specific cotton growing areas
- Emphasized to follow strict guidelines to release varieties/hybrids through Varietal Identification Committee (VIC) meeting in order to release only best cultivars to farmers
- Whole genome sequencing of *Gossypium* spp. revealed the presence more than 41,000 predicted genes in *G. hirsutum.* GWAS, MAS and Genome editing techniques to be explored in cotton for further improvement
- Speed breeding to be followed to accelerate the breeding process by increasing the no. of breeding cycles per year
- The Research Publication from AICRP should be presented in future.

DDG-Crop Sciences also stressed to concentrate the following six researchable areas for further improvement in cotton research

(i) Insect resistance management
(ii) Drought tolerant varieties for drought hit and rainfed areas
(iii) Varieties suitable for salinity and water logging conditions
(iv) Breeding for photo-insensitive varieties for cultivation
(v) Water Use Efficiency (WUE) and Nutrient Use Efficiency (NUE) genotypes for cultivation
(vi) Disease resistance varieties for major diseases like leaf curl, TSV and other leaf spots

- Intensification of pre-breeding activities to broaden the genetic base of cotton genome

- Bt hybrid development is need of the hour from public sector breeding programmes
- Use of plant architecture as basic trait for hybrid development in cotton breeding
- Branding of cotton for Special characters needs to be concentrated
- Public private partnership to be strengthened for breeding material diversification as well as development of genotypes and technologies by joint venture
- Technology Identification Committee (TIC) to be setup in AICRP system for systematic evaluation, release and providing of certificate to technology
- Drone technology to be used for research and pesticide spray in cotton research programme
- Scientific data generation, statistical analysis and publication in high impact journals are mandatory in AICRP system

**Dr C.D. Mayee, Chairman, Programme Advisory and Monitoring committee**

- More number of crosses to be attempted for successful introgression of target traits from wild species to cultivated species
- HDPS suitability study to be conducted at specific geographical locations which are <300 kg average lint yield/ha.
- Technologies for organic cotton cultivation to be standardized and stream lined

**Dr. R. K. Singh, ADG (CC), ICAR, New Delhi**

- The boll size of public sector Bt cotton varieties should be addresses and should be atleast 4.0- 4.5 g and plant geometry to be worked out for better yields. If not should not be consider for promotion.

**Dr. P. K. Chakrabarty, Member (Plant Sciences), ASRB, New Delhi**

- Bio-stimulant specific for cotton to be registered using AICRP data in CIB & RC for use in future which is gaining momentum at present

Dr. C D Mayee, Chairman of the Programme Advisory and Monitoring committee advised the PIs of the Cotton AICRP system to present the results in Comprehensive manner with minimum ppt slides and highlighting only signification achievements. The session was ended by completion of all the presentations and discussions.

## Proceedings of Session I Special Lectures held as a part of Annual Group Meeting 2022 Fifty years (golden jubilee) of cotton hybrid technology on 7:04:2022

### Session I Special Lectures

The session on special lectures was chaired by Dr P. K. Chakrabarty, Member, ASRB, New Delhi and co-chaired by Dr. R. K. Singh, ADG (Commercial Crops), ICAR, New Delhi. The Chairman started the session with the introductory note emphasizing the importance of biotechnology in improving crop yields, crop quality, effective pest and disease management. The recent advances in biotechnology especially the CRISPR- Cas mediated genome editing was successfully used to edit 17 genes to manage 20 diseases in 21 host plants.

**Dr. K. S. Subramanian**, Director of Research, TNAU, presented a special lecture on "Nanotechnology in Cotton Research". In his lecture, he deliberated various applications of nanotechnology in agriculture and how these applications can be extrapolated to cotton. He opined that the advances in nanotechnology in the field of seed technology viz., nano diagnostics – e- Nose technology for quality assessment by establishing relationship between VOC and seed quality; bioimaging of seeds to generate spectral signature and nZnO enabled seed invigoration can be effectively used to improve the productivity of cotton. For drought management, nano emulsion based foliar sprays and, chitosan-based gel for soil moisture and encapsulation of seeds with nano fibre, would be viable options in cotton. For nutrient Management, nano capsules for micronutrient management, and nano urea for drone technology can be explored. The early detection and cure of plant diseases could be made possible with nanotechnology. Smart delivery of desired biomolecules into plants can be made possible through nano silica based delivery systems like nano chip technology and nano-silica derived from bagasse. Artificial Intelligence to detect whitefly incidence and improvement of stability of coloured cotton can also be done by nanotechnology. He also explained about the cost benefits of nanotechnology during the discussion session.

**Dr. Mukesh Kumar Rana,** Principal Scientist, Molecular Genetics, NBPGR, New Delhi, in his lecture on DNA finger printing in crops, explained the importance of DNA fingerprinting in identification of specific cultivar of plants. The challenges of DNA fingerprinting in plants as explained by him are multitude of species, diverse requirements, vegetatively propagated to cross bred species, diverse genetic composition, strong to weak substructure and presence of common alleles across groups. Seed purity testing of crop varieties (to identify admixtures) hybridity testing of commercial hybrids to ensure genetically pure seed, investigating the declared parentage of varieties, enforcement of protection of plant varieties and farmer's rights Act, 2001, support and improvement of the effectiveness of the DUS testing procedure, investigation on infringement on plant breeder's rights and protection of plant biodiversity are the major applications of DNA fingerprinting as mentioned by him. He also mentioned about the molecular profiling techniques such as RFLP, RAPD, AFLP, SSR, SRAP and SNP and opined

that the specific tool selected depends on several criteria including precision, technology available, cost of assay etc.

He enumerated that a total of 648 varieties of 48 crops from various Institutes had been barcoded so far. In cotton 162 varieties from 66 lots have been barcoded. GEAC has been insisting on DNA evidence to prove background genotype of transgenics for over 15 years now. He also briefed about the new initiative of formation of Expert Opinion Committee taken under the chairmanship of Dr. H. S. Gupta to deal with scientific technical or legal issues related to DNA fingerprinting of crop varieties. He also expressed his concerns related to DNA fingerprinting such as maintenance of quality standards.

The session was concluded with the remarks of the Chairman Dr. P. K. Chakrabarty, Member, ASRB and Co-Chair Dr. R. K. Singh, ADG (Commercial Crops). The chairman mentioned that using CRISPR-Cas genome editing technology, a wild type tomato is converted into domesticated one. Similar approach can be followed in cotton to exploit the wild type cultivars in cotton to improve the productivity in cotton. He also emphasized that formulation and standardizing the nanofertilsers like nanourea for drone technology is impertinent to cope up with advances in technology The Co-chairman emphasized the importance of nanotechnology in improving the yields of cotton and role of DNA fingerprinting in identifying specific cultivars in cotton. Dr. L. Mahalingam, Professor, Dept of Cotton, TNAU, Coimbatore and Dr. (Mrs.) J. Annie Sheeba, Senior Scientist, ICAR-CICR, RS, Coimbatore were the rapporteurs of the session.

## Session II: Interactive session with stakeholders (PPP)

**Chairman:** Dr. T.R. Sharma, DDG (CS), ICAR, New Delhi

**Co-Chairman:** Dr. C. D. Mayee, Chairman, Programme Advisory & Monitoring Committee

**Members:**

1. Dr. R. K. Singh, ADG (CC), ICAR-New Delhi
2. Dr. Y. G. Prasad, Director, ICAR-CICR, Nagpur
3. Dr. (Mrs) Sujata Saxena, Director, ICAR-CIRCOT, Mumbai
4. Dr. K. S. Subramanian, Director of Research, TNAU, Coimbatore
5. Representative from NSAI
6. Representative from SAI
7. Representative from Fertilizer Industries
8. Representative from Pesticide Industries

**Member Secretary:** Dr. A. H. Prakash, Project Coordinator

**Rapporteurs:** Dr. K. Sakthivel, Asst. Prof (PBG), CRS, Veppanthattai

Dr (Mrs) K. Baghyalakshmi, Scientist, ICAR-CICR, RS, Coimbatore.

An Interactive session with carious stakeholders of Public Private Partnership was conducted on 7th April 2022. The following expectations / comments expressed by the private partners were discussed during the session.

1. Yield stagnation is being observed in cotton and there is a need for new intervention to overcome the stagnant yield. The reasons for yield plateau are restricted money flow to the research where the breeders lose their motivation due to lack of resources. The rate of introduction of new genetic stocks has slowdown
2. The duration of testing for release of Bt hybrids need to be reduced to 2 years of validation from 3 years. Choice of location for testing has to be chosen where the cotton is cultivated extensively. Rajasthan could be included in the central zone further number of testing location in Maharashtra should be proportionate to the area of cotton cultivation
3. The spacing followed in the trials should be based on the farmers need and adoption
4. Improvement of ginning outturn (GOT) in India is lacking. GOT has to be raised from 35 to 40 percent for which variability is needed. Programmes have to be initiated in a fast trackmode to reach 40 per cent of GOT
5. The cotton productivity has to be increased through mechanization, HDPS, application of plant growth regulators etc.
6. SAUs can be allowed to test the Bt cotton variety for a particular place/location to meet the local need
7. Huge germplasm available with the public sector need to be evaluated for yield potential and that could be shared with the private agencies
8. Small companies should be given opportunity to test or to forward the ICAR released technologies
9. To promote hybrid cultivation development with high GOT procurement based on lint yield need to be channelized
10. Inputs from textile industries need to be looked into to develop varieties and hybrids
11. Loss of diversity is being observed in cotton production for which consortium for cotton can be establishedas in other crops as to understand the industry/market need
12. There is a need to formulate proper guidelines to share the germplasm with the private agencies

Dr. B. M. Khadi added that there are germplasms and varieties with GOT 40 percent and these lines could be used. The private sector entries have GOT not more than 35 per cent which should be improved. To utilize the wild species available with public sector, the private companies can sign MOU to receive the pre-breeding stocks. Fibre strength by length ratio should be increased from 1.1 to 1.25. All the categories of cotton need to be given importance unlike putting the resource into two to three categories of cotton.

Dr. A. H. Prakash, Project Coordinator (ICAR-AICRP on Cotton) and Head, ICAR-CICR Regional Station, Coimbatore listed and addressed the points raised by different companies.

1. A committee under the chairmanship of Prof. B.S. Dhillon, Former Vice Chancellor, Punjab Agricultural University, Ludhiana was constituted to 'Revisiting the guidelines for testing of Bt cotton varieties/hybrids under AICRP on cotton'. The committee has recommended that three years data is must for identification and release of hybrids

2. There are no agronomy trials for the release of hybrids based on best package of practices. If the companies come up with the data, special trials will be conducted. The entries provided for HDPS should have compact stature genetically and should not depend solely on the chemicals applied.

3. The guidelines from GEAC strictly advocates that the Bt entries need to be evaluated only through AICRP and if the hybrid is found suitable for particular location, it is encouraged for state release through AICRP.

4. Now GOT is being given importance and only the entries with GOT more than 37 per cent and on par yield are promoted and also will be considered for identification.

5. The AICRP is having a long-term relation with the textile industry. The Industry demand for fibre quality is dynamic and its requirement changes based on the demand from the International market.

Co - Chairman Dr. C.D. Mayee, added that if the genotype is having any special character AICRP would possibly give a special notification to the government requesting that the genotype is released for that particular trait and the prices should be based on the trait. If the special trait is GOT that would benefit the farmer. He also added that the lint yield can also be taken into account for the release of the entry. He said that the representatives from bio-pesticide companies should be invited for this session from the next group meeting. He further emphasised that the concept of Zones needs to be reoriented based on the cotton productivity.

Dr. Y.G. Prasad in his deliberation told that GOT will be evaluated as a special trait. He also said that there should be directed pre-breeding activity for improvement of particular traits and the mechanism for sharing these materials will be further worked out. He expressed the need of evaluating the hybrids suited for HDPS separately as clubbing the data along with the other hybrids will be misleading.

Dr. R.K. Singh, ADG (CC) shared his views on data recording for the AICRP trials and suggests that online data entry module to be developed for effective and timely submission of data for compilation.

Dr. Y. G. Prasad, Director, ICAR-CICR, Nagpur proposed vote of thanks.

## Technical Programme

### Breeding Trials:2022-23

Date: 08-04-2022, 9.00 AM to 1200 Noon

Chairman: Dr. B. M. Khadi, Member, Programme Advisory & Monitoring Committee
Co- Chairman: Dr. VN Waghmare, Head, DCI, ICAR-CICR, Nagpur
Dr. S. S. Sewach, Former Director of Research, CCSHAU, Hisar
Convener: Dr. S. Manickam, Principal Investigator, (Plant Breeding),
Rapporteurs: Dr.G.Anand, Asst. Prof (Breeding),CRS, Srivilliputhur
Dr. A. Manivannan, Scientist, ICAR-CICR, RS, Coimbatore

The meeting started with the remarks by Dr. B. M. Khadi, in which he stressed the following points.

- As of now, the per capita cloth is 34 square meter and the demand is expected to be 47 square meter per capita. This cloth demand can be met by improving the production of cotton using the technology of HDPS especially with Bt varieties.
- Species diversification is very important for keeping the equilibrium of cotton cultivation.
- Arboreum can be tried in HDPS and mechanical harvesting in arboreum will be yielding much dividends.
- *Gossypium australe* has to be inducted in pre-breeding programme at CICR, Nagpur centre.
- AICRP on Cotton has to be acknowledged by all the centres who are using the data obtained from AICRP testing in their research publications and annual reports without fail.

*Formulation of technical programme:* Dr. Manickam made the presentation on details of the trials for all the zones to be conducted during 2022-23. He informed that the data entry will be online through IASRI Web portal and the details will be shared among the participating centres, both public and private. An online training programme will be organized shortly for submitting the data online.

**Private R & D** – Please pay the testing fee (@ Rs. 60,000 + 10,800/- Service Tax per entry at national level; Of this amount 6,000/- may be deducted as TDS and remaining **Rs. 64,800/-** may be paid) through NEFT State Bank of India Current A/c no. 10663183268, IFSC code no. SBIN0002274 in favour of the Project Coordinator (Cotton Improvement), Coimbatore. No entry shall be entertained without the submission of testing fee and R & D recognition by DST. The companies which have not updated the R & D recognition shall update and submit a copy at the time of submitting the seed without which the entry shall not be included in the trial.

**For North Zone Trials**

**Last date for submission of seeds at CICR, Sirsa: 19/04/2022 before 4.00 PM**

**Issue of coded seeds: 21/04/2022 after 3.00 PM**

**For Central and South Zone Trials**

**Last date for submission of seeds at CICR, Coimbatore: 26/04/2022 before 4.00 PM**

The entries received for trials were listed along with the local check.

**GENERAL POINTS TO BE NOTED**

- The trials should be conducted strictly as per the technical programme **and no other entry should be included** in the trial (including the check varieties).
- All the trials should have at least one border row.
- All the data sheets should have Name of the agency conducting trial, location of the trial (and not the location of the company) and the name of the trial.
- All those who are conducting the breeding trials are requested to furnish both the mean data as well as the replicated data analyzed statistically. The mean data is to be submitted as per the model data sheet given below as **Excel sheet and not as Word file**.

| S. No. | Code# | SCY (kg/ha) | LY (kg/ha) | GOT (%) | Boll No | Boll Wt (g) | Upper Half Mean Length (mm) | Mic | BS (g/tex) | Seed Oil (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 101 | | | | | | | | | |
| 2 | 102 | | | | | | | | | |
| | | | | | | | | | | |
| N | 10n | | | | | | | | | |
| | CD@5% | | | | | | | | | |
| | CV % | | | | | | | | | |

#Code numbers in ascending order; n=number of coded entries

- The data should be submitted separately in different Excel sheets for each trial, and the data of different trials are not to be combined in a single sheet.
- The incomplete and insufficient data will not be included in report preparation, and shall be reported to the higher officials for noncompliance.
- The **lint samples pooled over replications should be prepared for all the entries from the first picked kapas**, cleaned neatly and labeled properly (mentioning the name of the agency conducting the trial, location of the trial, and AICRP code number in each packet of the lint sample) and sent to concerned CIRCOT centre for fibre quality evaluation in time (**on or before 30-12-2022**). Kindly send the lint samples with AICRP Breeding trial code only to

CIRCOT, or else the sample will not be evaluated. **The centres should ensure door delivery of lint to above mentioned CIRCOT units**.

- **Kindly send the data on or before 30-12-2022 (for north zone locations) 15-01-2023 (for central zone locations) and 30-01-2023 (for south zone locations).**
- All are requested to visit the website of CICR / AICCIP at **www.cicr.org**.in for any information, announcement etc. No communication in any respect will be sent individually.
- **All the breeders are requested to part 40g seed of varieties and 20 g of hybrids for Pathology / entomology observations and no separate packets will be given to pathologists / entomologists.**
- Seeds received in less quantity than the prescribed quantity will not be included in the trial.
- All the breeders of the varieties / hybrids recommended for agronomic trials are requested to submit the required quantity of **seeds directly to the concerned agronomists (and not to Project Coordinator)** and to keep track with the agronomists for getting the data on agronomy trial and to submit the lint samples for micro-spinning to CIRCOT, Mumbai.

## NORTH ZONETRIALS

### Br. 22 a/b Initial Evaluation Trial -*G. arboreum*

| S. No | Entry | Sponsored by | Locations | LC (2) |
|---|---|---|---|---|
| 1. | PBD 154 | PAU, Bathinda | SGNR | RG 542 |
| 2. | PBD 155 | PAU, Bathinda | Faridkot | LD 949 |
| 3. | RG 892 | SKRAU, Sriganganagar | Bathinda | LD 949 |
| 4. | RG 895 | SKRAU, Sriganganagar | Hisar | HD 432 |
| 5. | HD 545 | CCS HAU, Hisar | Sirsa (C) | CISA 310 |
| 6. | HD 563 | CCS HAU, Hisar | | |
| 7. | FDK 331 | PAU, Faridkot | | |
| 8. | FDK 341 | PAU, Faridkot | | |
| 9. | FDK 345 | PAU, Faridkot | | |
| 10. | CISAA 33-9 | CICR, Sirsa | | |
| 11. | CISAA 6-165 | CICR, Sirsa | | |
| 12. | ZC (FDK 124) | | | |
| 13. | LC | | | |

| | |
|---|---|
| **Trial** | Design: RBD; Rows: 2 (6 m length); Reps: 3; Seed Qty: 120 g X 5 + 2 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

### Br. 25 a/b Preliminary Hybrid Trial - Desi Hybrid

| S. No | Name of Entry | Sponsor | Locations | LC |
|---|---|---|---|---|
| 1. | AAH 46 | CCS HAU, Hisar | Sriganganagar | RAJ DH. 9 |
| 2. | AAH 47 | CCS HAU, Hisar | Bhatinda | FMDH 9 |
| 3. | KR 160 | Shakti Vardhak | Hisar | AAH 1 |
| 4. | KR 161 | Shakti Vardhak | Arya Nagar (Shakti Vardhak) | AAH 1 |
| 5. | KR 162 | Shakti Vardhak | Sirsa (CICR) | CICR-2 |
| 6. | CISAA 21-1 | CICR, Sirsa | | |
| 7. | CISAA 21-2 | CICR, Sirsa | | |
| 8. | LC | | | |
| 9. | ZC (KR 64-NZ) | | | |

| | |
|---|---|
| **Trial** | Design: RBD; Rows: 2 (6 m length); Reps: 3; Seed Qty: 100 g X 5 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-04 a – Coordinated Variety trial of *G. hirsutum***

| Entries retained | Location | Local Check |
|---|---|---|
| F 2732 | Sriganganagar | RS 2013 |
| F 2743 | Faridkot | LH 2108 |
| ZC (F 2228) | Bathinda | LH 2108 |
| Quality Check (CSH 3129) | Hisar | H 1098 i |
| LC | Sirsa | CSH 3129 |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 4; Rows: 8 (6 m length); Seed qty: 500 g X 5 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-24 a - Coordinated Variety trial of *G. arboreum***

| Entries promoted | Entries retained | Location | Local Check |
|---|---|---|---|
| FDK 325 | FDK 324 | Sriganganagar | RG 542 |
| PBD 156 | FDK 312 | Hisar | HD 432 |
| RG 868 | | Faridkot | LD 949 |
| FDK 315 | | Bathinda | LD 949 |
| RG 888 | | Sirsa (CICR) | CISA 614 |
| CISA 33-7 | FDK 124 (ZC) | | |
| FDK 325 | Local Check | | |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 3; Rows: 4 (6 m length); Seed qty: 250 g X 5 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-25 a Coordinated Desi Hybrid trial**

| Entries promoted | Entries retained | Location | Local Check |
|---|---|---|---|
| KR 152 | KR 149 | Sriganganagar | RAJ DH 9 |
| CISAA 20-1 | CISAA 19-4 | Hisar | AAH 1 |
| KR 153 | KR 150 | Faridkot | FMDH 9 |
| Zonal Check (KR 64) | | Bathinda | FMDH 9 |
| Local Check | | Aryanagar (Shaktivardhak) | CISAA 2 |
| | | Sirsa (CICR) | CISAA 2 |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 3; Rows: 4 (6 m length); Seed qty: 200 g X 6 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

## CENTRAL ZONETRIALS

### Br. 22 a/b IET-*G. arboreum*

| S. No | Entry | Sponsor | Locations | LC (2) |
|---|---|---|---|---|
| 1. | GAM 288 | JAU, Amreli | Amreli | G.Cot.19 |
| 2. | GAM 296 | JAU, Amreli | Khandwa | JK 5 |
| 3. | CNA 1084 | CICR, Nagpur | Akola | AKA. 8 |
| 4. | CNA 1085 | CICR, Nagpur | Parbhani | PA 740 |
| 5. | CNA 1086 | CICR, Nagpur | Jalgaon | JLA 505 |
| 6. | CNA20178 | CICR, Nagpur | Nagpur | AKA. 8 |
| 7. | GBav 137 | NAU, Bharuch | Bharuch | GN Cot 29 |
| 8. | GBav 181 | NAU, Bharuch | Viramgam | G Cot 19 |
| 9. | AKA 2016-3 | PDKV, Akola | | |
| 10 | PA 919 | VNMKV, Parbhani | | |
| 11 | PA 929 | VNMKV, Parbhani | | |
| 12 | KGA 1001 | JNKVV, Khandwa | | |
| 13 | JLA 1641 | MPKV, Jalgaon | | |
| 14 | JLA 1707 | MPKV, Jalgaon | | |
| 15 | GVav 1332 | AAU, Viramgam | | |
| 16 | ZC (AKA 7) | | | |
| 17 | LC | | | |
| 18 | QC (PA 255) | | | |

| | |
|---|---|
| **Trial** | Design: RBD; Rows: 2 (6 m length); Reps: 3; Seed Qty: 120 g X 8 + 2 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

### Br. 32b IET of *G. herbaceum*

| S.No | Name of Entry | Sponsor | Locations | LC (2) |
|---|---|---|---|---|
| 1. | GShv 812/17 | NAU, Surat | Surat | GN.Cot.25 |
| 2. | GShv 843/17 | NAU, Surat | Bharuch | GN.Cot.25 |
| 3. | GBhv 334 | NAU, Bharuch | Viramgam | GADC 3 |
| 4. | GBhv 340 | NAU, Bharuch | Bharuch (CSSRI) | GN.Cot.25 |
| 5. | GBhv 356 | NAU, Bharuch | Dhandhuka | GADC 3 |
| 6. | CNh-33 | CICR, Nagpur | Kukada | GN Cot 25 |
| 7. | CNh 66 | CICR, Nagpur | | |
| 8. | ZC (G Cot 23) | | | |
| 9. | LC | | | |

| | |
|---|---|
| **Trial** | Design: RBD; Rows: 2 (6 m length); Reps: 3; Seed Qty: 120 g X 6 + 2 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-03 a/b – PVT Coloured cotton - Irrigated**

| New Entry | Entries promoted | Entries Retained | Location | Local Check |
|---|---|---|---|---|
| | CNH 20449 | CNH 17395 | Surat (R) | GN.Cot. 22 |
| | CCH 20452 | CNH 19325 | Khandwa (I) | JK 4 |
| Phule Yamuna (ZC) | DHCC 2151 | CNH 19480 | CICR, Nagpur (R) | AKH 8828 |
| Local Check | CNH 20449 | | | |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 3; Rows: 4 (6 m length); Seed qty: 200 g X 3 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-24 b CVT – *G. arboreum***

| Entries promoted | Entries retained | Location | Local Check |
|---|---|---|---|
| JLA 1204 | CNA 1072 | Amreli | G Cot 19 |
| GAM 283 | JLA-1430 | Akola | AKA 8 |
| AKA 2016-11 | GAM 269 | Jalgaon | JLA 505 |
| QC (PA 255) | GAM 266 | Parbhani | PA 740 |
| ZC (AKA 7) | | Khandwa | JK 5 |
| LC | | Nagpur | AKA 8 |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 3; Rows: 4 (6 m length); Seed qty: 200 g X 6 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-24b – CVT Coloured Cotton - Arboreum**

| New Entries | Entries retained | Location | Local Check |
|---|---|---|---|
| | DDCC 2001 | Khandwa | JK 5 |
| | CNA 19475 | Surat | G. Cot 19 |
| | CNA 1092 | Nanded | PA 255 |
| | CNA 20402 | Nagpur | AKA 8 |
| | AKA 7 (Zonal Check) | Parbhani | PA 740 |
| | Local Check | Jalgaon | JLA 505 |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 4; Rows: 4 (6 m length); Seed qty: 200 g X 6 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

## SOUTH ZONE TRIALS

### Br-03 a/b (CC) – PVT Colour Cotton - Irrigated

| New Entries | Entries Retained | Location | Local Check |
|---|---|---|---|
| | DHCC 2151 | Srivilliputhur (I) | SVPR 6 |
| | DHCC 2002 | Raichur (I) | BGDS1063 |
| | Suraj (Zonal Check) | Dharwad (R) | ARBH 813 |
| | Local Check | Lam (I) | Sivanandi |
| | Vaidehi 1 (ZC CC) | Nandyal (R) | Sivanandi |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 4; Rows: 4 (6 m length); Seed qty: 200 g X 5 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

### Br-04a – CVT - Irrigated

| Entries | Location | Local Check |
|---|---|---|
| RAH 1081 | Arabhavi | ARBH 813 |
| RAH 1082 | Lam | NDLH 1938 |
| RAH 1083 | Srivilliputhur | SVPR 6 |
| TSH 387 | Raichur | BGDS1063 |
| ZC (Suraj) | | |
| LC | | |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 4; Rows: 8 (6 m length); Seed qty: 500 g X 4 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

### Br – 14 a CVT *G. barbadense*

| New Entries | Entries retained in 14a | Location |
|---|---|---|
| CCB22-2 | CCB 26 | Coimbatore (TNAU) |
| CCB22-1 | CCB 6 | Dharwad |
| SIMA B-8 | | Chamraj Nagar |
| | ZC (Rhcb-011-CZ; Suvin-SZ) | Rahuri |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 4; Rows: 8 (6 m length); Seed qty: 400 g X 4 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br-24 b: CVT – G. arboreum**

| New Entries | Entries promoted | Location | Local Check |
|---|---|---|---|
| NDLA 3152-1 | MDL 2674 | Dharwad | AKA 235 |
| NDLA 3146-2 | CNA 2034 | Nandyal | Yaganti |
| DWDa 2251 | PA 888 | Kovilpatti | K 12 |
| DWDa 2252 | DWDa 2051 | | |
| CNA 1084 | PA 887 | | |
| CNA 1085 | PA 898 | | |
| CNA 1086 | PAIG 411 | | |
| | ZC (DLSa 17) | | |
| | LC | | |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 3; Rows: 4 (6 m length); Seed qty: 200 g X 3 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

**Br24a/b – CVT Arboreum (CC) – Rainfed**

| New Entries | Entries Retained | Location | Local Check |
|---|---|---|---|
| | DDCC 2001 | Dharwad | AKA 235 |
| | DDCC 2151 | Nandyal | Yaganti |
| | DDCC 1 (CC) | Kovilpatti | K 12 |
| | Local Check | | |

| | |
|---|---|
| **Trial** | Design: RBD; Reps: 5; Rows: 4 (6 m length); Seed qty: 400 g X 3 |
| **Data to be recorded** | Seed cotton yield (kg/ha); Lint yield (kg/ha), Ginning outturn (%), Boll number/plant; Boll weight (g) |
| **Fiber quality** | Consolidated lint samples may be prepared and sent to ICAR-CIRCOT, Mumbai for fibre quality evaluation in HVI mode |

## ENTRIES PROPOSED FOR AGRONOMY TRIAL

| Zone | Species | Variety / Hybrid | Irrigated / Rainfed | Entries |
|---|---|---|---|---|
| North Zone | *G. arboreum* | Variety | Irrigated | PBD 88 |
| Central Zone | *G. hirsutum* | Variety | Irrigated | GJHV 566 |
| | *G. hirsutum* | Variety | Rainfed | TVH 007 |
| | *G. hirsutum* | Variety (Coloured Cotton) | Rainfed | CNH 18529 |
| | *G. arboreum* | Variety | Rainfed | NDLA 3116-3, AKA 2013-8, PA 873 |
| | *G. arboreum* | Variety (Coloured Cotton) | Rainfed | DDCC 1901 |
| South Zone | *G. hirsutum* | Variety | Irrigated | CPD 1902, CCH 19-2 |
| | *G. hirsutum* | Variety (Coloured Cotton) | Irrigated / Rainfed | DHCC 1901, CCHC 19-1 CCHC 19-2 |
| | *G. barbadense* | Variety | Irrigated | DB 1901 |
| | *G. hirsutum* | Variety | Rainfed | NDLH 2056-4, CCH 19-2 |
| | *G. arboreum* | Variety | Rainfed | NDLA 3104-4 |
| | *G. arboreum* | Variety (Coloured Cotton) | Rainfed | DDCC 1902 |

All the breeders of the above varieties / hybrids are requested to submit 1.0 kg (variety)/0.5 kg (hybrid) of **seeds directly to the concerned agronomists (and not to Project Coordinator)** and to keep track with the agronomists for getting the data on agronomy trial and to submit the lint samples to CIRCOT from concerned location. The agronomists are requested to submit **6 kg of lint samples for full scale spinning directly to Director, CIRCOT, Mumbai (Door Delivery only).** Further, agronomists are requested to send the agronomic trials data to the concerned breeder in addition to the Principal Investigator (Agronomy) in time to facilitate the breeder to submit the release proposals before due date.

# Pre-Breeding Program

**Centre : Main Cotton Research Station ,NAU, Surat**

<table>
<tr><th>S. No.</th><th>Activity for 2022-23</th></tr>
<tr><td>1.</td><td>Crosses between available wild species and cultivated diploid and tetraploid cotton species</td></tr>
<tr><td></td><td>Following crosses will continues for next season
<table>
<tr><th>Female</th><th>Male</th></tr>
<tr><td>{(G-6 X G.anomalum) X G.tomentosum} X G.Cot.10</td><td>G.Cot.10</td></tr>
<tr><td>(Karnugani-1 X G.stocksii) X G.Cot.10</td><td>G.Cot.10</td></tr>
<tr><td>{(G-6 X G.anomalum) X G.tomentosum} X G.Cot.10</td><td>GN.Cot.22</td></tr>
<tr><td>(Karnugani-1 X G.stocksii) X G.Cot.10</td><td>GN.Cot.22</td></tr>
</table></td></tr>
<tr><td>2.</td><td>Growing successful crosses and back crossing with cultivated parents</td></tr>
<tr><td></td><td>Growing of previous year two successful crosses i.e. {(G-6 X G.anomalum) X G.tomentosum} X G.Cot.10} x GN.Cot.22, {(Karnugani-1 X G. stocksii) X G.Cot.10} x GN.Cot.22 and back crossing with cultivated parents</td></tr>
<tr><td>3.</td><td>Cholchicine treatment for doubling the chromosome of successful crosses between wild species and cultivated species</td></tr>
<tr><td></td><td>Cholchicine treatment should apply if necessary to previous year successful crosses</td></tr>
<tr><td>4.</td><td>Segregating introgression lines to be shared among the participating centers (with quantity of seeds)</td></tr>
<tr><td></td><td>1. GISV 331 x CCH 15-1 : Segregating lines with high ginning percent > 40% (200 g linted seed harvested from F3 population is available for sharing)<br>2. GISV 323 x TCH 1716 : Segregating lines with high ginning percent > 40% and stay green character (200 g linted seed harvested from F4 population is available for sharing)</td></tr>
</table>

**CICR, Regional Station, Coimbatore**

Material Wild: *G.Aridum*(D4), *G. armourianum* (D2)
Triploid: *G. hirsutum x G.triphyllum*(AD1B2)
Races: *G. arboreum* 2 plants, *G. barbadense*

- Maintenance: Propagating the *G.armourianum* through cuttings, inducing boll formation and seed collection
- Attempting wide crosses: *G. aridum*(D4), *G. armourianum* (D2) with diploid and tetraploid cultivars
- Evaluation and establishing of new crosses and segregating lines of NDLH 1938 xwild Barbadense (F1)
- Attempting colchicine treatment (Cotton swab method) to double the triploid plant obtained from the crosses between NDLH 1938 x *G.armourianum* (F1), *G.arboreum* x *G.anomalum* and FBt 1968 X *G.armourianum* (F1), further maintaining the triploid lines

**PAU Faridkot and Ludhiana**

From a few $BC_1F_1$ seeds of the cross, *G. hirsutum* × *G. armourianum* obtained during 2021-22, $BC_1F_1$ plants will be raised and screened for CLCuD resistance. CLCuD resistant $BC_1F_1$ plants will be backcrossed with *G. hirsutum* to obtain $BC_2F_1$ seeds.

As a few BC1F1 seeds were obtained, therefore, it will not be possible to share BC1F1 seeds. However, we have already shared F1 seeds of *G. hirsutum x G. armourianum* crosses during 2021-22.

**CICR, Nagpur**

1. Multiplication of seeds of the newly imported Gossypium species from USDA.
2. Utilising tetraploid Gossypium species especially *G. tomentosum*&*G. mustelinum* in crossing with popular *G. hirsutum* varieties (to be identified & finalised)
3. Advancing $F_1$ fertile crosses (obtained in previous year 2021-22) to $F_2$& Backcrossing with recurrent parent
   a. *G. stocksii* - drought tolerance
   b. *G.capitisvirides* - Bacterial Blight tolerance
   c. *G.davidsonii*- tolerance to sucking pests, salinity & Bacterial blight
4. Identification & characterization of the best line among the 10 lines of *G.arboreum* x *G. longicalyx* evaluated at various cenrtes during 2021-22 for registration as Genetic stock.
5. Evaluation of the following material for second year:

| **Details** | **Centre** | **Trait** |
|---|---|---|
| Segregating material of the cross *G. hirsutum x G. armourianum* | PAU, Faridkot | Sucking pest tolerance |
| Stable line of the cross *G. arboreum x G. anomalum* | MPKV, Rahuri | Fibre quality |
| Segregating line of the cross GISV 322 X CCH 15-1 | NAU, Surat | Jassid tolerance |
| Segregating line of the cross GISV 316 x BGDS 1033 | NAU, Surat | High Ginning Outturn |
| Notified variety GISV 218 (G. N. Cot. 22) | NAU, Surat | Jassid tolerance |

**Material for sharing among partners**:

1. Introgressed lines with fairly good fibre fineness combined with tolerance to major pests and diseases – 20 lines
2. Progenies of *G.arboreum* race Indicum x *G. davidsonii* – 10 stable lines

*[Special traits of G. davidsonii -tolerance to sucking pests, salinity & Bacterial blight]

**MPKV, Rahuri**

**A) Interspecific hybridization**

I. Interspecific hybridization will be attempted in two crosses
   - *G. arboreum* x *G. thurberi*
   - *G. arboreum* x *G. raimondii*

**B) Phenotypic characterization of selfed seed of segregating material received from ICAR-Central Institute for Cotton Research, Regional Station, Coimbatore**

Details of selfed seed available with Cotton Improvement Project, MPKV Rahuri

| Sr. No. | Segregating Material |
|---|---|
| **1.** | *G. a* x *G. r. 99-1* |
| **2.** | *G. a* x *G. r. 125-2* |
| **3.** | *G. a* x *G. r. 113-5* |
| **4.** | *G. a* x *G. r. 126-1* |
| **5.** | *G. a* x *G. r. 122-1* |
| **6.** | *G. a* x *G. r. 118-1* |
| **7.** | *G. a* x *G. r. 115-2* |
| **8.** | *G. a* x *G. r. 119-1* |
| **9.** | *G. a* x *G. r. 134-2* |
| **10.** | *G. a* x *G. r. 82-2* |
| **11.** | G.N. cot-22(GISV-218) |
| **12.** | GISV 322x CCH-15-1 (Seg. Line) |
| **13.** | GISV-316 x BGDS-1033 (Seg. Line) |

## TECHNICAL PROGRAMME OF ICAR-Bt COTTON TRIALS: 2022-23

**Private R & D (for deregulated Bt event only)** – Please pay the prescribed testing fee (as detailed below) through online in State Bank of India Current A/c no. 10663183268, IFSC code no. SBIN0002274 in favour of the Project Coordinator (Cotton Improvement), Coimbatore. No entry shall be entertained without the submission of testing fee and hard copy of all the documents as per the ICAR Test Guidelines (available in official website).

| S. No. | Particulars | Total per entry for 2 locations |
|---|---|---|
| 1 | Testing fee | Rs.2,00,000 |
| 2 | GST @ 18% | Rs. 36,000 |
| 3 | Total | Rs.2,36,000 |
| 4 | TDS @ 10.0% (-) | Rs. 20,000 |
| 5 | Total amount payable | Rs.2,16,000 |

| S. No. | Particulars | Total per entry for 3 locations |
|---|---|---|
| 1 | Testing fee | Rs.3,00,000 |
| 2 | GST @ 18% | Rs. 54,000 |
| 3 | Total | Rs.3,54,000 |
| 4 | TDS @ 10.0% (-) | Rs. 30,000 |
| 5 | Total amount payable | Rs.3,24,000 |

| S. No. | Particulars | Total per entry for 4 locations |
|---|---|---|
| 1 | Testing fee | Rs.4,00,000 |
| 2 | GST @ 18% | Rs. 72,000 |
| 3 | Total | Rs.4,72,000 |
| 4 | TDS @ 10.0% (-) | Rs. 40,000 |
| 5 | Total amount payable | Rs.4,32,000 |

| S. No. | Particulars | Total per entry for 5 locations |
|---|---|---|
| 1 | Testing fee | Rs.5,00,000 |
| 2 | GST @ 18% | Rs. 90,000 |
| 3 | Total | Rs.5,90,000 |
| 4 | TDS @ 10.0% (-) | Rs. 50,000 |
| 5 | Total amount payable | Rs.5,40,000 |

## Bt COTTON NORTH ZONE TRIALS

**Last date for submission of seeds at CICR, Sirsa: 19/04/2022 before 4.00 PM**

**Issue of coded seeds: 21/04/2022 after 3.00 PM**

### GENERAL POINTS TO BE NOTED

- The seeds sponsored for the trials should be acid delinted without any seed treatment and seeds to be packed individually as per the quantity mentioned and number of location and **each packet of seed must be labeled with the name of the sponsoring company, name of the entry, trial name, etc.**
- No seeds shall be accepted after the due date as mentioned above for coding.
- The list of entry as per the trial given below is final, and no addition / modification will be entertained.
- M/s. Rasi Seeds and M/s. Seed works are requested to send requisite seeds of check hybrids as indicated in each trial**.**

### Initial Evaluation Trial of Intra-Hirsutum Hybrids(Testing Fee for five locations)

| S. No. | Entries | Sponsored by | Location |
|---|---|---|---|
| 1. | ACH-911-2 BGII | Ajeet SeedsPvt Ltd | Sriganganagar |
| 2. | ACH-944-2 BGII | Ajeet Seeds Pvt Ltd | Faridkot |
| 3. | ARCH 1006 BG II | Ankur Seeds Pvt Ltd | Bathinda |
| 4. | ARCH 1010 BG II | Ankur Seeds Pvt Ltd | Hisar |
| 5. | BIO 6275 BGII | Bioseed Research India | CICR, Sirsa |
| 6. | BIO 6635 BGII | Bioseed Research India | Sriganganagar (Ankur) |
| 7. | SP7701 BGII | Crystal Crop Protection Limited | Hanumangarh (Kaveri) |
| 8. | DACH 45N45 BG II | Dharti Seeds | Abohar (Mahyco) |
| 9. | DACH 47N47 BG II | Dharti Seeds | Sirsa (Bioseed) |
| 10. | HYCH - 1278 | Hi Yield Agri Genetics Pvt Ltd. | |
| 11. | KCH 9377 BG II | Kaveri Seeds Pvt Ltd | |
| 12. | KCH 9388 BG II | Kaveri Seeds Pvt Ltd | |
| 13. | C 9316 BG II | Mahyco Pvt Ltd | |
| 14. | C 9317 BG II | Mahyco Pvt Ltd | |
| 15. | DC5418 BGII | Rallis India Limited | |
| 16. | CT003 BGII | Rasi Seeds Pvt Ltd | |
| 17. | CT006 BGII | Rasi Seeds Pvt Ltd | |
| 18. | US 712 BGII | Seed Works International Pvt Ltd | |
| 19. | **Zonal BGII Check – 1** | **RCH 773 BG II** | |
| 20. | **Zonal BGII Check – 2** | **US 51 BG II** | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 9<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at PAU, Faridkot and CICR, Sirsa |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial of Intra-Hirsutum Hybrids– I (Testing Fee for five locations)**

| S. No. | Entries Promoted from IET | Sponsored by | Remark | Location |
|---|---|---|---|---|
| 1. | DC 5417 BGII | Rallis India Limited | High yield at 140 DAS | Sriganganagar |
| 2. | SP7692 BGII | Crystal Crop Protection Limited | High GOT | Faridkot |
| 3. | RCH 997 BG II | Rasi Seeds Pvt Ltd | CLCuV and foliar disease tolerant | Bathinda |
| 4. | US 709 BGII | Seed Works International Pvt Ltd | Better fibre quality, CLCuD Resistant | Hisar |
| 5. | ACH-927-2 BGII | Ajeet Seeds Pvt Ltd | Better fibre quality, CLCuD Resistant | CICR, Sirsa |
| 6. | ACH-559-2 BGII | Ajeet Seeds Pvt Ltd | High GOT and CLCuD Resistant | Sriganganagar (Kaveri) |
| 7. | US 705 BG II | Seed Works International Pvt Ltd | -1.3%, better CLCUD, Better tenacity, Retained | Sriganganagar (Rallis) |
| 8. | RCH 986 BG II | RasiSeeds Pvt Ltd | CLCuV, Jassid and foliar disease tolerant, Retained | Hisar (Seed works) |
| 9. | C 9315 BG II | Mahyco Pvt. Ltd. | 1.7%, CLCuD Resistant, Retained | |
| 10. | SP7683 BGII | Crystal Crop Protection Limited | Higher lint yield, biotic resistance, Retained | |
| 11. | **Zonal BGII Check – 1** | **RCH 773 BG II** | | |
| 12. | **Zonal BGII Check – 2** | **US 51 BG II** | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 8<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at PAU, Faridkot and CICR, Sirsa |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial of Intra-Hirsutum Hybrids – II (Testing Fee for five locations)**

| S. No. | Entries Promoted from AET-I | Sponsored by | Remark | Location |
|---|---|---|---|---|
| 1. | MC 5410 BG II | Rallis India Limited | Promoted from AET 1 | Sriganganagar |
| 2. | KCH 9344 BG II | Kaveri Seeds Pvt Ltd | Promoted from AET 1 | Faridkot |
| 3. | ACH 902-2 BG II | Ajeet Seeds Pvt Ltd | Promoted from AET 1 | Bathinda |
| 4. | KCH 9322 BG II | Kaveri Seeds Pvt Ltd | Promoted from AET 1 | Hisar |
| 5. | C 9314 BG II | Mahyco Pvt. Ltd. | Promoted from AET 1 | CICR, Sirsa |
| 6. | RCH 983 BG II | RasiSeeds Pvt Ltd | Promoted from AET 1 | Sriganganagar (Kaveri) |
| 7. | KCH9323 BGII | Kaveri Seeds Pvt Ltd | 4.3 %, Retained | Sriganganagar (Rallis) |
| 8. | KCH9333 BGII | Kaveri Seeds Pvt Ltd | 4.7 % , Retained | |
| 9. | **ZC BGII Check – 1** | **RCH 773 BG II** | | |
| 10. | **ZC BGII Check – 2** | **US 51 BG II** | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 7<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Quantity of Cry Protein data to be generated at ICAR-CICR, Sirsa and PAU, Faridkot as detailed at the end.Bio-efficacy data to be generated at ICAR-CICR, Sirsa. |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Compact Intra-Hirsutum Hybrids(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location |
|---|---|---|---|
| 1. | ACH-72-2 BGII | Ajeet Seeds Pvt Ltd. | Hisar |
| 2. | ARCH 2020 BGII | Ankur Seeds Private Limited | Bathinda |
| 3. | C 9403 BG II | Mahyco Pvt. Ltd. | Sriganganagar |
| 4. | Rasi Max 036BGII | Rasi seeds(P) Ltd, | Faridkot |
| 5. | Rasi Max 039BGII | Rasi seeds(P) Ltd, | CICR, Sirsa |
| 6. | **(ZC) RCH 773 BG II under closer spacing (coded)** | | Sriganganagar (Kaveri) |
| 7. | **ZC(2) – US 51 BG II under closer spacing (coded)** | | Abohar (Mahyco) |
| 8. | **(ZC) RCH 773 BG II under normal spacing without coding** | | Fatehabad (Ankur) |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 8;<br>Protected: 6 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm; Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at PAU, Faridkot and CICR, Sirsa. |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial– I of Compact Intra-Hirsutum Hybrids(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remarks | Location |
|---|---|---|---|---|
| 1. | Rasi Max 003 BGII | Rasi seeds(P) Ltd, | Promoted | Hisar |
| 2. | Rasi Max 001 BGII | Rasi seeds(P) Ltd, | Promoted | Bathinda |
| 3. | **(ZC) RCH 773 BG II under closer spacing (coded)** | | | Sriganganagar |
| 4. | **Zonal Check (2) – US 51 BG II under closer spacing (coded)** | | | Faridkot |
| 5. | **(ZC) RCH 773 BG II under normal spacing without coding** | | | CICR, Sirsa |
| | | | | Sriganganagar (Kaveri) |
| | | | | Hisar (Seed works) |

| | |
|---|---|
| **Trial** | Seed requirement: 500 g x 7;<br>Protected: 12 rows, 4 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm; Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at PAU, Faridkot and CICR, Sirsa. |
| **Agronomic and plant rotection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Bt Cotton Varieties (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1. | CICR Bt-30 | CICR, Sirsa | Sriganganagar | RS 2013 |
| 2. | CICR Bt-26 | CICR, Sirsa | Faridkot | LH 2108 |
| 3. | FBt 1905 | PAU, Faridkot | Bathinda | LH 2108 |
| 4. | FBt 1913 | PAU, Faridkot | Sirsa (CICR) | CSH 3129 |
| 5. | FBt 1916 | PAU, Faridkot | Hisar | H 1098i |
| 6. | PBH Bt 17 | PAU, Bathinda | | |
| 7. | PBH Bt 24 | PAU, Bathinda | | |
| 8. | HAU Bt 3 | CCSHAU, Hisar | | |
| 9. | **F 2228 (Non-Bt ZC)** | | | |
| 10. | **PAU Bt3 (Bt ZC)** | | | |
| 11. | **Local Check Non-Bt** | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 5<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial – II of Bt Cotton Varieties (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1. | ARCV 22 Bt | Ankur Seeds Private Limited | Sriganganagar | RS 2013 |
| 2. | FBt 1908 | PAU, Faridkot | Faridkot | LH 2108 |
| 3. | **F 2228 (Non-Bt ZC)** | | Bathinda | LH 2108 |
| 4. | **PAU Bt3 (Bt ZC)** | | Sirsa (CICR) | CSH 3129 |
| 5. | **Local Check Non-Bt** | | Hisar | H 1098i |

| | |
|---|---|
| **Trial** | Seed requirement: 250 g x 5<br>Protected: 4 rows, 4 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Compact Bt Cotton Varieties**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1. | FBt 2108 | PAU, Faridkot | Sriganganagar | RS 2013 |
| 2. | FBt 2121 | PAU, Faridkot | Faridkot | LH 2108 |
| 3. | **F 2228 (Non-Bt ZC)** | | Bathinda | LH 2108 |
| 4. | **PAU Bt3 (Bt ZC)** | | Sirsa (CICR) | CSH 3129 |
| 5. | **Local Check Non-Bt** | | Hisar | H 1098i |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 5<br>Protected: 6 rows, 4 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac to be carried at PAU, Faridkot and CICR, Sirsa |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

## Data to be recorded in all the above trials:

**Biometric evaluation**

1. Germination percentage
2. Plant stand at harvest
3. Plant height (cm) at harvest
4. Number of monopodia
5. Number of sympodia
6. Boll weight (g/boll)
7. Number of bolls / plant
8. Number of bolls / sq.m.
9. Lint Index (g)
10. Seed Index (g)
11. Ginning outturn (%)
12. Upper Half Mean Length (mm) under HVI Mode
13. Uniformity index under HVI Mode
14. Micronaire under HVI Mode
15. Tenacity under HVI Mode
16. Seed Cotton Yield (q/ha) at 140 DAS
17. Seed Cotton Yield (q/ha) at 165 DAS
18. Total Seed Cotton Yield (q/ha) (at 140 DAS + 165 DAS)
19. Qualitative presence of Cry Protein @ 30 days after sowing (DAS) following standard protocol (in leaf) and @ 90 days after sowing (DAS) following standard protocol (in square & boll tissues) in Initial Evaluation Trial and Advanced Evaluation Trial – I at ICAR-CICR, Sirsa and PAU, Faridkot.
    Quantity of Cry Protein @ 30, 60, 90& 120 days after sowing (DAS) following standard protocol (in leaf, square & boll tissues) in Advanced Evaluation Trial – II.
20. Bio-efficacy data to be generated at ICAR-CICR, Sirsa against insect pests. (under laboratory conditions in Advanced Evaluation Trial – II during the third year of evaluation against lepidopteron insect pests of cotton)

**Evaluation under Protected Condition for Insect pests & Diseases incidences**

1. Jassids (average of 3 leaves/plant)
2. Thrips (average of 3 leaves per plant)
3. Whitefly (average of 3 leaves/plant)
4. Bollworms (No. of larvae/5 plants)
5. Percent locule damage
6. Percent open boll damage
7. Percent Disease Index for major diseases

**Evaluation under unprotected condition for insect pests and diseases:**
**Insect pests:**

1. Jassids (average on 3 leaves/plant)
2. Thrips (average of 3 leaves per plant)
3. Spotted bollworms (mean of counts/5 plants)
4. Bollworms (mean of counts/5 plants)
5. Percent Locule damage
6. Percent Open boll damage
7. Population of natural enemies of insect pests of cotton
8. Number of sprays for sap sucking pests – Protected

**Plant Pathology observations**

1. Percent Disease Index (PDI) of Grey Mildew
2. Percent Disease Index(PDI) of Bacterial Leaf Blight
3. Percent Disease Index (PDI) of Alternaria Leaf Spot
4. Percent Disease Index (PDI) of CLCuD (in North Zone only)
5. Incidence of any other diseases/ disorders

***Note: The standard operating protocols for recording data on yield attributes, yield, insect pest and disease incidences as per ICAR-AICRP on Cotton shall be followed.***

## BT COTTON CENTRAL AND SOUTH ZONE TRIAL: 2022-23

**Last date for submission of seeds at CICR, Coimbatore: 26/04/2022 before 4.00 PM**

## CENTRAL ZONE TRIALS

**Initial Evaluation Trial of Intra-Hirsutum Hybrids – Irrigated (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | ACH-902-2 BGII | Ajeet Seeds Pvt Ltd | JAU, Junagadh | PCH 4599 BG II |
| 2 | ARCH 3132 BGII | Ankur Seeds Pvt Ltd | SDAU, Talod | PCH 4599 BG II |
| 3 | ARCH 6659 BGII | Ankur Seeds Pvt Ltd | MPKV, Rahuri | NCS 854 BG II |
| 4 | BIO 6004 BGII | Bioseed Research India | RVSKVV, Khandwa | RCH 659 BG II |
| 5 | BGCH-2001 BGII | Booster Plant Genetics P. Ltd. | Nagpur (Ankur) | NCS 854 BG II |
| 6 | SP7704 BGII | Crystal Crop Protection Limited | Aurangabad (Kaveri) | NCS 854 BG II |
| 7 | SP7333 BGII | Crystal Crop Protection Limited | | |
| 8 | DLCH 459 | DhanalakshmiSeedsPvt Ltd | | |
| 9 | DACH 70C70 BGII | Dharti Seeds | | |
| 10 | DACH 75C75 BGII | Dharti Seeds | | |
| 11 | Tarang BGII | Eldorado AgritechPvt. Ltd | | |
| 12 | HYCH –411 | Hi Yield Agri Genetics Pvt Ltd. | | |
| 13 | GJBHH-1901 BG-II | JAU, Junagadh | | |
| 14 | GJBHH-1912 BG-II | JAU, Junagadh | | |
| 15 | KCH9214 BGII | Kaveri Seeds Pvt Ltd | | |
| 16 | KCH9216 BGII | Kaveri Seeds Pvt Ltd | | |
| 17 | C 9337 BG II | MahycoPvt. Ltd. | | |
| 18 | NBC-211 BG II | Nath Biogenes (I) Ltd | | |

| | | | | |
|---|---|---|---|---|
| 19 | GSBHH 124 BG II | NAU, Surat | | |
| 20 | GSBHH 151 BG II | NAU, Surat | | |
| 21 | DC5103 BG II | Rallis India Ltd. | | |
| 22 | DC5102 BGII | Rallis India Ltd. | | |
| 23 | CT016BGII | Rasi Seeds Pvt Ltd | | |
| 24 | CT018BGII | Rasi Seeds Pvt Ltd | | |
| 25 | RSCH-189 BG II | Royal Seeds Pvt Ltd | | |
| 26 | RSCH-459 BG II | Royal Seeds Pvt Ltd | | |
| 27 | US 713 BG II | Seed Works International Pvt Ltd | | |
| 28 | US 714BG II | Seed Works International Pvt Ltd | | |
| 29 | Vikky 5 BG II | Vikky`s Agrisciences Pvt Ltd | | |
| 30 | Vikky 7 BG II | Vikky`s Agrisciences Pvt Ltd | | |
| 31 | Vikky 9 BG II | Vikky`s Agrisciences Pvt Ltd | | |
| 32 | MRC 7351 BG II (ZC) | | | |
| 33 | BG II Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 6<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagdh |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial of Intra-hirsutum Hybrids-I – Irrigated (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | DC 5100 BG II | Rallis India Ltd. | Promoted | JAU, Junagadh | PCH 4599 BG II |
| 2 | RCH 999 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | SDAU, Talod | PCH 4599 BG II |
| 3 | RCH 965 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | MPKV, Rahuri | NCS 854 BG II |
| 4 | SS 1188 BGII | Eldorado AgritechPvt. | 15.4 % ZC | RVSKVV, Khandwa | RCH 659 BG II |
| 5 | NCS 9711 Bt2 | Nuziveedu Seeds Ltd | Early, big boll | Nagpur (Ankur) | NCS 854 BG II |
| 6 | ACH-555-2 BGII | Ajeet Seeds Pvt Ltd | High GOT | Aurangabad (Seed Works) | NCS 854 BG II |
| 7 | MRC 7351 BG II (ZC) | | | Gangapur (Ajeet) | NCS 854 BG II |
| 8 | BG II Local Check | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 7<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagadh |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial-II of Intra-hirsutum Hybrids – Irrigated (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | ATCH 1365 BG II | Agri Top Seeds | Promoted | JAU, Junagadh | PCH 4599 BG II |
| 2 | RCH 989 BG II | Rasi Seeds Pvt Ltd | Jassid and Foliar diease tolerant | AAU, Anand | PCH 4599 BG II |
| 3 | RCH 981 BG II | Rasi Seeds Pvt Ltd | Jassid and Foliar diease tolerant | MPKV, Rahuri | NCS 854 BG II |
| 4 | ACH-981-2 BGII | Ajeet Seeds Pvt Ltd | Promoted | RVSKVV, Khandwa | RCH 659 BG II |
| 5 | Super 2141 BG II | Super Seeds | Pest and disease tolerance | Gangapur (Ajeet) | NCS 854 BG II |
| 6 | BIO 6101 BGII | Bioseed | >6% yield over ZC in MP | | |
| 7 | D 1199 BG II | DaftariAgro Pvt Ltd | Good fibre quality | | |
| 8 | D 1579 BG II | DaftariAgroPvt. Ltd | Good fibre quality | | |
| 9 | MRC 7351 BG II (ZC) | | | | |
| 10 | BG II Local Check | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 5<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagadh<br>Bio-efficacy data to be generated at MPKV, Rahuri. |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Compact Intra-Hirsutum Hybrids – Irrigated**
**(Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | ACH-27-2 BGII | Ajeet SeedsPrivate Ltd | JAU, Junagadh | PCH 4599 BG II |
| 2 | NCS 8022 Bt2 | Nuziveedu Seeds Ltd | SDAU, Talod | PCH 4599 BG II |
| 3 | DC5301 BG II | Rasi seeds(P) Ltd | MPKV, Rahuri | NCS 854 BG II |
| 4 | Rasi Max 069BGII | Rasi seeds(P) Ltd, | RVSKVV, Khandwa | RCH 659 BG II |
| 5 | Rasi Max 060BGII | Rasi seeds(P) Ltd, | Aurangabad (Seed Works) | NCS 854 BG II |
| 6 | MRC 7351 BG II (ZC) (coded under closer spacing) | | Jalgaon (PrabhatAgri) | |
| 7 | Local Check (coded under closer spacing) | | | |
| 8 | MRC 7351 BG II (ZC) (normal spacing without coding) | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 5<br>Protected: 6 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm; Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagadh |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial-I of Compact Intra-Hirsutum Hybrids – Irrigated**
**(Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | ARCH 3028 BG II | Ankur Seeds Private Ltd | Promoted | JAU, Junagadh | PCH 4599 BG II |
| 2 | Rasi Max 006 BGII | Rasi Seeds Pvt Ltd | Promoted | AAU, Anand | PCH 4599 BG II |
| 3 | Rasi Max 009 BG II | Rasi Seeds Pvt Ltd | Early with High GOT | MPKV, Rahuri | NCS 854 BG II |
| 4 | ACH-9-2 BGII | Ajeet Seeds Private Ltd | High GOT | RVSKVV, Khandwa | RCH 659 BG II |
| 5 | MRC 7351 BG II (ZC) (coded under closer spacing) | | | Nagpur (Ankur) | NCS 854 BG II |
| 6 | Local Check (coded under closer spacing) | | | | |
| 7 | MRC 7351 BG II (ZC) (normal spacing without coding) | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 500 g x 5<br>Protected: 12 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm; Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagadh |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Combined Evaluation Trial of Interspecific H X B Hybrids – Irrigated (Testing Fee for two locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | Indam-1624 BG II | Indo-American Hybrid Seeds (I) Pvt. Ltd. | MPKV, Rahuri | Bahubali |
| 2 | Indam-1643 BG II | Indo-American Hybrid Seeds (I) Pvt. Ltd. | ARS, Banswara | Bahubali |
| 3 | C 7938 BG II | MahycoPvt. Ltd. | | |
| 4 | C 7939 BG II | MahycoPvt. Ltd. | | |
| 5 | MRC 7918 BG II (ZC) | | | |
| 6 | DCH 32 (Non Bt ZC) | | | |
| 7 | BG II Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 2<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Quantitative ELISA to estimate Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri; Bio-efficacy data to be generated at MPKV, Rahuri. |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Hirsutum Varieties – Irrigated (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | CICR Bt 2 | CICR, Nagpur | JAU, Junagadh | GN. Cot 22 |
| 2 | CICR Bt 4 | CICR, Nagpur | SDAU, Talod | GN. Cot 22 |
| 3 | CICR Bt 12 | CICR, Nagpur | MPKV, Rahuri | Phule 688 |
| 4 | GISV 312 Cry1Ac | NAU, Surat | RVSKVV, | JK 4 |
| 5 | GPC 28 Cry1Ac | NAU, Surat | | |
| 6 | BC 68-2 Cry 1Ac | NAU, Surat | | |
| 7 | NH 1903 Bt | VNMKV, Nanded | | |
| 8 | NH 1904Bt | VNMKV, Nanded | | |
| 9 | SurajBt (ZC Bt) | | | |
| 10 | Phule Yamuna (ZC Non-Bt) | | | |
| 11 | Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 4<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagdh |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial (I) of Hirsutum Varieties – Irrigated (Testing Fee for four locations)**

Trial not constituted because **None of the entry qualifies for promotion from IET (Bench mark value = 13.91 q/ha)**

**Advanced Evaluation Trial (II) of Hirsutum Varieties – Irrigated (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | CICR 18 Bt | CICR, Nagpur | JAU, Junagadh | GN. Cot 22 |
| 2 | G Cot 16 Cry 1 Ac | NAU, Surat | SDAU, Talod | GN. Cot 22 |
| 3 | CICR Bt 20-31 | CICR, Nagpur | MPKV, Rahuri | Phule 688 |
| 4 | G Cot 10 Cry 1 Ac | NAU, Surat | RVSKVV, Khandwa | JK 4 |
| 5 | SurajBt (ZC Bt) | | | |
| 6 | Phule Yamuna (ZC Non-Bt) | | | |
| 7 | Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 4<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design<br>**(Bench mark value = 14.28 q/ha)** |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at MPKV, Rahuri and JAU, Junagdh; Bioassay to be done at Rahuri |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Intra-Hirsutum Hybrids –Rainfed**
**(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | ARCH 444 BGII | Ankur Seeds Pvt Ltd | NAU, Surat | MRC 7347 |
| 2 | ARCH 789 BGII | Ankur Seeds Pvt Ltd | NAU, Bharuch | MRC 7347 |
| 3 | BIO 6901 BGII | Bioseed Research India | PDKV, Akola | MRC 7347 |
| 4 | CNHH 51 Bt | CICR, Nagpur | ICAR-CICR, Nagpur | MRC 7347 |
| 5 | CNHH 52 Bt | CICR, Nagpur | ARS, Banswara | MRC 7347 |
| 6 | SP7702 BGII | Crystal Crop Protection Limited | Nagpur (Ankur) | MRC 7347 |
| 7 | SP7703 BGII | Crystal Crop Protection Limited | Badnapur (Bioseed) | MRC 7347 |
| 8 | D 2929 BG II | DaftariAgroPvt. Ltd. | | |
| 9 | DACH 55C55 BGII | Dharti Seeds | | |
| 10 | DACH 58C58 BGII | Dharti Seeds | | |
| 11 | Indam-2029 BG II | Indo-American Hybrid Seeds (I) Pvt. Ltd. | | |
| 12 | C 9338 BG II | Mahyco Pvt Ltd | | |
| 13 | GBBHH 16/11 BG II | NAU, Bharuch | | |
| 14 | GBBHH 16/14 BG II | NAU, Bharuch | | |
| 15 | DC5104 BGII | Rallis India Ltd. | | |
| 16 | CT033BGII | Rasi seeds(P) Ltd, | | |
| 17 | CT066BGII | Rasi seeds(P) Ltd, | | |
| 18 | US 713 BG II | Seed Works International Pvt Ltd | | |
| 19 | US 714BG II | Seed Works International Pvt Ltd | | |
| 20 | Jadoo BG II (ZC) | | | |
| 21 | BG II Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 7<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Nagpur and NAU, Surat |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial – I of Intra-hirsutum Hybrids –Rainfed**
**(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | DC 5100 BG II | Rallis India Ltd. | Promoted | NAU, Surat | MRC 7347 |
| 2 | DC 5101 BG II | Rallis India Ltd. | Promoted | NAU, Bharuch | MRC 7347 |
| 3 | ARCH 844 BG II | Ankur Seeds Pvt | Promoted | PDKV, Akola | MRC 7347 |
| 4 | GBBHH 15/4 BG II | NAU, Bharuch | Retained | ICAR-CICR, | MRC 7347 |
| 5 | GBBHH 15/5 BG II | NAU, Bharuch | Retained | ARS, Banswara | MRC 7347 |
| 6 | SP7689 BGII | Crystal Crop Protection Ltd | High GOT | Nagpur (Ankur) | MRC 7347 |
| 7 | SP7690 BGII | Crystal Crop Protection Ltd | Big boll | Aurangabad (Rallis) | MRC 7347 |
| 8 | BIO 6802 BGII | Bioseed Research India | High GOT | Akola (MSSCL) | MRC 7347 |
| 9 | Trumpcard BG II | DaftariAgroPvt. Ltd. | Good fibre quality | | |
| 10 | Jadoo BG II (ZC) | | | | |
| 11 | BG II Local Check | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 8<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Nagpur and NAU, Surat |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial – II of Intra-hirsutum Hybrids –Rainfed**
**(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | RCH 990 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | NAU, Surat | MRC 7347 |
| 2 | BIO 6511 BGII | Bioseeds | 2% Ginning outturn superiority | NAU, Bharuch | MRC 7347 |
| 3 | Jadoo BG II (ZC) | | | PDKV, Akola | MRC 7347 |
| 4 | BG II LC | | | ICAR-CICR, Nagpur | MRC 7347 |
| 5 | | | | ARS, Banswara | MRC 7347 |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 8<br>Protected: 4 rows, 5 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Compact Intra-Hirsutum Hybrids – Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | BIO 6000 BGII | Bioseeds | NAU, Surat | MRC 7347 |
| 2 | Indam-1340 BG II | Indo-American Hybrid Seeds (I) Pvt. Ltd. | NAU, Bharuch | MRC 7347 |
| 3 | NCS 8020 Bt2 | Nuziveedu Seeds Limited | PDKV, Akola | MRC 7347 |
| 4 | Rasi Max 099 BGII | Rasi seeds (P) Ltd, | ICAR-CICR, Nagpur | MRC 7347 |
| 5 | Rasi Max 096 BGII | Rasi seeds (P) Ltd, | ARS, Banswara | MRC 7347 |
| 6 | Jadoo BG II (ZC) (coded under closer spacing) | | Aurangabad (Nuziveedu) | MRC 7347 |
| 7 | Local Check | | | |
| 8 | Jadoo BG II (ZC) (normal spacing without coding) | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 6<br>Protected: 6 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm; Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Nagpur and NAU, Surat |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial-I of Compact Intra-Hirsutum Hybrids – Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | Rasi Max 066 BGII | Rasi seeds (P) Ltd, | NAU, Surat | MRC 7347 |
| 2 | Rasi Max 099 BG II | Rasi seeds (P) Ltd, | NAU, Bharuch | MRC 7347 |
| 3 | VSCH 139 BG II | Veda Seed Sciences Pvt Ltd | VNMKV, Nanded | MRC 7347 |
| 4 | C 9401 BG II | Mahyco | ICAR-CICR, Nagpur | MRC 7347 |
| 5 | Jadoo BG II (ZC) (coded under closer spacing) | | ARS, Banswara | MRC 7347 |
| 6 | Local Check (coded under closer spacing) | | Aurangabad - Nuziveedu | MRC 7347 |
| 7 | Jadoo BG II (ZC) (normal spacing without coding) | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 500 g x 6<br>Protected: 12 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm; Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Nagpur and NAU, Surat |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Hirsutum Varieties - Rainfed (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | CICR Bt 2 | CICR, Nagpur | NAU, Surat | G Cot 16 |
| 2 | CICR Bt 4 | CICR, Nagpur | NAU, Bharuch | G Cot 16 |
| 3 | CICR Bt 12 | CICR, Nagpur | PDKV, Akola | AKH 8828 |
| 4 | CICR Bt 22-31 | CICR, Nagpur | ICAR-CICR, | AKH 8828 |
| 5 | CICR Bt 22-32 | CICR, Nagpur | | |
| 6 | CICR Bt 22-33 | CICR, Nagpur | | |
| 7 | NH 1906 Bt | VNMKV, Nanded | | |
| 8 | NH 1907 Bt | VNMKV, Nanded | | |
| 9 | NH 1908 Bt | VNMKV, Nanded | | |
| 10 | NH 1909 Bt | VNMKV, Nanded | | |
| 11 | NH 1910 Bt | VNMKV, Nanded | | |
| 12 | SurajBt (Zonal Check) | | | |
| 13 | NH 615 (Zonal Check NBt) | | | |
| 14 | Local Check NBt | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 4<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Nagpur and NAU, Surat |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial - I of Hirsutum Varieties– Rainfed**
**(Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | CICR Bt 21-32 | CICR, Nagpur | NAU, Surat | G Cot 16 |
| 2 | CICR Bt 21-31 | CICR, Nagpur | NAU, Bharuch | G Cot 16 |
| 3 | SurajBt (Zonal Check) | | PDKV, Akola | AKH 8828 |
| 4 | NH 615 (Zonal Check NBt) | | ICAR-CICR,Nagpur | AKH 8828 |
| 5 | Local Check NBt | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 4<br>Protected: 4 rows, 4 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Nagpur and NAU, Surat |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial - II of Hirsutum Varieties– Rainfed (Testing Fee for four locations)**

| S. No. | Entries | Location | Local Check |
|---|---|---|---|
| 1 | CICR 18 Bt | ICAR-CICR, Nagpur | G Cot 16 |
| 2 | CICR Bt 20-31 | PDKV, Akola | AKH 8828 |
| 3 | NH 1901 Bt | ICAR-CICR, Nagpur | AKH 8828 |
| 4 | NH 1902 Bt | VNMKV, Nanded | NH 615 |
| 5 | NH 1904 Bt | | |
| 6 | SurajBt (Zonal Check) | | |
| 7 | NH 615 (Zonal Check NBt) | | |
| 8 | Local Check NBt | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 4<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Quantitative ELISA to estimate Cry 1Ac and Cry 2Ab to be carried at CICR, NAGPUR and NAU, Bharuch; Bio-efficacy data to be generated at CICR, Nagpur. |
| **Data to be recorded** | Given at the end |

## Bt COTTON SOUTH ZONE TRIALS

**Initial Evaluation Trial of Intra-Hirsutum Hybrids – Irrigated**
**(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | ACH-955-2 BGII | Ajeet Seeds Pvt Ltd | Warangal | MRC 7351 |
| 2 | ARCH 3132 BGII | Ankur Seeds Pvt Ltd | Lam | NCS 245 |
| 3 | ARCH 6659 BGII | Ankur Seeds Pvt Ltd | Raichur | NCS 864 |
| 4 | BIO 6004 BGII | Bioseed Research India | B'Gudi | NCS 864 |
| 5 | CNHH 51 Bt | CICR, Nagpur | Coimbatore | MRC 7351 |
| 6 | CNHH 52 Bt | CICR, Nagpur | Warangal (Kaveri) | MRC 7351 |
| 7 | DLCH 459 | DhanalakshmiSeedsPvt Ltd | Guntur (Ankur) | NCS 245 |
| 8 | DACH 70C70 BGII | Dharti Seeds | Ranebennur (Mahyco) | NCS 864 |
| 9 | DACH 75C75 BGII | Dharti Seeds | Hyderabad (Bioseed) | MRC 7351 |
| 10 | Tarang BG II | Eldorado AgritechPvt. Ltd | | |
| 11 | GSCH-21 | Goutami Seeds Pvt Ltd | | |
| 12 | HYCH - 411 | Hi Yield Agri Genetics Pvt Ltd. | | |
| 13 | KCH 9214 BGII | Kaveri Seeds Pvt Ltd | | |
| 14 | KCH 9216 BGII | Kaveri Seeds Pvt Ltd | | |
| 15 | C 9337 BG-II | Mahyco Pvt Ltd | | |
| 16 | NBC-211 BG II | NathBiogenes (I) Ltd | | |
| 17 | DC5103 BG II | Rallis India Ltd. | | |
| 18 | CT016BGII | Rasi Seeds Pvt Ltd | | |
| 19 | CT018BGII | Rasi Seeds Pvt Ltd | | |
| 20 | US 713 BG II | Seed Works International Pvt Ltd | | |
| 21 | US 714 BG II | Seed Works International Pvt Ltd | | |
| 22 | Nayak 5 BG II | Vikky`s Agrisciences Pvt Ltd | | |
| 23 | Nayak 7 BG II | Vikky`s Agrisciences Pvt Ltd | | |
| 24 | Nayak 9 BG II | Vikky`s Agrisciences Pvt Ltd | | |
| 25 | RCH 659 B II (ZC) | | | |
| 26 | BG II Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 9<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Coimbatore and UAS, Raichur |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial-I of Intra-hirsutum Hybrids - Irrigated (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | KCH 9111 BG II | Kaveri Seeds Pvt Ltd | Promoted from IET | Warangal | MRC 7351 |
| 2 | VSCH 219 BG II | Veda Seed Sciences Pvt Ltd | Promoted from IET | Lam | NCS 245 |
| 3 | NBC 2020 BG II | NathBiogenes (I) Ltd | Promoted from IET | Raichur | NCS 864 |
| 4 | US 711 BG II | Seed Works International Pvt Ltd | Promoted from IET | B'Gudi | NCS 864 |
| 5 | DC 5100 BG II | Rallis India Ltd. | Promoted from IET | Coimbatore | MRC 7351 |
| 6 | JKCH 18568 BG II | JK Agri Genetics | Promoted from IET | Kaveri (Warangal) | MRC 7351 |
| 7 | ACH 981-2 BG II | Ajeet Seeds Pvt Ltd | Promoted from IET | Guntur (Ankur) | NCS 245 |
| 8 | SS 1188 BG II | Eldorado AgritechPvt Ltd | Promoted from IET | Hyderabad (Rallis) | MRC 7351 |
| 9 | KCH 9122 BG II | Kaveri Seeds | Promoted from IET | Hyderabad (Seed works) | MRC 7351 |
| 10 | ACH 151-2 BG II | Ajeet Seeds | Promoted from IET | | |
| 11 | ARCH 6651 BG II | Ankur Seeds | Promoted from IET | | |
| 12 | RCH 999 BG II | Rasi Seeds | Early with Jassid tolerant | | |
| 13 | RCH 965 BG II | Rasi Seeds | Early with Jassid tolerant | | |
| 14 | BIO 6938 BGII | Bioseed Research India | 54.59% & 18.22% over ZC & LC in Karnataka | | |
| 15 | RCH 659 B II (ZC) | | | | |
| 16 | BG II Local Check | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 9<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Coimbatore and UAS, Raichur |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial -II of Intra-hirsutum Hybrids - Irrigated**
**(Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | D 1199 BG II | DaftariAgro Pvt Ltd | Promoted | Warangal | MRC 7351 |
| 2 | ACH 909-2 BG II | Ajeet Seeds Pvt Ltd | Promoted | Lam | NCS 245 |
| 3 | BIO GHH 074 BGII (BIO 6074 BGII) | Shriram Bioseed Genetics | Promoted | Raichur | NCS 864 |
| 4 | US 707 BG II | Seed Works International Pvt Ltd | Promoted | B'Gudi | NCS 864 |
| 5 | RCH 989 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | Coimbatore | MRC 7351 |
| 6 | RCH 981 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | Guntur (Bioseed) | NCS 245 |
| 7 | Daftari 2244 BG II | DaftariAgro Pvt Ltd | Good fibre quality | | |
| 8 | RCH 659 B II (ZC) | | | | |
| 9 | BG II (LC) | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 5<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Coimbatore and UAS, Raichur. Bio-efficacy data to be generated at CICR, Coimbatore. |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Compact Intra-Hirsutum Hybrids – Irrigated (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | ACH-27-2 BGII | Ajeet Seeds Private | Warangal | MRC 7351 |
| 2 | KCH 9111 BG II | Kaveri Seed Company Limited | Lam | NCS 245 |
| 3 | RASI MAX 069 BGII | Rasi seeds (P) Ltd, | Raichur | NCS 864 |
| 4 | RASI MAX 060 BGII | Rasi seeds (P) Ltd, | B'Gudi | NCS 864 |
| 5 | Local Check | | Coimbatore | MRC 7351 |
| 6 | RCH 659 B II (ZC) (coded under closer spacing) | | Guntur (Nuziveedu) | NCS 245 |
| 7 | RCH 659 B II (ZC) (normal spacing without coding) | | Warangal (Kaveri) | NCS 864 |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 7<br>Protected: 6 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Coimbatore and UAS, Raichur. Bio-efficacy data to be generated at CICR, Coimbatore. |

| | |
|---|---|
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial - I of Compact Intra-Hirsutum Hybrids – Irrigated (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remarks | Location | Local Check |
|---|---|---|---|---|---|
| 1 | Rasi Max 009 BGII | Rasi seeds(P) Ltd, | Promoted | Warangal | MRC 7351 |
| 2 | Rasi Max 006 BGII | Rasi seeds(P) Ltd, | Promoted | Lam | NCS 245 |
| 3 | ACH-9-2 BGII | Ajeet Seeds Private Ltd | High GOT | Raichur | NCS 864 |
| 4 | C 9402 BG-II | Mahyco | Early | B'Gudi | NCS 864 |
| 5 | RCH 659 B II (ZC) (coded under closer spacing) | | | Coimbatore | MRC 7351 |
| 6 | Local Check | | | | |
| 7 | RCH 659 B II (ZC) (normal spacing without coding) | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 500 g x 5<br>Protected: 12 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Coimbatore and UAS, Raichur. |
| **Agronomic and plant protection measures** | As per standard operating procedures. Plant growth regulator {Mepiquat chloride (60 ppm)} to be sprayed @ 50, 65 & 80 DAS. Third spray should be need based |
| **Data to be recorded** | Given at the end |

**Combined Evaluation trial of Interspecific H X B Hybrids (New + Promoted Entries)- Irrigated (Testing Fee for four locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | New Entries | | Lam | Bahubali BG II |
| 2 | C 7938 BG-II | Mahyco | Dharwad | DCH 32 BG II |
| 3 | C 7939 BG-II | Mahyco | Chamraj Nagar | DCH 32 BG II |
| 4 | C 7940 BG-II | Mahyco | Coimbatore | RCHB 708 BG II |
| 5 | Promoted Entries | | | |
| 6 | MC 5500 BG II | Rallis India Ltd. | | |
| 7 | MRC 7918 BG II (ZC) | | | |
| 8 | BG II Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 5<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at CICR, Coimbatore and UAS, Dharwad. |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Hirsutum Varieties - Irrigated (Testing Fee for five locations)**

(No entries received)

**Advanced Evaluation Trial (I) of Hirsutum Varieties –Irrigated (Testing Fee for five locations)**

None of the entry qualifies for promotion from IET (Bench mark value = 23.00 q/ha)

**Initial Evaluation Trial of Intra-Hirsutum Hybrids – Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | ARCH 444 BG II | Ankur Seeds Pvt Ltd | Mudhole | NCS 854 |
| 2 | ARCH 789 BG II | Ankur Seeds Pvt Ltd | Adilabad | NCS 854 |
| 3 | BIO 6901 BGII | Bioseed Research India | Nandyal | NCS 245 |
| 4 | CNHH 51 Bt | CICR, Nagpur | Dharwad | NCS 954 |
| 5 | CNHH 52 Bt | CICR, Nagpur | Perambalur | NCS 954 |
| 6 | SP7702 BGII | Crystal Crop Protection Limited | Warangal (Ankur) | NCS 854 |
| 7 | DACH 55C55 BGII | DhartiAgro Chemicals Pvt. Ltd. | Ranebennur (Mahyco) | NCS 954 |
| 8 | DACH 58C58 BGII | DhartiAgro Chemicals Pvt. Ltd. | | |
| 9 | Indam-2029 BG II | Indo-American Hybrid Seeds (I) Pvt. Ltd. | | |
| 10 | C 9338 BG-II | Mahyco | | |
| 11 | DC5104 BGII | Rallis India Ltd. | | |
| 12 | CT033 BGII | Rasi seeds (P) Ltd, | | |
| 13 | CT066 BGII | Rasi seeds (P) Ltd, | | |
| 14 | RSCH-189 BG II | Royal Seeds Pvt Ltd | | |
| 15 | RSCH-459 BG II | Royal Seeds Pvt Ltd | | |
| 16 | US 713 BG II | | | |
| 17 | US 714 BG II | | | |
| 18 | Jadoo BG II (ZC) | | | |
| 19 | BG II Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 7<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at UAS, Dharwad and ANGRAU, Nandyal |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial-I of Intra-hirsutum Hybrids –Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | US 711 BG II | Seed Works International Pvt Ltd | Promoted | Mudhole | NCS 854 |
| 2 | SS 963 BG II | Sumathi Seeds Pvt. Ltd | Promoted | Adilabad | NCS 854 |
| 3 | DC 5100 BG II | Rallis India Ltd. | Promoted | Nandyal | NCS 245 |
| 4 | SP7689 BGII | Crystal Crop Protection Ltd | High GOT | Dharwad | NCS 954 |
| 5 | SP7691 BGII | Crystal Crop Protection Ltd | High GOT | Perambalur | NCS 954 |
| 6 | BIO 6802 BGII | Bioseed Research India | High yield in AP & TG State | Warangal (Seed works) | NCS 854 |
| 7 | Jadoo BG II (ZC) | | | | |
| 8 | BG II (LC) | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 3<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at UAS, Dharwad and ANGRAU, Nandyal |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial- II of Intra-hirsutum Hybrids –Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | SS 246 BG II | Sumathi Seeds Pvt. Ltd | Promoted | Mudhole | NCS 854 |
| 2 | 60 SS 66 BG II | Sri SathyaAgri Biotech Pvt Ltd | Promoted | Adilabad | NCS 854 |
| 3 | SP 7688 BG II | Crystal Crop Protection Limited | Promoted | Nandyal | NCS 245 |
| 4 | RCH 990 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | Dharwad | NCS 954 |
| 5 | RCH 996 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | Perambalur | NCS 954 |
| 6 | SP 7680 BG II | Crystal Crop Protection Limited | More lint yield | | |
| 7 | Jadoo BG II (ZC) | | | | |
| 8 | BG II (LC) | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 5<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Quantitative ELISA to estimate Cry 1Ac and Cry 2Ab to be carried at UAS, Dharwad and ANGRAU, Nandyal; Bio-efficacy data to be generated at UAS, Dharwad. |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Compact Intra-Hirsutum Hybrids – Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local |
|---|---|---|---|---|
| 1 | BIO 6000 BGII | Bioseeds | Mudhole | NCS 854 |
| 2 | Indam-1340 BG II | Indo-American Hybrid Seeds (I) Pvt. Ltd. | Adilabad | NCS 854 |
| 3 | PCH 7520 Bt2 | PrabhatAgri Biotech Limited | Nandyal | NCS 245 |
| 4 | RASI MAX 099 BGII | Rasi seeds (P) Ltd, | Dharwad | NCS 954 |
| 5 | RASI MAX 096 BGII | Rasi seeds (P) Ltd, | Perambalur | NCS 954 |
| 6 | Jadoo BG II (ZC) (coded under closer spacing) | | Hyderabad –Prabhat Agri Biotech | NCS 854 |
| 7 | Local Check | | | |
| 8 | Jadoo BG II (ZC) (normal spacing without coding) | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 6<br>Protected: 6 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at UAS, Dharwad and ANGRAU, Nandyal |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial-I of Compact Intra-Hirsutum Hybrids – Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Remark | Location | Local Check |
|---|---|---|---|---|---|
| 1 | CCH 1809 BG II | Crystal Crop Protection Ltd | Promoted | Mudhole | NCS 854 |
| 2 | ARCH 3224 BG II | Ankur Seeds Private Ltd | Promoted | Adilabad | NCS 854 |
| 3 | Rasi Max 33 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | Nandyal | NCS 245 |
| 4 | Rasi Max 66 BG II | Rasi Seeds Pvt Ltd | Early with Jassid tolerant | Dharwad | NCS 954 |
| 5 | VSCH-139 BG II | Veda Seed Sciences | Early with 5% | Perambalur | NCS |

| | | | | | |
|---|---|---|---|---|---|
| | | | yield advantage | | 954 |
| 6 | Jadoo BG II (ZC) (coded under closer spacing) | | | Warangal (Ankur) | NCS 854 |
| 7 | Local Check (coded under closer spacing) | | | | |
| 8 | Jadoo BG II (ZC) (normal spacing without coding) | | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 500 g x 6<br>Protected: 12 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Spacing: 90 x 15 cm<br>Design: Completely Randomized Block Design |
| **Data to be recorded** | Given at the end |

**Initial Evaluation Trial of Hirsutum Varieties - Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local |
|---|---|---|---|---|
| 1 | DHBt 2251 | UAS, Dharwad | Mudhole | Sivanandi |
| 2 | DHBt 2252 | UAS, Dharwad | Adilabad | Sivanandi |
| 3 | DHBt 2253 | UAS, Dharwad | Nandyal | Sivanandi |
| 4 | SHt 7 (BG I) | SIMA-CDRA | Dharwad | ARBH 813 |
| 5 | NH 1901 Bt | | Perambalur | KC 3 |
| 6 | NH 1902 Bt | | | |
| 7 | CICR 23 Bt (Bt Zonal Check) | | | |
| 8 | Sahana (Non Bt Zonal Check) | | | |
| 9 | Local Check | | | |

| | |
|---|---|
| **Trial** | Seed requirement: 200 g x 5<br>Protected: 4 rows, 3 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at UAS, Dharwad and ANGRAU, Nandyal |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial of Hirsutum Varieties - I – Rainfed (Testing Fee for five locations)**

| S. No. | Entries | Sponsored by | Location | Local Check |
|---|---|---|---|---|
| 1 | PKV 081 Bt | CICR, Nagpur | Mudhole | Sivanandi |
| 2 | CICR Bt 20-31 (Retained) | CICR, Nagpur | Adilabad | Sivanandi |
| 3 | CICR 23 Bt (Bt Zonal Check) | | Nandyal | Sivanandi |
| 4 | Sahana (Non Bt Zonal Check) | | Dharwad | ARBH 813 |
| 5 | Local Check | | Perambalur | KC 3 |

| | |
|---|---|
| **Trial** | Seed requirement: 300 g x 5<br>Protected: 6 rows, 4 replications<br>Unprotected: 2 rows, unreplicated<br>Design: Completely Randomized Block Design |
| **ELISA test** | Qualitative ELISA to confirm Cry 1Ac and Cry 2Ab to be carried at UAS, Dharwad and ANGRAU, Nandyal |
| **Data to be recorded** | Given at the end |

**Advanced Evaluation Trial of Hirsutum Varieties - II – Rainfed (Testing Fee for five locations)**

**No entries were promoted from AET-I (Bench mark value = 13.89 q/ha)**

## Data to be recorded in all the above trials:

**Biometric evaluation**

1. Germination percentage
2. Plant stand at harvest
3. Plant height (cm) at harvest
4. Number of monopodia
5. Number of sympodia
6. Boll weight (g/boll)
7. Number of bolls / plant
8. Number of bolls / sq.m.
9. Lint Index (g)
10. Seed Index (g)
11. Ginning outturn (%)
12. Upper Half Mean Length (mm) under HVI Mode
13. Uniformity index under HVI Mode
14. Micronaire under HVI Mode
15. Tenacity under HVI Mode
16. Seed Cotton Yield (q/ha) at 140 DAS
17. Seed Cotton Yield (q/ha) at 165 DAS
18. Total Seed Cotton Yield (q/ha) (at 140 DAS + 165 DAS)
19. Qualitative presence of Cry Protein @ 30 days after sowing (DAS) following standard protocol (in leaf) and @ 90 days after sowing (DAS) following standard protocol (in square & boll tissues) in Initial Evaluation Trial and Advanced Evaluation Trial – I.
    Quantity of Cry Protein @ 30, 60, 90 & 120 days after sowing (DAS) following standard protocol (in leaf, square & boll tissues) in Advanced Evaluation Trial – II.
    Cry protein data to be generated at ICAR-CICR, Nagpur and NAU, Surat for rainfed trials, MPKV, Rahuri and JAU, Junagadh for irrigated trials of Central Zone.
    Cry protein data to be generated at ICAR-CICR, Coimbatore and UAS, Raichur for irrigated trials, UAS, Dharwad and ANGRAU, Nandyal for rainfed trials of South Zone.
20. Bio-efficacy data to be generated at ICAR-CICR, Nagpur for rainfed trials, MPKV, Rahuri for irrigated trials of Central Zone and at ICAR-CICR, Coimbatore for irrigated trials, UAS, Dharwad for rainfed trials of South Zone against insect pests. (under laboratory conditions in Advanced Evaluation Trial – II during the third year of evaluation against lepidopteron insect pests of cotton)

**Evaluation under Protected Condition for Insect pests & Diseases incidences**

- Jassids (average of 3 leaves/plant)
- Thrips (average of 3 leaves per plant)
- Whitefly (average of 3 leaves/plant)
- Bollworms (No. of larvae/5 plants)
- Percent locule damage
- Percent open boll damage
- Percent Disease Index for major diseases

**Evaluation under unprotected condition for insect pests and diseases:**
**Insect pests:**

- Jassids (average on 3 leaves/plant)
- Thrips (average of 3 leaves per plant)
- Spotted bollworms (mean of counts/5 plants)
- Bollworms (mean of counts/5 plants)
- Percent Locule damage
- Percent Open boll damage
- Population of natural enemies of insect pests of cotton
- Number of sprays for sap sucking pests – Protected

**Plant Pathology observations**

- Percent Disease Index (PDI) of Grey Mildew
- Percent Disease Index(PDI) of Bacterial Leaf Blight
- Percent Disease Index (PDI) of Alternaria Leaf Spot
- Percent Disease Index (PDI) of CLCuD (in North Zone only)
- Incidence of any other diseases/ disorders

***Note: The standard operating protocols for recording data on yield attributes, yield, insect pest and disease incidences as per ICAR-AICRP on Cotton shall be followed.***

# Proceedings of Agronomy Panel held on 8th April 2022, ICAR-AICRP on Cotton

As part of ICAR-AICRP on Cotton Annual Group Meeting 2022 through hybridmode, the Agronomy Panel chaired by Dr. A.R. Sharma, Director of Research, RLBCAU, Jhansi and Co-chaired by Dr. Blaise D'souza, Head, Crop Production, ICAR-CICR, Nagpur and Dr. M. V. Venugopalan, Principal Scientist, CICR, Nagpur has discussed the results of agronomic trials of 2021-22 and technical programme for 2022-23 on 8th April, 2022. Dr. K. Sankaranarayanan, PI-Agronomy (ICAR-AICRP on Cotton) presented the technical programme for 2022-23 and Dr. D.Kanjana, Senior Scientist, CICR, Coimbatore and Dr.K.Thirukumaran, Assoc.Professor, TNAU, Coimbatore were rapporteurs.

- The Action Taken Report on the recommendations of last year was presented and the same was accepted by the house
- Statistical analysis (SEd and CD (%)) to be followed commonly and CV values is to be reported
- Publication in high impact journal was insisted
- Trend of long-term experimentsresults should be reported every year
- Status (new/ ongoing/concluding) of the experiment willbe reported
- Blanket recommendation willbe avoided
- Soil test based nutrientrecommendation will be followed
- Yield maximisation trialwill beinitiated in coming years
- Final completion reports with pooled analysis of the results will be submitted for experiments includes soil crust, Bt varieties trial at Central zone, moisture stress experiment, organic cotton trial at Sriganganagar, Dharwad and LAM and Bio chemical tolerance of pest and disease
- Organic cotton experiment will be allowed to close at LAM, Dharwad and Sriganganagar. Cropping system approach will be followed for other centres. Initial value of organic carbon status will be reported inevery times. Trend of the result of previous years will be presented insubsequent year report
- Check variety with recommended spacing and nutrient level should be kept as control for agronomic requirement studies

The meeting was ended with the vote of thanks to the Chair and the participants.

## Technical Programme of Agronomy, Physiology & Biochemistry ICAR-AICRP (Cotton), Coimbatore (2022-23)

The research experiments were formulated based on the following thematic areas:

- Agronomic requirements of promising pre-release/recently released *hirsutum*/ *arboreum*/ *barbadense* genotypes including compact / hybrids of both interspecific and desi hybrids of *cotton*
- Augmenting ELS cotton production
- Technology for organic Cotton Production
- Conservation agriculture
- Moisture Stress management in Bt cotton
- Soil crust management in North Zone
- Packages for Bt varieties
- Input use pattern & cost of cultivation
- Multi-tier intercropping
- Physiological and biochemical aspects in cotton production

### TECHNICAL PROGRAMME FOR AGRONOMY: 2022-23

| | |
|---|---|
| Agronomy I | Agronomic requirements of promising non Bt and Bt pre-release/recently released *hirsutum*/ *arboreum*/ *barbadense* genotypes including compact / hybrids of both interspecific and desi hybrids of *cotton* |
| Agronomy II | Augmenting ELS cotton production |
| Agronomy IV | Technology for Organic Cotton Production. |
| Agronomy V | Conservation agriculture. |
| Agronomy VII | Input use pattern & cost of cultivation |
| Agronomy IX | Standardisation of geometry for Bt varieties (HDPS): |
| Agronomy X | Multi-tier intercropping |
| Agronomy XI | Bio stimulant on growth and development of cotton |
| Agronomy XII | Drought and water logging management |

### TECHNICAL PROGRAMME FOR PHYSIOLOGY and BIOCHEMISTRY: 2022-23

| | |
|---|---|
| PHY 1 | PGR for optimum morpho frame and enhanced yield |
| PHY2 | Preparing for climate change - Growth and development of *arboreum* cotton in response to growth regulators |
| PHY 3 | Effect of growth retardant on physiological parameters and productivity of compact genotypes |
| PHY 4 | Use of Defoliants to facilitate mechanical picking |
| BIO CHEM1 | Screening of Cotton genotypes for abiotic stress tolerance and estimation of seed oil, gossypol and protein |
| BIO CHEM2 | Analysis of biochemical constituents of organic cotton experiment (Agronomy IV), morpho frame (Phy:1), climate change (Phy :2) growth retardants ( Phy:3) and defoliants (Phy:4) |

The details of Technical Programme formulated under crop production are presented as under:

**Status: Mandatory trial**

## Agronomy I: Agronomic requirements of promising non Bt and Bt pre-release/recently released *hirsutum*/ *arboreum*/ *barbadense* genotypes including compact / hybrids of both interspecific and desi hybrids of *cotton*

**Preamble:**Growth and development of a plant is the result of the interaction of two major components viz. genetic potential of individual and environment. Among the improved agronomic practices, important yield contributing agro techniques are spacing and fertilizer application. Optimization of spacing and fertilizer requirement is the pre-requisite for releasing of promising genotypes. The field experiments are conducted with graded levels of nitrogen and spacing levels as per the required environment in multi-location at different AICRP (cotton) centres.

In this project, the pre-released varieties/hybrids of Bt and non Bt version developed and suggested by the breeding panel under irrigated/rainfed conditions shall be tested at respective centres in the zone for their response to optimum fertilizer levels and crop geometry requirements (applicable to both public & private sector varieties/hybrids). All the participating centers shall invariably conduct these trials incorporating the new genotypes/hybrids against the local check for determining the optimum spacing and fertilizer requirements.

## Agronomy IA: Agronomic requirements of promising non Bt pre-release/recently released *hirsutum*/ *arboreum*/ *barbadense* genotypes including compact / hybrids of both interspecific and desi hybrids of *cotton*

**Objective: To find out geometry and nitrogen requirement of pre released genotypes**

**Note:** Different spacings and soil-test based recommended nitrogen levels (75, 100 & 125% Nitrogen) only to be simulated and soil test based recommended levels of P & K should be kept as constant for various treatment combinations in agronomic requirement study of pre released conventional and compact genotypes.

Separate experiment should be conducted for each genotype. Minimum required error degree of freedom to be assured.

**North Zone**

| Centres | *Hirsutum* varieties | | *Arboreum* | |
|---|---|---|---|---|
| | Varieties | Hybrids | Varieties | Hybrids |
| Faridkot(I) | | | | PBD 88* |
| Bhatinda(I) | | | | |
| Hisar(I) | | | | |
| Sriganganagar (I) | | | | |

**Central Zone**

| Centers | Hirsutum | | Barbadense Varieties | Hirsutumx Barbadense | Arboreum Varieties | |
|---|---|---|---|---|---|---|
| | Varieties | Hybrids | | | | Desi Hybrid |
| Surat (I) | GJHV 566* | | | | | |
| Junagarh (I) | CNH 18529 | | | | | |
| Rahuri (I) | | | | | | |
| Akola (R) | TVH 007 | | | | NDLA 3116-3, AKA 2013-8, PA 873 | |
| Nanded (R) | CNH 18529 | | | | DDCC 1901 | |
| Bhawanipatna (R) | | | | | | |

**South Zone**

| Centers | Hirsutum Varieties | Hirsutumx Barbadense | Barbadense Varieties | Arboreum Varieties |
|---|---|---|---|---|
| Raichur(I) | CPD 1902*<br>CCH 19-2 | | | |
| Lam (I) | | | | |
| Coimbatore(I) | | | DB 1901 | |
| Srivilliputhur(I) | DHCC 1901<br>CCHC 19-1<br>CCHC 19-2 | | | |
| Dharwad(R) | DHCC 1901<br>CCHC 19-1<br>CCHC 19-2 | | | NDLA 3104-4 |
| Chamrajnagar(R) | | | | |
| Nandyal (R) | NDLH 2056-4<br>CCH 19-2 | | | DDCC 1902 |

**Observations to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of Sympodia at harvest
4) No. of Bolls/squaremeter
5) Boll weight (g)
6) Final Plant population (no /net plot)
7) Seed cotton Yield at 140 and 160 DAS (kg/ha), For H x B use 160 and 190 DAS depending on the duration of the crop
8) Duration of the crop

**Statistical Analysis:**

1) Standard error of difference
2) Critical Difference
3) Coefficient variation

**Note:** Data should be reported in interaction tables with above said parameters to find out optimum spacing and fertilizer level requirement of each entry, which is warranted for submitting release proposal.

**Reporting:** Data sheet of IA is to be followed

- Check variety with recommended spacing and nutrient level should be kept as control
- *Necessary instruction for agronomic requirement study of the entries CPD 1902, PBD 88 and GJHV 566 were allotted respectively at Raichur, Faridkot and Surat asfollow.
    - 75,100 and 125 % RDF (N, P K) is simulated, one more treatment of 75 % RDF + Seed treatment, soil application at 25 DAS and foliar application of MBF at squaring, flowering and boll development will be included
    - Analysis of FRBD will be followed by excluding added treatment. RBD analysis will be made by comparing control versus others
    - MBF –Microbial culture will be supplied by Dr. K. Velmourougane , Senior Scientist, CICR, Nagpur
- ANOVA (SEd+ and CD (5%) is compulsory. Kindly avoid reporting of SEm and SD values.
- For all experiments on AGR and other nutrient studies, testing of different levels of nutrients based on blanket recommendation is not permitted. Kindly arrive RDN and different level RDN based on soil test values.
- Basic soil parameters including pH, OC, EC, available N, P, K, date of sowing, number of irrigation, genotypes, total rainfall, recommendation of N,P&K etc. should be given at the bottom of the Table as a foot note so as to understand the kind of response and the yield expected under the conditions in agronomic requirement and other nutrient related experiments.
- Different spacing and nitrogen levels (75, 100 & 125% N) are only to be simulated and recommended levels of P & K are should be kept as constant for various treatment combinations in agronomic requirement study of pre-released conventional and compact genotypes.

**For AGR 1** All the breeders of the above varieties/hybrids are requested to submit 1.0 kg (variety) and 0.5 kg (hybrid) of **seeds directly to the concerned Agronomists (not to Project Coordinator)** and to keep track with the agronomists for getting the data on agronomy trial and to submit the lint samples to CIRCOT from concerned location. The agronomists are requested to submit the 6 kg lint samples directly for micro-spinning to Director, CIRCOT, Mumbai (**Door Delivery only and not by Railway Parcel**). Further, agronomists are requested to send the agronomic trials data (interaction tables) to the concerned breeder in addition to the Principal Investigator (Agronomy) in time to facilitate the submit the release proposals before due date.

**Action to be taken:**

- These varieties/hybrids have been recommended by the Breeding panel after ascertaining their performance.
- Concerned Breeders shall send the required seeds directly to the Agronomists of respective centers without delay for taking up experiments.
- The center, where experiment is conducted, send lint samples for full scale spinning.
- Entomology & Pathology data will be collected from the concerned Principal Investigator.

**Reporting:** Data sheet of 1A is to be followed

**Status (Mandatory trial)**

## Agronomy IB: Agronomic requirements of promising pre-release Bt Variety /Bt hybrids

**Preamble:**Growth and development of a plant is the result of the interaction of two major components viz. genetic potential of individual and environment. Among the improved agronomic practices, important yield contributing agro techniques are spacing and fertilizer application. Optimization of spacing and fertilizer requirement is the pre-requisite for releasing of promising genotypes. The field experiments are conducted with graded levels of nutrients and spacing levels as per the required environment in multi location at different AICRP (cotton) centres.

**Objective:** To find out geometry and nutrient requirement of **Bt variety / hybrid**

### Agronomic evaluation of Bt variety / hybrid being evaluated in AET-II trials

| Entry | Sponsored by | Category | Zone | Irrigated | Location |
|---|---|---|---|---|---|
| MC 5410 BG II | Rallis India Limited | H X H Hybrid | North | Irrigated | CCSHAU, Hisar |
| KCH 9344 BG II | Kaveri Seeds Pvt Ltd | H X H Hybrid | North | Irrigated | PAU, Faridkot |
| ACH 902-2 BG II | Ajeet Seeds Pvt Ltd | H X H Hybrid | North | Irrigated | PAU, Faridkot |
| KCH 9322 BG II | Kaveri Seeds Pvt Ltd | H X H Hybrid | North | Irrigated | PAU, Bathinda |
| C 9314 BG II | MahycoPvt. Ltd. | H X H Hybrid | North | Irrigated | SKRAU, Sriganganagar |
| RCH 983 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | North | Irrigated | SKRAU, Sriganganagar |
| ARCV 22 Bt | Ankur Seeds Pvt Ltd | Hirsutum | North | Irrigated | CCSHAU, Hisar |
| FBt 1908 | PAU, Faridkot | Hirsutum | North | Irrigated | SKRAU, Sriganganagar |
| ATCH 1365 BG II | Agri Top Seeds | H X H Hybrid | Central | Irrigated | JAU, Junagadh |
| RCH 989 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | Central | Irrigated | JAU, Junagadh |
| RCH 981 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | Central | Irrigated | MPKV, Rahuri |
| ACH-981-2 BGII | Ajeet Seeds Pvt Ltd | H X H Hybrid | Central | Irrigated | MPKV, Rahuri |
| Super 2141 BG II | Super Seeds | H X H Hybrid | Central | Irrigated | RVSKVV, Khandwa |
| BIO 6101 BGII | Bioseed | H X H Hybrid | Central | Irrigated | RVSKVV, Khandwa |
| D 1199 BG II | DaftariAgro Pvt Ltd | H X H Hybrid | Central | Irrigated | SDAU, Talod |
| D 1579 BG II | DaftariAgroPvt. Ltd | H X H Hybrid | Central | Irrigated | SDAU, Talod |
| JKCH 161042 BGII | J K Agri Genetics Ltd. | H X H Hybrid | Central | Irrigated | AAU, Anand |
| Jaiho BGII | Eldorado AgritechPvt. Ltd | H X H Hybrid | Central | Irrigated | AAU, Anand |
| C 7938 BG II | MahycoPvt. Ltd. | H X B Hybrid | Central | Irrigated | MPKV, Rahuri |
| CICR 18 Bt | CICR, Nagpur | Hirsutum | Central | Irrigated | JAU, Junagadh |
| G Cot 16 Cry 1 Ac | NAU, Surat | Hirsutum | Central | Irrigated | MPKV, Rahuri |
| CICR Bt 20-31 | CICR, Nagpur | Hirsutum | Central | Irrigated | RVSKVV, Khandwa |
| G Cot 10 Cry 1 Ac | NAU, Surat | Hirsutum | Central | Irrigated | SDAU, Talod |
| RCH 990 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | Central | Rainfed | NAU, Surat |
| BIO 6511 BGII | Bioseeds | H X H Hybrid | Central | Rainfed | PDKV, Akola |
| CICR 18 Bt | CICR, Nagpur | Hirsutum | Central | Rainfed | VNMKV, Nanded |
| CICR Bt 20-31 | CICR, Nagpur | Hirsutum | Central | Rainfed | PDKV, Akola |
| NH 1901 Bt | VNMKV, Nanded | Hirsutum | Central | Rainfed | ICAR-CICR, Nagpur |
| NH 1902 Bt | VNMKV, Nanded | Hirsutum | Central | Rainfed | NAU, Surat |
| NH 1904 Bt | VNMKV, Nanded | Hirsutum | Central | Rainfed | NAU, Bharuch |
| D 1199 BG II | DaftariAgro Pvt Ltd | H X H Hybrid | South | Irrigated | PJTSAU, Warangal |
| ACH 909-2 BG II | Ajeet Seeds Pvt Ltd | H X H Hybrid | South | Irrigated | PJTSAU, Warangal |
| BIO GHH 074 BGII (BIO 6074 BGII) | Shriram Bioseed Genetics | H X H Hybrid | South | Irrigated | ANGRAU, Lam |
| US 707 BG II | Seed Works International Pvt Ltd | H X H Hybrid | South | Irrigated | ANGRAU, Lam |
| RCH 989 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | South | Irrigated | UAS, Raichur |
| RCH 981 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | South | Irrigated | UAS, Raichur |
| Daftari 2244 BG II | DaftariAgro Pvt Ltd | H X H Hybrid | South | Irrigated | UAS, B'Gudi |
| Jaiho BGII | Eldorado AgritechPvt. Ltd | H X H Hybrid | South | Irrigated | UAS, B'Gudi |
| SS 246 BG II | Sumathi Seeds Pvt. Ltd | H X H Hybrid | South | Rainfed | UAS, Dharwad |

| | | | | | |
|---|---|---|---|---|---|
| 60 SS 66 BG II | Sri Sathya Agri Biotech Pvt Ltd | H X H Hybrid | South | Rainfed | UAS, Dharwad |
| SP 7688 BG II | Crystal Crop Protection Ltd | H X H Hybrid | South | Rainfed | PJTSAU, Mudhole |
| RCH 990 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | South | Rainfed | PJTSAU, Adilabad |
| RCH 996 BG II | Rasi Seeds Pvt Ltd | H X H Hybrid | South | Rainfed | ANGRAU, Nandyal |
| SP 7680 BG II | Crystal Crop Protection Ltd | H X H Hybrid | South | Rainfed | TNAU, Perambalur |

- All the participating centers shall invariably conduct these trials incorporating the new genotypes/hybrids against the local check for determining the optimum spacing and fertilizer requirements.
- Optimum plot size of 50 $m^2$ to be followed
- Spacing levels of minimum of three has to be simulated to find out geometry
- Testing of different levels of nutrients based on blanket recommendation is not permitted.
- Soil-test based recommended nitrogen levels (75 , 100 & 125% Nitrogen) only to be simulated and soil test based recommended levels of P & K should be kept as constant for various treatment combinations in agronomic requirement study
- Separate experiment should be conducted for each genotype. Minimum required error degree of freedom (12) to be assured.
- Data should be reported in interaction tables with above said parameters to find out ptimum spacing and nitrogen level requirement of each entry, which is warranted for submitting release proposal.
- ANOVA (SEd$\pm$ , CD (5%) and CV) is compulsory. Kindly avoid reporting of SEm and SD values .
- Check Bt variety/ Bt hybrid with recommended spacing and nutrient level should be kept as control
- Analysis of FRBD will be followed by excluding check . RBD analysis will be made by comparing control versus others
- Basic soil parameters including pH, OC, EC, available N, P, K, Rainfall, No of irrigation , Recommended N,P&K , Recommended spacing and genotype etc. should be given at the bottom of the Table as a foot note so as to understand the kind of response and the yield expected under the conditions in agronomic requirement and other nutrient related experiments.
- All the breeders of the above varieties/hybrids are requested to submit 1.0 kg (variety) and 0.5 kg (hybrid) of **seeds directly to the concerned Agronomists (not to Project Coordinator)** and to keep track with the agronomists for getting the data on agronomy trial.
- Further, agronomists are requested to send the agronomic trials data (interaction tables) to the concerned breeder in addition to the Principal Investigator (Agronomy) in time to facilitate the submit the release proposals before due date.

**Action to be taken:**

- These Bt varieties/Bt hybrids have been recommended by the Breeding panel after ascertaining their performance.

- Concerned Breeders shall send the required seeds directly to the Agronomists of respective centers without delay for taking up experiments.
- Entomology & Pathology data will be collected from the concerned Principal Investigator.

**Observations to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of Sympodia at harvest
4) No. of Bolls/squaremeter
5) Boll weight (g)
6) Final Plant population (no /net plot)
7) Seed cotton Yield at 140 and 160 DAS (kg/ha), For H x B use 160 and 190 DAS depending on the duration of the crop
8) Duration of the crop (50% boll bursting days)

**Statistical Analysis:**

4) Standard error of difference
5) Critical Difference
6) Coefficient variation

**Reporting:** Data sheet of 1B is to be followed

**Status: ongoing (Fourth year)**

## Agronomy II: Augmenting ELS cotton production

### AGR II A Standardization of sowing window in cotton for southern dry zone of Karnataka

**Preamble**: The demand for the textile products made out of ELS cotton (32 mm and above) is growing exponentially. Despite of good harvest, there is mismatch in demand & supply of different staple group of cotton particularly in ELS cotton. The country is still importing ELS cotton annually from Egypt, Sudan, U.S.A and others. The demand for ELS cotton in India is about 9 lakh bales against the availability of only about 4 lakh bales. Chamarajanagar station is recently established under AICRP (cotton) to address the region-specific problem of ELS cotton cultivation. The rainfall pattern observed is continuous rains from April to December and multi sowing dates are commonly followed by farmers. Hence time of sowing experiments is proposed to find out optimum times of sowing of ELS cotton.

**Objectives:**

- To find out sowing window of ELS cotton in newly established ELS center at Chamarajanagar
- To study the influence of different times of sowing on yield and economic return of ELS cotton.

| | |
|---|---|
| **Implementing Centres** | South Zone-Chamarajanagar |

**Treatments Schedule**

$T_1$: March-2nd Fortnight
$T_2$: Apirl-1$^{st}$ Fortnight
$T_3$: April-2$^{nd}$ Fortnight

$T_4$: May-1st Fortnight
$T_5$: May-2nd Fortnight
$T_6$: June-1st Fortnight
$T_7$: June- 2nd Fortnight
$T_8$: July-1st Fortnight
$T_9$: July-2nd Fortnight
$T_{10}$: Aug-11st Fortnight
$T_{11}$: Aug- 2nd Fortnight
$T_{12}$: September 1st Fortnight

**Design:** RBD; Replications: 3

**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of Bolls/square metre
5) Boll weight (g)
6) Final plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)
8) Rainfall and effective rainfall
9) GDD,RTD&RHD
10) Correlation analysis yield with weather parameters
11. Pink boll worm observation

**Statistical Analysis:**
1) Standard error of difference
2) Critical Difference
3) Fibre quality parameters

**Economics Parameters:**
1) Cost of cultivation
2) Gross return

- Note : Estimation of quality parameters is mandatory for ELS experiments
- A more critical analysis of the rainfall pattern and other weather variables vis-a-vis the crop growth stages should be made for times of sowing experiment.

**Reporting:** Data sheet of AGR II A is to be followed

**Status: (Third year)**

## AGR II B Developing Package for inter specific ELS Bt hybrid

**Objective:** To find out geometry and nutrient requirement of ELS Bt hybrid

**Implementing Centres** South Zone – Chamarajanagar & Coimbatore

**Treatments Schedule**
**Genotypes**
G1. DCH 32 Bt
G2. Ruling Bt hybrid
**Spacing**
S1. Recommended spacing

S2. Closer spacing (25% less rec.)
**Nutrient Levels**
$N_0$. Control ( only P & K is applied)
$N_1$. 100% RDN (P& K are constant)
$N_2$. 125% RDN (P& K are constant)
$N_3$. 150% RDN (P& K are constant)
**Design: FRBD; Replications: 3**
**Note**: Different spacing and soil-test based recommended nitrogen levels (75 , 100 & 125% N) only to be simulated and soil-test based recommended levels of P & K are should be kept as constant.

Estimation of quality parameters is mandatory for ELS experiments.A more critical analysis of the rainfall pattern and other weather variables vis-a-vis the crop growth stages should be made for times of sowing experiment

**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of bolls/square metre
5) Boll weight (g)
6) Final plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)
8) Rainfall and effective rainfall
9) Pink boll worm observation

**Statistical Analysis:**
1) Standard error of difference
2) Critical Difference
3) Fibre quality parameters

**Economics Parameters:**
1) Cost of cultivation
2) Gross return

**Reporting:** Data sheet of AGR II B is to be followed

**Status: New (first year)**

## AGR II C Growth and yield performance of barbadense varieties

**Objective:** To assess performance of barbadense varieties in comparison to suvin

**Implementing Centres:** South Zone – Chamarajanagar &Perambalur (rainfed)& Coimbatore (irrigated)

**Genotypes (barbadense)**
G1.DB1601
G2.DB1602
G3.ARBB1502
G4.CICR B cotton 37
G5.CICR B cotton 45
G6.CO 18
G7.Control (suvin)
G8.Control (HxB BG II popular hybrid of the region)
**Design:**RBD Replications: Three

**Observation to be recorded (Replication wise data to be reported)**

| | |
|---|---|
| 1) Plant height (cm) at harvest | 2) No. of monopodia at harvest |
| 3) No. of sympodia at harvest | 4) No. of bolls/sqm |
| 5) Boll weight (g) | 6) Days of 50 % boll opening |
| 7) Seed cotton Yield (kg/ha) | 8) No of spray for sucking pest |
| 9) No of spray for boll worms | 10) Magnesium deficiency |
| **Statistical Analysis:** | **Economics Parameters:** |
| 1.LintIndex(g) | 1) Cost of cultivation |
| 2.SeedIndex(g) | 2) Gross return |
| 3.Ginningoutturn(%) | 3) Net return |
| 4.UpperHalfMeanLength (mm)underHVIMode | 4) Benefit Cost Ratio |
| 5.Uniformityindex underHVIMode | |
| 6.Micronaire underHVIMode | |
| 7.TenacityunderHVIMode | |

**Status: ongoing (Sixth Year)**

## Agronomy IV: Technology for Organic Nutrient Management of Cotton

**Preamble:** India is the largest producer of organic cotton in the world. India's contribution to global organic cotton production is 51 per cent. Evolving organic nutrient management strategy is very much required to support our organic production system. Market prices of organic manures are costly. Hence evolving low cost organic nutrient management strategy is proposed by integrating different sources of organic nutrients.

**Objectives:**

- To find out low cost nutrient management techniques for organic cotton production in different domains
- To assess soil organic carbon status, nutrient availability and economic return of selected organic nutrient management techniques.

**Implementing Centres:** All Centresof central and south Zone (except Dharwad and LAM)

**Treatments Schedule**

$T_1$ Absolute control (No organic& inorganic)
$T_2$ Control (STCR based inorganic)
$T_3$ RD of Nutrient through organic based on P equivalent basis
$T_4$ Seed treatment and soil application of recommended bio fertilisers and foliar application of PPFM
$T_5$ Neem cake 250 kg/ha
$T_6$ Raising of sunnhemp / fodder cowpea between rows incorporated before flowering
$T_7$ Intercropping with green gram/black gram/ groundnut/soybean
$T_8$ $T_4+T_5$
$T_9$ $T_4+T_6$
$T_{10}$ $T_4+T_5+T_6$
$T_{11}$ $T_4+ T_5 + T_7$

**Design:** RBD; Replications: 3
**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of bolls/squaremetre
5) Boll weight (g)
6) Final Plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)

**Statistical Analysis:**

1) Standard error of difference
2) Critical difference
3) Coefficient variation

**Economics Parameters:**

1) Cost of cultivation
2) Gross return
3) Net return
4) Benefit Cost Ratio
5) Cost of treatments & BCR

**Analysis:** Nutrient availability at planting and harvest & uptake; organic carbon content (before sowing and after harvest)

**Important Note:**

1. Long-linted a*rboreum* or *hirsutum* resistant to sucking pests should be selected. Raichur has to select arboreum in the place of herbaceum.
2. This project is to be conducted on the fixed site and plant protection management should be done with organic pesticides.
3. PPFM culture will be supplied by TNAU, Coimbatore.
4. Pest and disease observations to be taken by respective Entomologists & Pathologists of AICRP (Cotton) centre.
5. Use of organics / green manures – biomass and N addition should be quantified. The contribution of leaf fall in cotton is also appreciable – its effect on soil fertility and on the following crop also need quantification in organic cotton experiment.
6. Organic carbon analysis is mandatory. If any abnormality noticed , reanalysis of the samples should be done to ensure true value.
7. In Organic cotton experiment, emphasis should be given to monitor the improvement in soil nutrient availability and cotton fibre quality (at least for the best performing treatment). An account on the pest, disease and weed management practices followed should be reported along with the results.
8. The experiment of organic cotton will be allowed to close at LAM, Dharwad and Sriganganagar. Cropping system approach will be followed for other centres. Initial value of organic carbon status will be reported in every times . Trend of the result of previous years will be presented in every year

**Reporting:** Data sheet of AGR IV B is to be followed

**Status: Ongoing (Fifth Year for Central and South zone and First year for North zone)**

## Agronomy V: Conservation agriculture in cotton-based cropping system

**Preamble:** Conservation agriculture protects the soil from erosion, conserves water and nutrients, promotes soil biological activity and contributes to integrated pest management (IPM),

diversification of crops in associations, sequences and rotations to enhance system resilience and controlled traffic that lessen soil compaction. Thus, CA avoids straw burning, improves soil organic carbon (SOC) content, enhances input use efficiency and has the potential to reduce greenhouse gas emissions

**Objectives:**

- To identify suitable conservation strategies in cotton-based cropping system
- To assess the impact of conservation strategies on soil properties, nutrient availability and economic return of cotton-based cropping system.

**Implementing Centres:** North Zone (Faridkot, Bathinda, Hisar &Sriganganagar )
Central Zone ( Junagadh& Rahuri)
South Zone ( Srivilliputhur&Chamrajnagar)

| | **Central & South Zone** |
|---|---|
| $T_1$ | Conventional tillage+ No residue management |
| $T_2$ | Zero tillage+ No residue management |
| $T_3$ | Zero tillage+ 50% residue management |
| $T_4$ | Zero tillage+ 100% residue management |
| $T_5$ | Permanent bed system + Zero tillage + No residue management |
| $T_6$ | Permanent bed system + Zero tillage+ 50% residue management |
| $T_7$ | Permanent bed system + Zero tillage+ 100% residue management |
| | **Treatments (Design: RBD); (Replications: 3) Plot size: (9x8 m)** |

**North Zone**

| Treatments | Kharif season (Cotton) | Followed by | Rabi season (Wheat) |
|---|---|---|---|
| T1 | Complete removal of wheat residue + conventional tillage for sowing of cotton (Control ) | ⇨ | Complete removal of cotton residue after picking + conventional tillage for sowing of wheat and drill sowing of wheat crop (Control) |
| T2 | Complete removal of wheat residue + conventional tillage for sowing of cotton (Control ) | ⇨ | 100% cotton residue incorporation after picking + sowing of wheat crop through Super seeder in one go |
| T3 | Complete removal of wheat residue + minimum tillage for sowing of cotton in rows at 67.5 cm only | ⇨ | Complete removal of cotton residue after picking+ sowing of wheat through zero till drill |
| T4 | 50% wheat residue incorporation by rotavator (after removal of loose straw) followed by sowing of cotton | ⇨ | Complete removal of cotton residue after picking + sowing of wheat crop through Super seeder |
| T5 | 50% wheat residue incorporation by rotavator (after removal of loose straw) followed by sowing of cotton | ⇨ | 100% cotton residue incorporation after picking + sowing of wheat crop through Super seeder in one go |
| T6 | 100% wheat residue incorporation by rotavator followed by sowing of cotton | ⇨ | Complete removal of cotton residue after picking + sowing of wheat crop through Super seeder |
| T7 | 100% wheat residue incorporation by rotavator followed by sowing of cotton | ⇨ | 100% cotton residue incorporation after picking + sowing of wheat crop through Super seeder in one go |

Note: The same treatment sequence will be retained in the respective experimental plots during both cropping seasons. E.g. The experimental plots allocated with Treatment no. 1during *Kharif* season will be retained under Treatment no. 1 during all subsequent *Kharif* as well as *Rabi* seasons until 4 experimental seasons.

**Conditions / cropping system**

| | | |
|---|---|---|
| North Zone | Irrigated | Cotton – wheat (One year rotation) |
| Central Zone | Irrigated | Cotton – maize/ Sorghum (One year rotation) |
| | Rainfed | Cotton - soybean (Two year rotation) |
| South Zone | Irrigated | Cotton – maize/sorghum (One year rotation) |
| | Rainfed | Cotton+ pulses –maize/sorghum (Two year rotation) |

**Observation to be recorded (Replication-wise data to be reported)**

**Analysis**

**I. Soil parameters**

**a. Soil physical parameters**

i) Soil texture, Soil bulk density , Soil infiltration rate, Soil temperature

**b. Soil chemical parameters**

i) Soil pH , Soil EC , Soil Organic Carbon, C: N Ratio

ii) Available nitrogen, phosphorus and potassium before and after every crop season

**II. Observations to be recorded in cotton**

**a. Growth attributes and phenology**

i) Plant stand, Plant height

**b. Yield attributes**

i) Bolls per plant , Boll weight (g)

ii) Seed cotton yield (kg $ha^{-1}$)

iii) Ginning out turn (GOT %)

iv) Lint yield (kg $ha^{-1}$)

viii) Seed yield (kg $ha^{-1}$)

ix) Dry weight of cotton

**III. Observations to be recorded in wheat**

**a. Growth parameters**

i) Emergence count, Plant height ,Dry matter accumulation (g $m^{-2}$)

**b. Yield attributes and yield of wheat**

i) Effective tillers, Ear length (cm), Number of grains per ear, 1000-grain weight (g)

ii) Grain yield (kg $ha^{-1}$), Biological yield (kg $ha^{-1}$), Harvest Index (%)

**IV. Observations to be recorded in maize**

1)Plant height at harvest (cm), 2) LAI at 60 DAS ,3) Dry matter accumulation at harvest 4) Number of grains per cob, 5) Grain weight (g /cob), 6)Grain yield (t ha-1), 7) Stover yield (t ha-1)

**V. Observations to be recorded in sorghum**

1)Plant height (cm), 2) Panicle length (cm), 3) Panicle diameter (cm), 4) 1000 grain weight (g) 5)Grain yield (t/ha), 6)Stover yield (t/ha)

**IV. Economic analysis**

i) Cost of cultivation, Gross returns, Net returns, Benefit- cost ratio

Note: The experiment is semi-permanent to be conducted on the fixed site with same layout

**Reporting:** Data sheet of AGR V is to be followed

**Status: Ongoing (Survey)**

## Agronomy VII: Input use pattern & cost of cultivation

**Preamble**: The objective of collecting input use pattern and cost of cultivation in different region with existing cotton type to create CICR data base and also to understand input-use pattern.

| Sl.No | State | Centre | Species | Type |
|---|---|---|---|---|
| 1 | Punjab | Faridkot | Hirsutum | HxH |
| | | Bathinda | Arboreum | Variety |
| 2 | Haryana | Hisar | Hirsutum | HxH |
| | | | Arboreum | Variety |
| 3 | Rajasthan | Sriganganagar | Hirsutum | HxH |
| | | | Arboreum | Variety |
| 4 | Maharashtra | Nanded | Hirsutum | HxH |
| | | Akola (Vidarbha) | Hirsutum | HxH |
| | | Rahuri | Hirsutum | HxH |
| 5 | Gujarat | Junagadh | Hirsutum | HxH |
| | | Surat | Hirsutum | HxH |
| 6 | Madya Pradesh | Khandwa | Hirsutum | HxH |
| 7 | Odisha | Bhawanipatna | Hirsutum | variety |
| 8 | Karnataka | Raichur | Hirsutum | HxH |
| | | Dharwad | Hirsutum | HxH |
| | | | Hirsutum | HxB |
| | | Chamrajnagar | Hirsutum | HxB |
| 9 | Andrapradesh | Nandyal | Hirsutum | HxH |
| | | LAM | Hirsutum | HxH |
| 10 | Tamil Nadu | Coimbatore | Hirsutum | HxH |
| | | | Hirsutum | HxB |
| | | Srivilliputhur | Hirsutum | HxH |
| | | Coimbatore (CICR) | Barbadense | Variety |
| | | | arboreum | variety |

Note: Methodology: Farm survey will be conducted for each case and the relevant questionnaire will be provided from AICRP, Coimbatore. The survey will be concentrated on major environment of the domain.

**Reporting:** Data sheet of AGR VII is to be followed

**Status: Ongoing (Third Year- North Zone, Second Year- South Zone)**

## Agronomy IX: Standardisation of geometry for Bt varieties (HDPS)

**Preamble:** Bt-cotton technology is expected to protect the cotton crop from bollworm attacks. Clearly the yield benefits should come from the hybrids or varieties. For best yield benefits, it is important that the hybrids or varieties must be ideally suited for specific agro-eco-zones. For example the best options for rainfed regions would be early-maturing short duration straight varieties, which are amenable for high-density planting system also. The newly released Bt varieties are taken for evaluation and suitability and geometry requirement.

**Objectives:**

- To standardize geometry of released Bt varieties
- To assess seed cotton yield and economic performance of Bt varieties.

**Implementing Centres:** North Zone (Hisar, Faridkot, Bathinda, Sriganganagar)South Zone (Dharwad, Adilabad, Perambalur&Nandyal)

**Treatments** (Design: Split); (Replications: 3)

| **North Zone(irrigated)** | **South Zone (rainfed)** |
|---|---|
| **Genotypes** | **Genotypes** |
| G1. PAU1Bt | G1.CICR Bt 23 |
| G2. PAU2Bt | G2.CICR Bt 25 |
| G3. PAU 3 Bt | **Spacing levels** |
| G4. CICR Bt 6 | S1. 60 X 15 cm |
| **Spacing levels** | S2. 60X 30 cm |
| S1. 67.5 X 15 cm | S3. 90 X 15 cm |
| S2. 67.5X 30 cm | S4. 90 X 60 cm |
| S3. 80 X 15 cm | **Nitrogen levels** |
| S4. 67.5 X 60 cm | N1.100% RDN (P&K are constant) |
| | N2.125% RDN (P&K are constant) |
| | N3.150% RDN (P&K are constant) |
| | N4.Control (No N, only P & K to be applied) |
| Control: Existing Bt hybrid with recommended spacing and nutrients | Control: Existing Bt hybrid with recommended spacing and nutrients |

**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) Sympodial length (cm)
5) No. of bolls/squaremetre
6) Boll weight (g)
7) Final plant population (no /net plot)
8) Seed cotton Yield (kg/ha)
9) Architectural changes due to spacing (LAI, plant height, no. of monopodia and its length, no. of sympodia and its length)

**Statistical Analysis:**

1) Standard error of difference
2) Critical difference
3) Coefficient of variation

**Note:**

- Control plot will be kept for comparison purpose. The design and layout will be planned for main and sub plot treatments only
- Bt seeds of 2 kg /each CICR genotype will be provided by Seed Section of CICR, Nagpur
- RDN- based on soil test value different levels to be simulated
- In Agronomy IX experiment "Standardization of geometry for Bt varieties", quantity of seed to be supplied for experimentation should be 1.5 times for north zone considering the soil crust problem related poor crop establishment.
- The experiment will be concluded in central zone. One more Bt variety (CICR 25) will be included for South Zone

**Reporting:** Data sheet of AGR IX is to be followed

**Status (Third Year)**

## Agronomy X :Multi-tier cropping system to enhance resource utilization, profitability and sustainability of *Bt* cotton *(Gossypium hirsutum)* production system

**Preamble**: Cotton is a crop of relatively longer duration; its slow initial growth offers a vast scope for cultivation of suitable intercrops. An ideal cotton based multi-tier intercropping should aim to produce higher economic return and yields per unit area, offer greater stability in production, meet the domestic needs of the farmer. The crops with diverse features (growth habit, root depth and duration) are useful in making multi-tier system with Bt cotton to enhance resource utilization, profitability and sustainability of Bt cotton production system.
**Objective:** To identify better inter cropping system have enhanced resource utilization, profitability and sustainability

**Implementing Centres:** Central Zone (Surat, Junagadh, Rahuri, Akola, Nanded ,Bhawanipatna& Khandwa)
South Zone ( Raichur, Dharwad, Chamarajanagar, Nandyal , LAM, Coimbatore, Srivilliputhur, Adilabad and Perambalur)

**Treatment schedule**
**Design: RBD Replications: 3**

$T_1$. Sole Bt cotton
$T_2$. Paired row planting of Bt cotton with two rows of intercrop (A)
$T_3$. Paired row planting of Bt cotton with two rows of intercrop (B)
$T_4$. Paired row planting of Bt cotton with two rows of intercrop (C)
$T_5$. Paired row planting of Bt cotton with one row (A) +one row (B)
$T_6$. Paired row planting of Bt cotton with one row (B) +one row (C)
$T_7$. Paired row planting of Bt cotton with one rows (C) +one row (A)
$T_8$. Farmers practice
$T_9$. Recommended intercropping

**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of bolls/squaremetre
5) Boll weight (g)
6) Final Plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)
8)weed count (No/$m^2$) and biomass (g/$m^2$) before weeding at two times

**Statistical Analysis:**

1. Relative production efficiency (RPE)
2. Relative Economic efficiency
3. Land equivalent ratio
4. Weed smothering efficiency
5. Diversification index
6. Input use efficiency (water, labour & nutrients)
7.Nutrient analysis (N,P&K Uptake and Available)

**Economics Parameters:**

1) Cost of cultivation
2) Gross returns
3) Net returns
4) Benefit : cost Ratio

**Note:** Pure crop of intercrops to be raised for analyzing advantage of intercropping
High performing intercrops (three) of the region will be selected for study
In multi-tier cropping system experiment, maximum two intercrops can be grown in a treatment and the treatment involving three intercrop may be dropped

**Reporting:** Data sheet of AGR X is to be followed. Photographs/images of intercropping are must for documentation

**Status: proposed**

**Agronomy XI Effect of Bio stimulant on growth and development of Bt cottonhybrids/varieties**

**Objective:** To assess the effect of bio stimulant on growth characters and yield

**Implementing Centres:** North Zone( Faridkot& Hisar)
Central Zone- (Akola, Khandwa, &Bhawanipatna)
South Zone (LAM, Raichur, Coimbatore &Srivilliputhur)

**Treatments** (Design: FRBD); (Replications:3) plot size: 50 $m^2$

**Treatments:** 8
**Main plot**
G1.Bt hybrid of the region
G2.Bt /non Bt variety

**Bio stimulant**
B1.Bio stimulant @4ml/l at 30, 45 and 60 DAS
B2. Bio stimulant @4 ml/l at 45, 60 and 75 DAS
B3. DMSO spray@ 100 µl/l at 30, 45, 60 and 75 DAS
B4.Control (water spray- 30, 45, 60 and 75 DAS)

**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of Bolls/square meter
5) Boll weight (g)
6) Final Plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)
8) Germination per centage, shoot length and seedling vigor
9)No of Days for 50 % squaring
10) No of Days for 50 % flowering
11) No of Days for 50 % boll bursting
12) Seed cotton yield (kg/ha) at 150 DAS

Economics Parameters:

**Statistical Analysis:**

1) Standard error of difference
2) Cost of cultivation
3) Critical difference
2) Gross returns
4) Coefficient of variation
3) Net returns

## Agronomy XII Drought and water logging Studies in cotton

Expt.1.Effect of land configuration and plant growth regulator on drought management in cotton

| | |
|---|---|
| Implementing Centres: | Central Zone- ( Nanded Akola, Khandwa, &Bhawanipatna)<br>South Zone (Dharwad, Chamrajanagar, LAM, Adilabad &Perambalur) |

**Treatment Schedule**

**A.Land Configuration (Main plot)**
A1.Broad Bed Furrow
A2.Ridges& Furrow
A3.Control –Farmers Practice

**B. Drought Management (Sub plot)**
D1.Glycine Betaine @100ppm single spray
D2. Salicylic acid @100ppm single spray
D3.Control

**Design:**Split-Split plot Design Replications: Three

## Expt.2.Effect of land configuration and plant growth regulator on water logging management in cotton

Implementing Centres: Central Zone(Surat &Junagadh)
South Zone (Raichur, Coimbatore&Srivilliputtur)

**Treatment Schedule**

**A.Land Configuration (Main plot)**
A1.Broad Bed Furrow with chemical based weed control
A2.Ridges& Furrow with chemical based weed control
A3.Control –Farmers Practice

**B.Water logging management (sub plot)**
W1. Nitrogen @20kg/ha + Potassium @20kg/ha
W2.Salicylic acid @0.5mM single spray
W3. Control

**Design:**Split-Split plot Design Replications: Three

**Observation to be recorded (Drought management)**
1) Plant height (cm) 2) No. of monopodia3) No. of sympodia 4) No. of Bolls/squaremetre 5) Boll weight (g) 6) Final Plant population (no. /net plot) 7) Single plant yield (g/plant) 8)Seed Cotton Yield (kg/ha) 9)Nutrient uptake,

**Observation to be recorded (Water logging management)**
1) Plant height (cm) 2) No. of monopodia3) No. of sympodia 4) No. of Bolls/squaremetre 5) Boll weight (g) 6) Final Plant population (no. /net plot) 7) Single plant yield (g/plant) 8)Seed Cotton Yield (kg/ha) 9)Nutrient available under water logged condition 10)Nutrient uptake, 11) Foliar Pigmental composition 12) mineral concentration

**Note:**Drought treatments to be imposed after depletion of 75 per cent of soil moisture Water logging will be created for 15 days which coincide with continuous wet spell of the season The water logging treatments to be imposed after drain the water from water logged field

**Reporting:** Data sheet of AGR XI is to be followed

# Technical Programme for Physiology and Biochemistry: 2022-23

| | |
|---|---|
| PHY 1 | PGR for optimum morpho frame and enhanced yield |
| PHY2 | Preparing for climate change - Growth and development of *arboreum* cotton in response to growth regulators |
| PHY 3 | Effect of growth retardant on physiological parameters and productivity of compact genotypes |
| PHY 4 | Use of Defoliants to facilitate mechanical picking |
| BIO CHEM1 | Screening of Cotton genotypes for abiotic stress tolerance and estimation of seed oil, gossypol and protein |
| BIO CHEM2 | Analysis of biochemical constituents of organic cotton experiment (Agronomy IV), morpho frame (Phy:1), climate change (Phy :2) growth retardants (Phy:3) and defoliants (Phy:4) |

**Status: Ongoing (Third Year)**

## PHY.1: PGR for optimum morpho frame and enhanced yield

**Preamble:** Plant growth and development are regulated by natural plant hormones; these processes may be influenced either by altering the plant hormone level or by changing the capacity of the plant response to natural hormones. Bt cotton, the plant morpho frame doesn't develop fully due to early switch over to reproductive phase under resource constraints condition. Modification of morpho frame by agrochemicals could greatly help in dispensing away these limitations

**Objectives:**

- To assess the effect of growth promoters and retardant on productivity of cotton
- To assess the effect of growth promoters and retardant on architectural changes

**Implementing Centres:** North Zone (Hisar), Central Zone(Surat)
South Zone ( Dharwad& Lam)

**Treatments Schedule**

**Main plot**
$G_1$. Bt hybrid of the region
$G_2$. Bt /non Bt variety

**Plant growth regulator**
$B_1$. Ethrel @ 45 ppm at 40 DAS
$B_2$. Mepiquat chloride @ 100ppm at 90 DAS
$B_3$. Ethrel @45 ppm at 40DAS + Mepiquat chloride @ 100ppm at 90 DAS
$B_4$. Control (water spray)

**Design:** FRBD Replications: Three

**Observation to be recorded at 40, 90 and 120 DAS and at harvest**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of Bolls/square meter
5) Boll weight (g)
6) Final Plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)
8) Germination per centage, shoot length and seedling vigor
9) Architectural changes due to spacing (LAI, Plant height, No of monopodia and its length, No of sympodia and its length) **.**
10) Fruiting positions should be recorded

**Statistical Analysis:**

1) Standard Deviation
2) Critical Difference
3) Coefficient variation

**Economics Parameters:**

1)Cost of cultivation
2)Gross return
3) Net return

**Reporting:** Data sheet of PHY I is to be followed.

**Status: Proposed**

## PHY 2: Preparing for climate change - Growth and development of *arboreum* cotton in response to growth regulators

**Preamble:** Desi cotton is known for tolerance of abiotic stress. However, the land races are known for photo and thermo sensitive characters. Delay sowing observed excessive vegetative growth with less or no flowering. However, delay sowing by late onset of monsoon is not uncommon by climate change. Hence the experiment is proposed to induce flowering by spraying PGRs in desi cotton under delay sowing situation

**Objective:** To assess the effect of flower inducing PGRs on performance of late sown arboreum cotton

**Implementing Centres:** Surat (Central Zone);
LAM and Dharwad (South Zone)

**Treatments Schedule**

**D. Sowing Time**

$D_1$ Normal sowing of the region
$D_2$ $D_1$ + 20 days
$D_3$ $D_2$ + 20 days

**G. Growth regulator**

$G_1$ Control
$G_2$ Detopping on 20$^{th}$ node
$G_3$ Gibberellic acid @ 100 ppm at 45 &60 DAS+ Detopping on 20$^{th}$ node
$G_4$ Ethrel@8.5µM at 45 DAS +Detopping on 20$^{th}$ node
$G_5$ Homobrassinolide@0.2 ppm at 45 & 60 DAS +Detopping on 20$^{th}$ node

**Design:** FRBD; Replications: 3

**Observation to be recorded (Replication wise data to be reported)**

1) Plant height (cm) at harvest
2) No. of monopodia at harvest
3) No. of sympodia at harvest
4) No. of Bolls/square metre
5) Boll weight (g)
6) Final Plant population (no. /net plot)
7) Seed cotton Yield (kg/ha)
8) Days to first squaring
9) Days for 50 % squaring
10) Days for first flowering
11) Days for 50 % flowering
12) No of days for first boll bursting
13) No of days for 50 % boll bursting
14) No of flowers at 50 % flowering and subsequently every 30 days after 50% flowering

**Reporting:** Data sheet of PHY 2 is to be followed

**Status: New ( First year)**

## PHY. 3 Effect of growth retardant on physiological parameters and productivity of compact genotypes

**Objective:** To study the effect of continuous application of growth retardant on physiological parameters and productivity of compact genotypes

**Implementing Centres:** Hisar (North Zone) Surat (Central Zone); LAM and Dharwad (South Zone)

**Treatment schedule**

$T_1$.Control
$T_2$.Detopping
$T_3$.Mepiquat chloride@45ppm at square initiation
$T_4$.Mepiquat chloride@45ppm at square initiation +Detopping
$T_5$.Mepiquat chloride@45ppm at square initiation and 15 days after first spray
$T_6$.Mepiquat chloride@45ppm at square initiation and 15 days after first spray +Detopping
$T_7$.Mepiquat chloride@45ppm at square initiation and 15 days after first spray and 15 days after second spray ( need based)
$T_8$.Mepiquat chloride@45ppm at square initiation and 15 days after first spray and 15 fays after second spray ( need based)+Detopping

**Genotypes:** North Zone ( compact Bt variety), Central Zone (RCH 608 BG II) and South Zone (NSL- Navaneeth)

**Design:** RBD Replications: 3, Planting Methods: HDPS ( North Zone 67.5 x 15 cm, RCH608 BG II (90 x15 cm) and NSL- Navaneeth (90 x 22.5 cm)

**Observation Schedule**

| | |
|---|---|
| 1.Germinationpercentage | 9.SeedIndex(g) |
| 2.Plantstandatharvest | 10. Ginningoutturn(%) |
| 3.Plantheight(cm)(priortoPGRSpray) and harvest | 11.UpperHalfMeanLength (mm) |

| | |
|---|---|
| 4.Numberofmonopodia | 12.Uniformityindex |
| 5.Numberofsympodia | 13.Micronaire |
| 6.Numberof nodes | 14.Tenacity |
| 7.Numberofbolls/sq.m | 15.SeedCottonYield(q/ha) |
| 8.LintIndex(g | |

**Note:** Detopping will be done on 20$^{th}$node for Bt hybrid on 15$^{th}$ node for Bt variety

**Status: proposed (New)**

**PHY 4 Use of Defoliants to facilitate mechanical picking**.

**Objective:**) To Study the effect of Defoliants on growth & Yield of cotton.

**Implementing Centres:** Surat and Junagadh (Central Zone);
Coimbatore (CICR), LAM and Dharwad (South Zone)

**Treatment schedule**
$T_1$.Control
$T_2$.Ethrel @2000 ppm
$T_3$.KCl @10%
$T_4$. Thidiazuron @500 ppm
$T_5$. Dimethopin @ 1200 ppm
$T_6$.T2+T5
$T_7$.T3+T5
$T_8$.T4+T5
$T_9$. T2+Diuron@200 ppm
$T_{10}$.T3+Diuron @200 PPM
$T_{11}$. T4+Diuron @200 PPM
$T_{12}$.Sodium chlorate @0.9 %
$T_{13}$.CICR Defoliant

**Design:** RBD Replications: three

**Genotypes:** Ruling Bt hybrid

**Treatments should be imposed after 65 % of boll opening**

**Observation to be recorded at harvest**

| | |
|---|---|
| 1) Plant height (cm) at harvest | 2) No. of monopodia at harvest |
| 3) No. of sympodia at harvest | 4) No. of Bolls/square meter |
| 5) Boll weight (g) | 6) Final Plant population (no. /net plot) |
| 7) Seed cotton Yield (kg/ha) | 8) Boll opening per centage |
| 9) Per cent defoliation at 5 and 10 days after spraying | 10) Earliness index |
| 11)**Trash analysis** | |
| Statistical Analysis: | Economics Parameters: |
| 1) Standard Deviation | 1)Cost of cultivation |
| 2) Critical Difference | 2)Gross return |
| 3) Coefficient variation | 4)Net return |

**Status: Ongoing regular programme**

## Bio Chem 1. Screening of Cotton genotypes for abiotic stress tolerance, estimation of for seed oil, gossypol and protein

**Preamble:** Pre released cultures are screened for abiotic stress tolerance and estimation of for seed oil, gossypol and protein. The information is useful if released as variety otherwise utilized as pre breeding materials

**Objectives:**

- To identify genotypes known for tolerance to drought and salinity
- Estimation of seed oil, gossypol and protein content of different genotypes /advanced materials
- Analysis of biochemical constituents of organic cotton and Bt varieties

**Implementing Centres:** Hisar, Surat and Dharwad

**Genotypes:** Pre-released cultures +Zonal Check +Local Check

**Action**: Data should be given in every monthly report.

**Observations to be recorded:**

- Seed Cotton Yield and ancillary data
- Phenology
- RWC, Chlorophyll stability index, Proline content, SLW, nutrient uptake
- Stress indices (PHSI, DMSI, YSI and S etc.)
- Monitoring of Periodic soil moisture profile
- Oil estimation, gossypol and protein
- Monitoring of soil salinity at initial and final stages
- Leaf Na and K content at peak flowering stage

Note: All the breeders are requested to provide 200 g of pre released genotypes of varieties/hybrids/local check/zonal check including compact cultures directly to Bio chemist of the respective zone with communication to PC & Head, and PI of agronomy and plant breeding

**Reporting:** Data sheet of Bio Chem.1 is to be followed

**BIO CHEM2:Analysis of biochemical constituents of organic cotton experiment (Agronomy IV), morpho frame (Phy:1), climate change (Phy :2) growth retardants (Phy:3) and defoliants (Phy:4)**

**Objective:** To estimate primary and secondary metabolite/ defensive compounds

**Implementing Centres:** Hisar, Surat and Dharwad

**Technical Programme**

Organic cotton experiment (Agronomy IV), morpho frame (Phy:1), climate change (Phy :2) growth retardants ( Phy:3) and defoliants (Phy:4)

**Observation to be recorded at harvest**

| | |
|---|---|
| 1) Plant height (cm) at harvest | 2) No. of monopodia at harvest |
| 3) No. of sympodia at harvest | 4) No. of Bolls/square meter |
| 5) Boll weight (g) | 6) Final Plant population (no. /net plot) |
| 7) Seed cotton Yield (kg/ha) | |

**Bio chemical Analysis**

- Estimation of primary metabolites (carbohydrates, proteins)
- Estimation of biochemical parameters such as tannins, phenols, flavonoids and gossypol

**Reporting:** Data sheet of Bio Chem.2A is to be followed

**Due Date for submission for Data (Zone wise)**

| | |
|---|---|
| North Zone Centres | December 31, 2022 |
| Central Zone Centres | January 15, 2023 |
| South Zone Centres | January 31, 2023 |

# Proceedings of the Entomology Panel

| | |
|---|---|
| **Chairman** | Dr. T.M. Manjunath, Member, Program Advisory & Monitoring Committee |
| **Co-Chairman** | Dr. Y.G. Prasad, Director, ICAR-CICR, Nagpur |
| | Dr. M.R. Srinivasan, Head In charge, Dept. of Entomology, TNAU, Coimbatore |
| | Dr.NandiniNarkhedkar, Head, Crop Protection Division, ICAR-CICR, Nagpur |
| **Convener** | Dr. Rishi Kumar, Principal Investigator (Entomology) (AICRP on Cotton) |
| **Rapporteurs** | Dr. M. Amutha, Senior Scientist, ICAR-CICR (RS), Coimbatore |
| | Dr. K. Senguttuvan, Asstt Professor (Entomology), Dept. of Cotton, TNAU, Coimbatore |

As conveyed in advance, all the centers have already submitted their written progress reports of the experiments conducted during last season (2021-22) under AICRP on Cotton Entomology. Therefore, to save time, randomly the following centers were invited to present the progress report of experiments conducted during 2021-22.

| S.N. | Name of the Scientist selected for presentations |
|---|---|
| 1 | Dr. S.G. Hanchinal, Scientist, UAS, Raichur, Karnataka |
| 2 | Dr. Annie Diana Grace, Scientist, RARS, Lam, Guntur |
| 3 | Dr. Poornima Matti, Scientist, ARS, Dharwad |

Based on the reports received, presentations made and discussion held, the following suggestions/comments were made:

**Dr T.M. Manjunath, Member, Program Advisory & Monitoring Committee:**

- It has been observed that the populations of pink bollworm remain the same in Bt and not Bt crops, which confirm the development of resistance in pink bollworm. It is a serious concern that needs to be addressed with the utmost priority.
- He emphasised that mating disruption through sex pheromone has already been proved to be an effective technology to combat PBW in other countries and also through several experiments in India. It can be deployed on a large-scale for further demonstration and subsequently for practical use.. It would also ultimately paves the way for restoring the efficacy of Bt cotton against PBW.
- It is reported that the moths of the fall armyworm, *Spodoptera frugiperda*, were caught in the pheromone traps set up for *Spodoptera litura*. It is an indication that *S. frugiperda* is fast spreading. Even though cotton is not a preferred host of this pest at present, a vigil should be kept on its incidence at all centres as a proactive measure in view of the fact that certain pests are known to change their host preferences over a period of time.
- He apprised that prior to the present recommendation of Refuge-in-bag (5-10% non-Bt seed mix), the earlier recommendation was to grow refugia in border rows either with 5% non-Bt without any control measures or 20% non-Bt with control measures.
- Dr. Manjunath emphasized that it would be wrong to address Helicoverpa (earlierHeliothis) armigera as ‘American bollworm’ as this species does not occur in America. When it was first noticed on cotton in India around 1970, it was mistaken for Heliothiszea, anew pest introduced from America. However, careful studies soon have revealed that it is our own indigenous species, H. armigera, hitherto known as ‘Tomato fruit borer’ that has shifted to

cotton. Therefore, it is more appropriate to call H. armigera as “False American bollworm” or “Old world bollworm.” He informed that he has clarified this issue long back and used the terms “False American bollworm” and “Old world bollworm” in his papers published more than 25 years ago and also subsequently.

**Dr.Y.G. Prasad, Director, ICAR-CICR, Nagpur**

- Suggested on identifying and depositing promising genotypes screened for resistance to sucking pests in a germplasm repository and their utilization in breeding programs
- Publications may be brought out using data generated in AICRP trials in high impact factor journals in a collaborative mode with support of other institutes for data analysis and development of models.
- Development and upgradation of zone-wise integrated pest management practices.
- Suggested to provide ready reckoner materials (data sheet) for recording insect pests and microclimate data recorders to all centres.
- In unprotected seasonal incidence trial, entomology plots should be sprayed with fungicides and pathology plots should be sprayed with insecticides. In addition, in plots used for recording bollworms damage, protection for sucking pests should be undertaken.
- Insisted that uniformity of data collection should be maintained across all centres.

**Dr. M.R. Srinivasan,** Head In-charge, Dept. of Entomology, TNAU, Coimbatore**&Dr. Nandini Narkhedkar,** Head, Crop Protection Division, ICAR-CICR, Nagpur, also guided with valuable inputs to formulate the experiments with statistical strength. They also advised to keep an eye on emerging pests such as thrips, mirid bugs, and fall armyworm.

## ENTOMOLOGYTECHNICALPROGRAMME: 2022-23

**List of the experiments to be conducted during 2022-23**

| Expt. No. | Title of the Experiment | Year | Participating Centers |
|---|---|---|---|
| Ent 1(a) | Screening of breeding material for resistance to insect-pests (National and Zonal Trials) | Continuous | All centers of North, Central & South zones |
| Ent 1(b) | Advance screening of promising entries for development of repository for sucking pests | Continuous | All North Centers<br>Central zone (Surat, Nanded, Junagarh, Rahuri)<br>South zone (Lam Guntur, Dharwad and Raichur) |
| Ent 2 | Seasonal dynamics to develop suitable forecasting model | Continuous | All centers |
| Ent 3 | Survey for key and emerging pests in farmers' fields for weekly advisory | Continuous | All centers |
| Ent4 | Integrated Pest Management in Cotton | I$^{st}$Year | All Centers |
| Ent 5 | Evaluation of Refugia in bag against bollworm complex in cotton (2022-23) | II$^{nd}$year | **North Zone**(Hisar, Bathinda, Faridkot and Sriganganagar)<br>**Central Zone** (Surat, Nanded, Junagarh, Rahuri& Akola)<br>**South Zone** (Nandyal, Warangal, Dharwad, Raichur & Guntur) |
| Ent 6 | Evaluation of prominent and label claimed insecticides against bollworm complex of cotton ( 2022-23) | II$^{nd}$ Year | All centers |
| Ent 6a | Evaluation of MakAdjuvol (Mineral Paraffin Oil) as adjuvant with insecticides—**sponsored product** | I$^{st}$Year | North Zone (Sirsa, Bathinda & Sriganganagar), Central Zone (Surat, Nanded, Junagarh&Banswara) & South Zone (Dharwad, Guntur and Raichur) |
| Ent7 | Microbial based volatiles for sucking pest management in Bt cotton **(Sponsored Technology)** | I$^{st}$Year | **North Zone**- Hisar, Sirsa, Sriganganagar, Bathinda, Faridkot<br>**Central Zone**- CICR, Nagpur, Junagarh, Surat, Nanded, Akola, Rahuri&Banswara<br>**South Zone**- Lam Guntur, Raichur, Dharwad, Coimbatore, Nandyal, Chamrajnagar |
| ??????? | Clustered Demonstration : Mating disruption technology for PBW in cluster (ca 60 acres) (Paid up/ sponsored trial) | One Year | The company proposed for conduct of trial during the Inaugural session, but did not attend the concurrent session for finalization of Technical programme, hence the product is not tested during 2022-23. |

## Technical Program (2022-2023)

### Ent. 1a: Screening of breeding material for resistance to insect pests

**Check entries for the different zones:**

- **North Zone**: RS2013 (resistant to jassid& whitefly); GA (susceptible) MRC 7017 BGII (bollworm resistant); MRC 7017 NBt (bollworm susceptible)
- **Central Zone**: NDLH-1938 (Leafhopper tolerant); DCH 32 (susceptible to Leaf hopper) & Suraj (Bollworms susceptible) Ajeet 155BG II (bollworm resistant) (separate for Gujrat/Maharashtra/MP)
- **South Zone**: NDLH-1938 (Leaf hopper tolerant); DCH 32 (susceptible to Leaf hopper) & Suraj (Susceptible to bollworms), Jadoo BGII (bollworm resistant)
- **(Action :Suggest name of scientist for supply of the seed of checks): Seeds supply – Sr Cotton breeders of their respective centers ( Suraj),Dr.Poornima for DCH 32, Dr Sivarama Krishna for NDLH-1938 will supply the respective seeds.**
- **Note**: Include check entries without seed treatment as that of coded entries. Find out resistant/tolerant entries (reference to varieties)
- Raising a okra crop between every four rows or at the boundary of each cotton genotype helps build up the sucking pest population in the target entries.
- Shortlist resistant/ tolerant entries-based on only grading as tolerant/susceptible. Collect seeds for advanced screening trial
- Besides the zonal trials, entomologists of all centres should observe the National Trials (Breeding/ Pathology) for healthy plants from point of sucking pests up to 70 DAS and at harvest and tag them, report them and collect seeds for further screening in the next year

**SCREENING TECHNIQUES OF KEY PESTS**
**(POPULATION AND DAMAGE ASSESSMENT) IN COTTON**

**Methodology:**

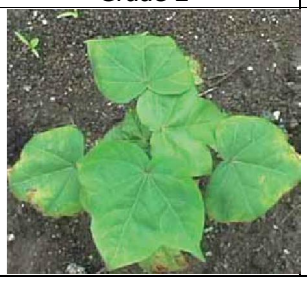
| **Particular** | **No of Obs** | **Stage** | **Observations: No of plants /plot** |
|---|---|---|---|
| Sucking pests: The population of leafhoppers, thrips and whiteflies will be recorded from three leaves per plant representing top, middle and bottom regions on five plants in each replication of all the entries | 2 | Anytime at Peak activity stage ie 45/60/75 / 90 days after sowing | 5 tagged |
| Bollworms: The fruiting body damage will be recorded at different stage after sowing. The open boll damage and locule damage will be assessed at harvest. | | | |
| Fruitingbody damage due to OWB or ABW/SBW/TC | 2 | Anytime at peak activity stage ie 75 /90 /105/120 days after sowing | 5 tagged plants /plot |
| Green boll damage due to PBW through destructive sampling | 2 | At peak activity stage ie 90, 105, 120&135 days after sowing | 10 bolls per plot in consultation with the breeder |
| Open boll & locule damage | 1 | At harvest | 5 tagged plants |

Specifically for leafhoppers, the injury grade will be assessed in each of the entry and mean grade index will be calculated as per the injury grade index formula.

| C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 |
|---|---|---|---|---|---|---|---|
| Entry tag number | Sample Number | Visual grade (G) | Population of leafhopper (P) | (GxP) (C3xC4) | Total Grade x population | Total number of populations | Injury grade Index |
| 1 | Plant 1 | G1 | P1 | G1XP1 | =(G1XP1+ G2XP2+ G3XP3+ G4XP4+ G5xP5) | =P1+P2+P3+P4+P5 | = C6/C7 |
| | Plant 2 | G2 | P2 | G2XP2 | | | |
| | Plant 3 | G3 | P3 | G3XP3 | | | |
| | Plant 4 | G4 | P4 | G4XP4 | | | |
| | Plant 5 | G5 | P5 | | | | |
| 2 …so on | Plant 1 | G1 | P1 | G1XP1 | =(G1XP1+ G2XP2+ G3XP3+ G4XP4 +G5xP5) | =P1+P2+P3+P4+P5 | = C6/C7 |
| | Plant 2 | G2 | P2 | G2XP2 | | | |
| | Plant 3 | G3 | P3 | G3XP3 | | | |
| | Plant 4 | G4 | P4 | G4XP4 | | | |
| | Plant | G5 | P5 | | | | |

**Leafhopper visual Grade**

- **Grade 1:** Entire foliage free from crinkling or curling with no yellowing
- **Grade 2:** Crinkling, curling of few leaves in the lower portion of plant and marginal yellowing of leaves
- **Grade 3:** Crinkling and curling of leaves almost all over the plant. Plant growth hampered
- **Grade 4:** Extreme curling, crinkling, yellowing, bronzing and drying of leaves

| Grade 1 | Grade 2 | Grade 3 | Grade 4 |
|---|---|---|---|
|  |  |  |  |

$$\text{Injury index} = \frac{G1xP1 + G2xP2 + G3xP3 + G4xP4}{P1 + P2 + P3 + P4}$$

Where
'G' - represents the number of the grade and
'P' - the population under that grade for each entry.
After the index will be worked out as above, grouping into different categories of resistance are calculated viz.,

| Injury index | Resistance rating |
|---|---|
| 0.0 ≤ 1.0 | Resistant |
| 1.0 >; ≤ 2.0 | Moderately resistant |
| 2.0 >; ≤ 3.0 | Susceptible |
| 3.0>; ≤ 4.0 | Highly Susceptible |

**Ent. 1b: Advanced screening of promising entries for development of repository for sucking pests {All North Centers, Central zone (Surat, Nanded, Junagarh, Rahuri) &South zone (Lam Guntur, Dharwad and Raichur)}**

- Use susceptible checks like HS-6 (North zone), DCH32 (For central & South zone), or follow okra plants to make leafhoppers more likely to show up for screening. Similarly include Resistant check of respective zone also
- Identified resistant entries against sucking pests requested to be deposited in a germplasm repository.

| S.No | North | | | Central | | | South | | |
|---|---|---|---|---|---|---|---|---|---|
| | Dr. Satnam | | | Dr.Rajesh Patel | | | Dr. Hanchinal | | |
| | whitefly | LH | BW | Whitefly | LH | BW | whitefly | LH | BW |
| | | | | | | | | | |
| | | | | | | | | | |

In case of advance screening artificial release to study the growth and development is compulsory

- In field advance screening:Raisingokra crop between every four rows of cotton genotypes helps build up the sucking pest population in the target entries.
- Artificial screening:Cover 4 plants in field with Muslin and release counted number of leafhoppers to study the reaction. In case polyhouse facilities are available, pot planting (20 plants) of each genotypes may be taken up for growth and development studies under artificial release (Field collected leafhoppers will be released 20 numbers /plant) at 60-70 DAS (during peak period). Potted plants can be either covered with muslin clothes or placed inside insect proof cage

**Ent. 2: Seasonal dynamics of insect population to develop suitable forecasting model (All centers)**

| S.N. | States | Genotypes for sucking pests | Centers | | | Observations |
|---|---|---|---|---|---|---|
| | | | Non BT | BG-II hybrids | | observations from **10 plants** (5 fixed or tagged and 5 random) for aphid, jassid, whitefly, thrips (3 leaves/plant), mealy bug, ABW, SBW, PBW and associated natural enemies after one month of sowing (Natural enemies to be recorded species wise). For PBW – Dissect 150 bolls from each variety/hybrid at 90,105,120 & 135 DAS for percent boll green damage and larval recovery . |
| 1 | Haryana | Ganganagar Ageti, RS2013 | HS6 | RCH650BG-II | Hisar, Sirsa . | |
| 2 | Punjab | Ganganagar Ageti | HS6 | RCH650BG | Faridkot, Bathinda. | |
| 3 | Rajsthan | Ganganagar Ageti | HS6 | RCH650BG | Sriganganagar. | |
| 4 | Rajasthan | DCH 32 | SURAJ | RCH-2BG-II | Banswara | |
| 5 | Gujarat | DCH 32 | SURAJ | RCH-2BG-II | Surat, Junagarh, Bharuch | |
| 6 | MP | DCH 32 | SURAJ | RCH-2 BG-II | Khandwa | |
| 7 | Maharashtra | DCH 32 | SURAJ | Ajeet 155 BG II | Nanded, Akola, Rahuri | |
| 8 | Odisha | DCH 32 | SURAJ | ---------- | Bhawani Patna | |
| 9 | Karnataka | DCH 32 | SURAJ | Jadoo BG II | Dharwad, Raichur, Chamrajnagar | |
| 10 | AP | DCH 32 | SURAJ | Jadoo BG II | Guntur, Nandyal | |
| 11 | Tamil Nadu | DCH 32 | SURAJ | Jadoo BG II | Coimbatore, Srivilliputhur | |

*Absolute count and grade to be followed for sucking pest's observation.

- ***Experimental layout:*** At least 3000-4000 sq. meter plots (as per availability) be sown for the studies on seasonal dynamics.
- Divide the plot into 2 half each (both under protected and unprotected condition. Keep one half untreated (for sucking pests) and apply required sprays of neem based & neonicotinoids (imidacloprid/ acetamiprid/ thiamethoxam/ clothianidin) in the other half as per requirement to keep the population of sucking pests under control, along with Gaucho seed treatment so that the observations for the bollworm can be taken.
- Monitor for the presence of dead pink bollworm larvae beginning 90 DAS to 150 DAS record the egg parasitism of PBW and percentage of parasitism and observe for the emergence of endoparasitoids at each centre.
- Any unusual survival and higher levels of infestation of any insect pests must be notified to PI immediately by mail or phone. The surviving bollworms (*Helicoverpaarmigera*and *Pectinophoragossypiella*) larvae both from Bt and conventional cotton will be brought to the laboratory.
- Monitoring of bollworms across the country, through Pherosensor-TM Sleeve-SP traps and lures uniformly sourced from concerned company (pheromonechemicals@gmail.com9440897918 Mr. Raghu Nath Kaja) source may be carried out during the season and off season and data may be recorded. Care must be taken to change lures at recommended frequency.

### Ent. 3: Survey and surveillance for key and emerging pests in cotton in Farmers Field for weekly advisory (All centers)

- On a weekly (Meteorological Standard Mean Week) basis, a minimum of five locations must be surveyed (Roving survey). The management decisions followed by farmers also need to be recorded.
- Observe 20plants per locations for sucking pests and bollworms. However for PBW destructive sampling dissect at least 20bolls per acre or location
- Record all the management aspect including insecticide, herbicide, fungicide, miticide and cultural operation against the pest and diseases.
- All the centers are requested to collect weekly information on the infestation of the pest on farmer's fields and inform through mail (every Tuesday) to the PI, Entomology for further publishing the information through weekly advisory.
- The centre Co-PI are requested to send the raw data also as per the seasonal dynamics experiment proforma.

### Ent4: Integrated Pest Management in Cotton (New) (All centers)

| | |
|---|---|
| Hybrids*: Any popular BG-II hybrids (North zone: RCH 773BG-II), Central Zone (Ajeet 155 BG II/ Jadoo BG II), South zone(Jadoo/RCH659BG-II or any Popular hybrid but should be common for experiment and farmers practice) | Observations: Sucking pests, Bollworms (ABW or OBW/SBW/TC & PBW (destructive sampling minimum20 bolls/plot), Natural enemies, Non target pests ( 10plants -5 random and 5 tagged/ fixed) and yield |
| **Plot size**: 500 sq meter for IPM vs. 500 sq meter for farmers practice ( Apply most common farmers practice of the zone) | |

| Experiment details | | | | | | | |
|---|---|---|---|---|---|---|---|
| Stage | | Monitoring | Interventions | No of time ETL crossed for individual insects | No of sprays applied | Cost of cultivation | Yield |
| 0-60 | Neem based >Entomopathogens etc. | Monitoring of whitefly and PBW based on YST and pheromone traps at 45 DAS | All bio pesticides and plant products will be applied at Pre-threshold ( 75% of ETL) | | | | |
| 61-90 | ETL based insecticides for bollworms and sucking pests | | ETL Based sprays, use of selected and safer insecticides zone wise for sucking pests as well as bollworms, ETL based sprays but interval between two spraysto be maintained (min 7 days or based on field persistence of specific pesticide molecule) | | | | |
| 91-120 | ETL based insecticides for bollworms and sucking pests | | | | | | |
| 121> | ETL based insecticides for bollworms and sucking pests | | | | | | |

**Hybrid & date of sowing for experiment and farmers practice should be common. Provide detail of the most common farmer's practice of respective zone.*

- To validate the package of pest management practices and to formulate zone wise recommendation
- Follow calendar based (prophylactic measures) pest management practices and also Farmers practices will be used to compare IPM practices.
- ETL based sprays need to give.Number of sprays, cost of protection, yield, and number of times the pest crossed ETL need to be recorded.
- ETL of the sucking pests can be assessed based on absolute counts/symptom based grading. For bollworm also, based on egg/larva count per plant, percent fruiting body damage (OBW/SBW/TC), percent rosette flowers/flower damage or destructive sampling of bolls for PBW. Minimum sample size of plants/flowers/bolls should be maintained.
- Agronomic practices should be same across the centres within a Zone

## Details of Insecticidal Interventions:

| Window based | North zone* | | Central Zone * | | South Zone* | |
|---|---|---|---|---|---|---|
| | Sucking pests | Bollworms | Sucking pests | Bollworms | Sucking pests | Bollworms |
| 0-60 | Nimbecidene /Neem oil/NSKE | | Azadirachtin 1500 ppm or NSKE 5% or *Verticillium lecanii* ($2x10^8$ CFU gm) | | Nimbecidene/Neem oil/NSKE *Beauveriabassiana* ($2x10^8$ CFU gm) or *Lecanicilliumlecanii*($2x10^8$ CFU gm) or Spinetoram | |
| 61-90 | **Thrips**: Spinetoram, Profenphos **Jassids:**Flonicamid, Dinotefuran **WF**: ,Diafenthiuron, Spiromesifen, Pyriproxyfen | PBW: Emmamectin benzoate, Profenphos, Chlorpyriphos,Indoxacarb,quinalphos | **Jassid:** Flonicamid, Dinotefuran, Thiamethoxam, Imidacloprid **Thrips:** Spinetoram, Flonicamid **Whitefly:** Pyriproxyfen, Difenthiuron, Spiromesifen **Aphid:** Flonicamid, Dinotefuran, Thiamethoxam, Imidacloprid | **PBW: 61-90 days** Thiodicarb 75 WP (60 DAS), Chlorpyriphos 20 EC (90 DAS) **PBW: 91-120 days** Indoxacarb 14.5 SC Emamectin benzoate 5 SG Spinosad 45 SC | *Beauveriabassiana* ($2x10^8$ CFU gm) *Lecanicilliumlecanii* ($2x10^8$ CFU gm) or Dinotefuran Flonicamid Thiamethoxam Difenthiuron | Profenphos Installation of pheromone traps for mass trapping (15/acre) Release of *Trichogrammabactrae* (20000/acre, 5 times at weekly interval from 60 DAS, Indoxacarb, Emmamaectin benzoate, Chlorantranilipro le, Chlopyriphos or quinalphos |
| 91-120 | | | **Mealybug:** Profenophos, Buprofezin | | Dinotefuran Flonicamid Difenthiuron Afidopyropen Diafenthiuron | Ampligo( Chloratranilprole (10%)+ Lambdacyhaloth rin (5%) ZC) Fenpropathrin, Thiodicarb or profenophos |
| 121> | | Ethion, Fanvalerate,Cypermethrin,Lamda-cyhalothrin,Deltamethrin, Alphamethrin, Fenpropathrin | **Aphid:** Flonicamid, Dinotefuran, Thiamethoxam, Imidacloprid | **PBW:>120 days** Lambda cyhalothrin 5 EC, Cypermethrin 10 EC Fanvalerate 20EC | | |

* Follow the CIBRC latest document for insecticides dosage applications or dose recommended by respective SAU. Avoid insecticide either banned or restricted use (as and when notified by GoI)

## Ent5: Evaluation of Refugia in bag against bollworm complex in cotton (2022-23)

For this experiment, square damage, rosette flower(PBW), green boll damage due to OBW(ABW)/SBW & PBW, and open boll damage need to be recorded.

**Background**: As GoI approved two types of seeds

- 450 g Bt +120 g Non Bt (Separate pack)
- 475 g RIB (containing minimum 5 and maximum 10 per cent non Bt seeds)
- Both Bt & Non Bt should be near isogenic linehaving similar flowering period and fibre quality in above two

| | |
|---|---|
| Centres involved | North ( Hisar, Bathinda, Sriganaganagar& Faridkot),<br>Centre (Akola,Rahuri, Surat, Junagarh and Nanded) and<br>South (Nandyal, Warangal, Dharwad, Raichur & Guntur) |
| Variety/Hybrid | Popular hybrid of concern Zone |
| Plot size | Plot size and plant pl calculates as per the spacing of zone.<br>1000 sq .m block for each treatment |
| Spacing | As per recommendation |
| Design | RBD |
| Treatments | 6 treatments<br>• T1: 100 % Bt<br>• T2: 100 % Non Bt<br>• T3-20 % structured refugia (Border sowing 4 rows & ETL based spray against bollworms)<br>• T4: RIB – Random (5 -10% Minimal non Bt seeds)-commercial pack used<br>• T5: RIB – Fixed pattern (5 % Minimal non Bt seeds)-if provided in separate pack of Bt & Non Bt (Isogenic). Non Bt plant should be surrounded by 4 Bt plants<br>• T6: RIB- Fixed pattern (10 % Maximum non Bt seeds)- if provide in separate pack of Bt & Non Bt (Isogenic). Non Bt plant should be surrounded by 4 Bt plants |
| Observations ( 40 plants per treatment) | In **T1&T2**- divide plot in 4 quadrants (10 plants from each).<br>In **T3**-structured refuge divide in 4 quadrant (10 plants from each quadrant - 8 plants from Bt + 2 plants form Non-Bt at boundary).<br>In **T4**(Commercial pack of RIB)-10 plants per quadrant (After tagging leaf can be tested for Bt presence)<br>In **T5 & T6**: 10 plants from each quadrant ( 2 Non-Bt plants + 8Bt plants ).<br>(Square damage, Rosette flowers, green boll damage due to OBW(ABW)/SBW & PBW, No. of larvae per 20 bolls, Open boll & locule damage at harvest and Yield: in q/ha |

## Ent 6. Evaluation of prominent and label claimed insecticides against bollworm complex of cotton (All previous centers)

| | |
|---|---|
| **Name of the hybrid**: Non-Bt (Popular) hirsutum | **Design**: RBD |
| **No of treatments**: 13 | **Replication**: 3 |
| **No of sprays**: 3 (spray initiation at ETL of any cotton bollworm- lab screening of these insecticides is optional and welcome if one center from each zone can do it or where possibility of field damage is less) | |
| **Obs**: 5 plants for Square damage, rosette flower (20 flowers /plot), green boll damage due to ABW or OBW /SBW, for PBW (destructive sampling 10 bolls per plot), and open boll&locule damage at harvest. | |
| Phytotoxicity needs to be observed till the end of the crop/ Economics also needs to be recorded. | |
| Persistence toxicity studies – optional if any center conduct, pl inform | |

| SN | Name of the insecticides | BW | g.a.i /ha | Dosage in ml /ha | Waiting periods |
|---|---|---|---|---|---|
| 1 | Bifenthrin 10EC | BW | 80 | 800 | 15 |
| 2 | Cypermethrin 25EC | BW | 40-70 | 200 | - |
| 3 | Fanpropathrin 10 Ec | BW | 75-100 | 500 | 14 |
| 4 | Profenofos 50 EC | BW | 750-1000 | 1500-2000 | 15 |
| 5 | Ethion 50EC | BW | 750-1000 | 1500-2000 | - |
| 6 | Chlorantraniliprole 18.5 SC | HA, EV, SL | 30 | 150 | 09 |
| 7 | Flubendiamide 39.35 SC | HA, EV | 48-60 | 100-125 | 25 |
| 8 | Indoxacarb 14.5 SC | BW | 75 | 500 | 16 |
| 9 | Spinetoram 11.7 SC | SL, EV | 50-56 | 420-470 | 30 |
| 10 | Spinosad 45 SC | HA | 75-100 | 165-220 | 10 |
| 11 | Emamectin benzoate 5 SG | BW | 9.5-11.0 | 190-220 | 10 |
| 12 | Pyridalyl 10EC | BW | 75-100 | 750-1000 | 07 |
| 13 | Control with water | -- | -- | -- | -- |
| The proposed insecticides should not be in list of banned /restricted use insecticides– All Scientists | | | | | |

## Ent 6a: Evaluation of MakAdjuvol (Mineral Paraffin Oil ) as adjuvant with insecticides

(Locations: 08 [North Zone (Hisar, Bathinda &Sriganganagar), Central Zone (Nanded, Junagarh &Banswara) &South Zone (Guntur & Raichur)]

| | |
|---|---|
| **Name of the hybrid**: Non- Bt common hirsutum hybrid/variety of the zone | **Design**: RBD |
| **No of treatments**: ---- **15** | **Replication**: 3 |
| **No of sprays**: 3 | **Plot size**: At least 50 plants /plot |
| **Observations**: 5 plants /plot. Population of sucking pests 3,7 & 14 days after application. Phytotoxicity need to be observed till the end of the crop | |

| SN | Name of the insecticides | Dosage in ml /ha |
|---|---|---|
| 1 | Flonicamid 50 WG ( Systemic) | 150 |
| 2 | Flonicamid 50 WG + **MakAdjuvol @0.75% (7.5ml/L water )** | 150 |
| 3 | Flonicamid 50 WG **+ MakAdjuvol @1.5% (15 ml/L water )** | 150 |
| 4 | Spinetoram 11.7 SC ( Product of fermentation of Saccharopolyspora spinosa) | 420 |
| 5 | Spinetoram 11.7 SC + **MakAdjuvol @0.75 % ( 7.5 ml/L water)** | 420 |
| 6 | Spinetoram 11.7 SC + **MakAdjuvol @1.5% (15 ml/L water** | 420 |
| 7 | Emamectin benzoate 5 SG **( Translaminar)** | 190-220 |
| 8 | Emamectin benzoate 5 SG **+ MakAdjuvol @0.75 % ( 7.5 ml/L water)** | 190-220 |
| 9 | Emamectin benzoate 5 SG+ **MakAdjuvol @ 1.5% ( 15 ml/L water)** | 190-220 |
| 10 | Profenofos 50 EC **( Contact )** | 1500-2000 |
| 11 | Profenofos 50 EC+ **MakAdjuvol @0.75% (7.5 ml/L water )** | 1500-2000 |
| 12 | Profenofos 50 EC+ **MakAdjuvol @1.5% (15 ml/L water )** | 1500-2000 |
| 13 | Water+MAKHMO @ 0.75 % or 7.5 ml /litre (Control) | -- |
| 14 | Water+MAKHMO @ 1.5 % @ 15 ml /litre (Control | |
| 15 | Control (Water spray) | -- |

**Volume of water to be used is 150 litre water /acre or 375 litre /ha

## Ent 7: Microbial based volatiles for sucking pest management in Bt cotton (New)

**Locations:** **North Zone** ( Hisar, Sirsa, Sriganganagar, Bathinda ),
**Central Zone** (CICR, Nagpur, Junagarh, Surat, Nanded, Akola, Rahuri&Banswara) &
**South Zone** (Lam Guntur, Raichur, Dharwad, Coimbatore, Nandyal, Chamrajnagar)

| | | |
|---|---|---|
| BG-II Hybrid: Common Zone wise | Design: CRD | Replications: 6 traps/ac with 3 replications |
| No of treatments-11 | Isolation distance: 5-10 m | Replications: 11 treatment/ac with 3 replications |
| Trap Installation: The lures (@ 5ppm conc.; 1.5 ml in glass vials) will be tied from the top of the YST in a way that the vial hangs in the center of the YST | | |
| Time of installation: (40, 50, 60, 70 DAS) | | |

| Trt | Code | Insects | Observations (No. of insect/trap) 5 Days after each installation i.e. at 45,55,65 and 75 days after installation |
|---|---|---|---|
| T1 | CICRMV-W | Whiteflies | • Sucking pests (whiteflies, leaf hoppers, aphids, thrips, and any other pests such as PBW adults, dusky cotton bug etc.) count in each trap (front and back)<br>• Beneficial insects (coccinellids, spiders, predators, parasitoids etc) count in each trap (front and back)<br>• Along with insect pest count, stage of the crop, crop damage or Injury grade need to be recorded |
| T2 | CICRMV-J | Jassid | |
| T3 | CICRMV-A | Aphids | |
| T4 | CICRMV-T | Thrips | |
| T5 | CICRMVBI-W | Whiteflies | |
| T6 | CICRMVBI-J | Jassid | |
| T7 | CICRMVBI-A | Aphids | |
| T8 | CICRMVBI-T | Thrips | |
| T9 | YST + Sovlent (S) (Positive) | Control | |
| T10 | YST only (Negative) | Control | |
| T11 | Control | Control | |

*Click photographs of both side of YST for observation/counting

# Proceedings of the Plant Pathology
# AICRP on cotton 2022-23

**Chairman:** Prof. C.D. Mayee, Chairman - Programme Advisory and Monitoring Committee and former Chairman, ASRB

**Co-Chairman:** Dr. P. K.Chakrabarthy, Member ASRB and Former ADG (PP)
Dr. D. Monga, Former Head, ICAR-CICR RS Sirsa

**Convener:** Dr. Satish Kumar Sain, Principal Scientist & Principal Investigator, AICRP on Cotton - Plant Pathology

**Rapporteurs:**
Dr (Mrs) E.Rajeswari, Assoc. Prof (Pathology), Dept of Cotton, TNAU, Coimbatore
Dr. Sampath Kumar –Senior Scientist (Plant Pathology) ICAR CICR RS Coimbatore

The concurrent session for the AICRP on Cotton-Plant Pathology was held on 08.04.2022 under the Chairmanship of Prof. C. D. Mayee, Chairman- PAMC and former Chairman- ASRB. The session was Co-Chaired by Dr. P.K. Chakrabarty, Member ASRB, New Delhi and Dr. D. Monga, Former Head, ICAR-CICR RS, Sirsa. Dr. Satish Kumar Sain, Principal Scientist & Principal Investigator, AICRP on Cotton- Plant pathology was the convener and the rapporteurs were Dr.E.Rajeswari, Assoc. Prof., Plant Pathology, Department of Cotton, TNAU, Coimbatore and Dr. A. Sampathkumar, Senior Scientist (Plant Pathology) ICAR-CICR, RS, Coimbatore. Dr. Sain gave welcome remarks to the Chair, Co-Chair, and all the participants and presented the highlights of the Plant Pathology report of 2021-22. The session was attended by Prof. M.S. Chauhan, Secretary CRDA HAU, 15 AICRP Scientists physicallyand 26 participants participated through virtual mode. 12 scientists from AICRP centers and ICAR-CICR across the country presented the AICRP progress report of their respective centers through virtual and physical modes. Vote of thanks was proposed by Dr.Sampathkumar.

The technical programme was discussed and the suggestions and advice are summarized in bullets and minor points are mentioned below in the detailed program:

- In North Zone, the Research on Cotton Leaf Curl Virus Disease (CLCuD) should be intensified and concerted efforts should be made to identify resistant sources for CLCuV.
- In addition to regular AICRP Plant Pathology experiments, each centre should conduct research on basic advanced aspects for location-specific diseases
- Regular monitoring of diseases should be done at all the centres and the occurrence of diseases should be reported for estimation of crop losses, development of breeding programs, management strategies and providing regular advisories.
- The area-wide approach must be followed for observations of diseases occurrence and crop loss estimation may be followed. Crop losses due to mixed infection of diseases may be studied under artificial epiphytotic and field conditions.
- Big data analysis (disease and weather data) and best-fit prediction models for disease forecasting must be developed by each centre in consultation with a statistician
- State of the art - artificial screening facilities must be developed for the following disease at ICAR-CICR & SAUs
    - Cotton leaf curl virus, ICAR-CICR, Regional Station, Sirsa
    - Bacterial leaf blight, MCRS- NAU Surat

- *Alternaria* leaf spot, UAS-Dharwad
- Corynespora --Guntur Andhra Pradesh
- Grey mildew- UAS-Dharwad, CICR- Nagpur new centre for artificial screening
- Root rot, CICR, RS, Sirsa

- Source of resistance must be informed to the breeders and utilized for breeding programmes
- Seed treatment must be followed with the best fungicide treatment (carboxin + thiram) by all the centres/agencies while exchanging the seed material (Before sowing)
- Salicylic acid can be used in place of streptomycin for the management of BLB
- Data generated for commercialized fungicides/formulations can be explored for label claim expansion through the private agencies
- At present different location specific IDM modules are recommended for multiple diseases in cotton. Therefore, one effective IDM module should be formulated and tested in the respective centres. A precise spray schedule must be developed for each zone for farmers' field recommendation and less than 100 DAS must be focused.
- At least 1-2 papers must be published by each centre during 2022-23 and zonal data must be compiled for publication rather than publishing the data from each centre.

**Experimental - Recommendations**

**Sooty mold management:** Three prophylactic sprays of flonicamid, propiconazole and mancozeb, first spray when whitefly population reaches near ETL level and followed by second and third spray at 15 days interval under polyhouse conditions in ICAR-CICR Sirsa-North Zone (whitefly infestation) and field conditions (aphid infestation) at Junagarh in Central Zone

**Fungal foliar spots, BLS and boll rot management through chemical and biocontrol agents:**

**At Nanded:** For management of*Alternaria* leaf blight, bacterial leaf blight and grey mildew among all the treatments foliar application of Pyraclostrobin @ 0.1%; gm/lit of water) followed by seed treatment (ST) with Carboxin 37.5+ Thiram37.5%WS @ 0.2%) (2 gm/kg seed) and combined application of *Bacillus tequeilencis* + *Bacillus aryabhattai*as seed treatment ($10^8$cfu/g @10g per kg) and soil application @ 2.5 kg/ha (at 30 & 60 DAS) with FYM/compost found effective.

**At ICAR-CICR Nagpur:** For management of root rot and *Corynespora* leaf spot, among all the treatments the seed treatment with carboxin 37.5+ Thiram37.5%WS (2 gm/kg) followed by combined application of *Bacillus tequeilencis* + *Bacillus aryabhattai*as a seed treatment ($10^8$cfu/g @10g per kg) and soil application @ 2.5 kg/ha (at 30 & 60 DAS) with FYM/compostwere most effective.

For management of Alternaria leaf spot and grey mildew, among all the treatments combined application of *Bacillus tequeilencis* + *Bacillus aryabhattai*as a seed treatment ($10^8$cfu/g @10g per kg) and soil application @ 2.5 kg/ha (at 30 & 60 DAS) and ST+ SA of commercial product *Bacillus subtilis* SA: $10^8$cfu/g @10g/kg seed and 2.5 kg/ha (30 & 60 DAS) with FYM/compost were found effective.

**At MCRS Surt:** For management of *Alternaria* leaf blight among all the treatments combined application of *Bacillus tequeilencis* + *Bacillus aryabhattai*as a seed treatment ($10^8$cfu/g @10g per kg) and soil application @ 2.5 kg/ha (at 30 & 60 DAS) and foliar application of Pyraclostrobin @ 0.1%; and for bacterial leaf blight ST+ SA of *Pf*CICR; SA: $10^8$cfu/g @10g per kg and @ 2.5 kg/ha (30 & 60 DAS) were found effective.

**Fungal foliar spots, BLS and boll rot management through CIB&RC recommended fungicides**

- Kresoxim-methyl 44.3% SC, azoxystrobin 18.2% W/W + difenoconazole 11.4 w/w SC (T6) and propineb 70% WP (T3) were superior in controlling fungal foliar spots (ALS, MLS, CLS) in North Zone.
- Fluxapyroxad 167 g/l + pyraclostrobin 333g/l SC, metiram 55% + pyraclostrobin 5% WG (T5) and azoxystrobin 18.2% W/W + difenoconazole 11.4 w/w SC (T6) were effective for management of ALB, BLB and boll rot In Central Zone.
- Propineb 70% WP followed by fluxapyroxad 167 g/l + pyraclostrobin 333g/l SC and azoxystrobin 18.2% W/W + difenoconazole 11.4 w/w SC were effective for the management of grey mildew in Central and South Zones.
- Captan 70%+Hexaconazole 5% WP @1.5g/L and Fluxapyroxad 167g/l + Pyroclostrobin 333g/l SC @ 0.6ml/l were most effective for management of Corynespora leaf spot diseases in Central and South Zone.

# Technical Programme Plant Pathology 2022-23

## Path.1: Observations on the occurrence of the diseases (Long term-continued)

### Path. 1(a): Observations on the occurrence of the diseases (in farmer's fields and research farms) - (All centres* except ICAR-CICR Sirsa). (Long term Revised: 2020-21)

All information regarding major/ minor / new emerging (e.g. Tobacco streak virus disease, *Corynespora, Helminthosporium*Leaf spot and *Cercospora* leaf spot, etc.) diseases have to be reported to the PI-Plant Pathology

**Locations:**

**North Zone:** (PAU, Faridkot; PAU, Bhatinda; CCSHAU, Hisar; ARS (SKRAU), Sriganganagar
**Central Zone:** ARS (MPUAT), NAU, Surat; CRS (JAU), Junagarh; Dr PDKV, Akola; CRS, (VNMKV), Nanded
**South Zone:** TNAU, Coimbatore; ANGRAU, Guntur; RARS, Warangal; UAS, Dharwad.

**A. Farmer's field observations:**

**Number of the survey: during early, mid and late season**

**Observations:** Minimum 10 locations each in farmers' fields as per the earlier finalized AICRP standardized protocols for disease incidence and PDI. In each location, 10 fields (10 plants in each field) should be observed for disease observations**.** In representative areas, the names of varieties or hybrids raised under farmers' holdings also need to be recorded. Information on various nematode diseases causing losses in cotton may also be recorded in association with experts of AICRP on nematodes or other university scientists during the surveys.

**Note:** The name of the district surveyed and the approximate cotton area in that district may be added to the table. The centers carrying surveys on the occurrence should mention the jurisdiction of the university along with the names of the districts covered.

**Note:** The area-wide approach must be followed for observations of diseases occurrence and crop loss estimation may be followed.

Crop losses due to mixed infection of diseases may be studied under artificial epiphytotic and field conditions. In selected farmers' fields and on-station trials cotton plants showing different disease severity grades (at least 100 plants for individual or mixed disease and 100 healthy plants) must be tagged and the seed cotton yield in cotton plants infected with various grades v/s healthy plants must be compared.

**B. Observations at On-station**

**Number of Observations: Five times** during different plant growth stages in varieties/hybrids and BG-II hybrids. The disease occurrence in organic cotton and high-density planting trials conducted at different centers should also be recorded and reported by the concerned Pathologists.

**C. Fortnightly observation report on the incidence of diseases at Farmer's field observations (All centers)**

**Observations:** At least five villages are to be surveyed under each district around the research location. In each location/village, 10 fields (10 plants in each field) should be observed for disease observations. The report should be submitted to the PI within 2 days after the end of every Fortnight / two SMW. (**New activity proposed as this is required for submission of fortnightly disease progress report to ICAR**).

**Path.1(b): Disease progress in relation to weather factors (All centers) (Long Term-Continued with modifications) (Long Term)**

The experiment will continue as per the modified procedure suggested. Each centre will focus on the most important disease on a susceptible variety/hybrid or Bt hybrid for correlation. Further, it was decided that the validation of the developed prediction equations has to be confirmed at all respective center's in North Zone (CLCuD), Central (Gray mildew, Bacterial leaf blight) and South Zone (Gray mildew- *G. arboreum & G. hirsutum*)

**Note:**

- A study on CLCuD progress with whitefly vector population/incidence should be conducted as Joint trails with the Pathologist & Entomologist at **Sirsa, Sriganganagar, Faridkot and Hisar**
- A study on boll rot should be conducted jointly with the Pathologist & Entomologist **at ICAR-CICR Nagpur** to record the association/contribution of insects vectors in its incidence and spread

**Locations for development and validation of prediction models:**

1. CLCuD by Sirsa, Hisar, Sriganganagar and Faridkot, 2. Alternaria bight at Rahuri, Akola, Junagarh, Nanded, Guntur & Dharwad centres, 3. Bacterial blight at Guntur, Surat, Junagarh, Nanded, Dharwad, 4. Rust at Guntur centre, Dharwad and 5. Grey mildew at Parbhani, Nanded,

Junagarh, Dharwad & Guntur Centres 6. *Corynespora* leaf spot at Guntur, Warangal, Junagarh, Nanded will be validated in the respective zones by other centres during 2020-21 where the diseases are prevalent, with their existing data. Following centres were requested to develop the prediction models based on the collection and collation of the existing and current data.

**Note:**

- All centres are required to collect and provide the weekly data of whitefly/ per three leaves along with CLCuD incidence/PDI. Each centre should also work out correlation and regression analysis (prediction model) and submits it with the annual reports and validate them under field conditions.

- Big data analysis (disease and weather data) and best-fit prediction models for disease forecasting must be developed by each centre in consultation with a statistician

## Path. 1(d) Survey and basic studies of TSV (Since-2009-10: revised 2020-21)

### A. Basic Studies:

- Basic studies on characterization, transmission, host range, etc. are to be conducted by ICAR-CICR- Nagpur, CICR-RS Coimbatore, CICR-RS Sirsa in collaboration with other institutes IIHR, IARI/SAUs
- In North Zone, the Research on Cotton Leaf Curl Virus Disease (CLCuD) should be intensified and concerted efforts should be made to identify resistant sources for CLCuV.
- In addition to regular AICRP Plant Pathology experiments, each centre should conduct research on basic advanced aspects for location-specific diseases
- Race identification of gray mildew disease of cotton should be performed at ICAR-CICR-Nagpur

### B. Continuous Monitoring

**Survey locations:** HAU Hisar, ARS-PAU Bathinda, ARS-PAU Faridkot, ARS-SKNRAU Sriganganagar, Lam, Guntur, TNAU, Coimbatore, UAS Dharwad, Chamrajnagar, and Dr PDKV, Akola; CRS, Nanded; MPKV, Rahuri, ICAR-CICR RS, Sirsa and ICAR-CICR, Nagpur

Surveys for the occurrence of **TSV, Target leaf spot** from major cotton-growing tracts of different districts in the states mentioned above will be carried out. Area-wide **TSV, Target leaf spot** incidence may be recorded to have an idea of the threat perception.

There are reports on the occurrence of TSV in the north zone. Cotton pathologists of the north zone should be alert and careful to record such observations during the season. Molecular characterization for disease confirmation will be done at ICAR-CICR, RS, Sirsa and CICR, Nagpur.

The tentative disease rating scale (0-4) which was finalized during the Annual Group Meet 2018-19 for TSV will be validated. A rating scale will be devised based on the extent of losses.

**Note:** Information on minor/new disease should be confirmed at morphological/molecular characterization with information to PI.

### Path.1(e): Studies on the variability of *Corynespora*leaf spot (New Experiment proposed)

All centres will collect 4-5 isolates and send them to RARS Lam, ANGRAU Guntur for morphological and molecular characterization and & disease progress in relation to weather factors

**Centres: Lam Guntur, Hisar, Faridkot, Sriganganagar, Nanded, Junagadh, Surat, Warangal, Guntur, Coimbatore, CICR RS Sirsa, CICR Nagpur**

All the scientists from different centers should collect the cultures of *Corynespora*leaf spot (Target Spot) isolates from the leaf spot samples (**At least 4-5 samples from different locations**). One set of all isolates is to be sent to PI Plant Pathology who will coordinate the identification and further registration process and another set to Lam, ANGRAU, Guntur, Andhra Pradesh. The pathogenicity and taxonomy for diversity analysis of *Corynespora* at species level will be carried out by the Principal Cotton Pathologist at the Department of Cotton, RARS Lam Farm, ANGRAU, Guntur

### Path. 2: Screening of AICRP entries for disease reaction (continued Long Term)

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

**North Zone Centres**: Both National and Zonal entries*
*Only National entries at CICR, RS, Sirsa

**Central and South Zones**: National and Zonal entries
A susceptible check for each important disease (Common or individual) should be maintained in each screening trial at all the centres.

**Observations:**
Observations will be taken for the occurrence of CLCuD at 100 DAS. All the centers will calculate CLCuD PDI by dividing the average grade of the test entry by the highest grade i.e. six (6) (0-6 rating scale). In the case of FFS, CoLS, GM, ALB, and BLB, the Grade Average of 10 leaves per plant and five plants per replication should be recorded (using 0-6 rating scale) and the final grade in two digits after decimals should be based on the average of two replications.

**Note:**

- To maintain uniformity in the data, mean PDI along with average/mean Grades (two digits after the decimal/0.00) should be given in the reports by the concerned Pathologists for all the fungal foliar diseases, BLB and TSV diseases.

**Note:**

- In the case of CLCuD a PDI of 40 or less will be kept as the cut-off for the purpose of identification of a variety/hybrid.
- In the case of other diseases, the reaction equal to or less than the local/Zonal check will be the cut-off for the above purpose. In addition, test entries showing an overall average reaction as susceptible should be red-flagged even if the local/zonal check also shows a susceptible reaction. Regular monitoring and recommended management practices must be followed for the susceptible entry if it is selected for better yield and quality characteristics.

## Path.2 (b) Confirmation and maintenance of disease-resistant lines (all centres) (Since 2009- 10)

At all centres, scientists will keep the resistant entries (few bolls of selfed seed) from the initial evaluation trials (National trials) like Br. 02a or b for *G. hirsutum* varieties, Br. 22 a/b for *G. arboreum*, Br. 34b for *G. herbaceum* and Br. 14a for *G. barbadense* after screening against important diseases.

**Observations and entries:**

A maximum of 2-3 important diseases prevailing in the area will be considered. A maximum of five entries will be kept from each trial.

Seed cotton yield and quality aspects will also be recorded keeping resistance as the top priority. Those lines will be evaluated again next year by the concerned pathologist at his centre under field conditions and also tested at the hot spot for that particular disease under nursery/ artificial inoculation conditions at the below-mentioned centers to have a confirmed final reaction.

Such entries (**National Trials**) with two years of field screening (**susceptible check**) and one-year artificial screening data (**Check should be S/HS during the season**) will be kept by plant pathologists for use in developing resistant varieties/hybrids by the center. **Selected promising entries after 2/3 year testing in field trials may be sent to the designated center for artificial screening if the facility is not available with the respective center, simultaneously it should also be evaluated in the field.**

**State of the art - artificial screening facilities must be developed for the following disease at ICAR-CICR & SAUs designated centres.**

1. **Cotton leaf curl virus**, ICAR-CICR, Regional Station, Sirsa
2. **Bacterial leaf blight,**MCRS- NAU Surat
3. ***Alternaria* leaf spot,**UAS-Dharwad
4. **Corynespora --**Guntur Andhra Pradesh
5. **Grey mildew**- UAS-Dharwad, CICR- Nagpur new center for artificial screening
6. **Root rot**, CICR, RS, Sirsa

The above-designated centers for developing and maintaining the artificial screening facilities should also perform the basic studies on the collection/maintenance of cultures, and characterization.

Race identification of grey mildew disease of cotton should be performed at ICAR-CICR-Nagpur

Crop losses due to individual and or mixed infection of diseases may be studied under artificial epiphytotic and field conditions. Plants showing different disease severity grades (at least 100 plants for individual or mixed disease and 100 healthy plants) must be tagged and the seed cotton yield in cotton plants infected with various grades v/s healthy plants must be compared. **(as per Path 4 (1)**

**Note:** The field screening will be considered valid only in those years when at least 3 or 4-grade reaction (Susceptible/Highly susceptible) is observed in susceptible checks in screening trials.

**Data for confirmation and maintenance of disease-resistant lines must be provided by the concerned Pathologists as per the format given in below table:**

| Entry Code & Name | Year of Start | First year | | Second year | | Third year | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Field trial | | Field trial | | Field trial | | Artificial inoculation trial | |
| | | PDI | Reaction | PDI | Reaction | PDI | Reaction | PDI | Reaction |
| Entry no/Name 1 | | | | | | | | | |
| - | | | | | | | | | |
| Susceptible check 1 | | | | | | | | | |
| Susceptible check 2 | | | | | | | | | |

**Note:**

- The source of resistance must be informed to the breeders of the respective centres and utilized for breeding programmes. The genetic purity of the selected resistant lines must be maintained by the breeders of the respective centres.
- One set of each confirmed resistant entry (25-50 g seed) may be sent to the Head, Division of Crop Protection, ICAR-CICR/ Incharge-Germplasm Maintenance, ICAR-CICR Nagpur and to PI Plant Pathology, which will serve as a repository.

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

**Location/Centres-** Hisar, Sriganganagar and Bathinda (**Since 2013-14 Revised on 2019-20** with new cultivars)

Entries: 8;
Replications: 3;
Design: RBD
Plot Size: 5.4m x 3.75m
Spacing: 67.5 x 30 cm (114 Plants) – For Varieties 67.5 x 60cm (60 Plants) – For Hybrids

**Observation:** Incidence and severity of CLCuD and Whitefly population should be recorded at the respective centre

**Varieties:** HS6, F846, RST-9 (Susceptible) H1098 (i), F 2228, CSH-3075(Moderately Resistant),

**Hybrids:** NSPL-531 (Moderately Susceptible), RCH 773 (Moderately Resistant)
The seed of varieties to be supplied by respective centres @ 500 g for each variety.

### Path.3: Management of Diseases

### Path. 3 (f): Management of sooty mold (*Capnodium*spp.) in cotton (From 2019-20)

**Locations**
**Field experiment:**Coimbatore (2019-20), Faridkot, Hisar (2020-21 onwards)

**Treatment details of the experiment:** Prophylactic sprays

1. Copper oxychloride (COC) 50 WP @ 1.25 g/litre of water- prophylactic spray followed by two sprays when sooty mold crosses Grade 1 of the rating scale.
2. Copper oxychloride (COC) 50 WP @ 2.50 g/litre of water- prophylactic spray followed by two sprays when sooty mold crosses Grade 1 of the rating scale.
3. Propiconazole 25 EC@ 1 ml /litre of water - prophylactic spray followed by two sprays when sooty mold crosses Grade 1 of the rating scale.
4. Mancozeb 50 WP @ 2.0 g /litre of water - prophylactic spray followed by two sprays when sooty mold crosses Grade 1 of the rating scale.
5. Neem oil 1500 ppm @ 5ml / litre of water – I, II and III spray should be repeated when whitefly crosses ETL.
6. Insecticide (Flonicamid) – I, II and III spray should be repeated when whitefly crosses ETL.
7. Control

**Spray schedule**: Prophylactic sprays to be started when whitefly crosses ETL.
Spacing - 1.0 x 0.6 m
Plot size –50 $M^2$
Replications - 3
Design - RBD
**Spray:** A total of three sprays will be applied at the fortnightly interval.

**Observations:** Before spray treatment, 7 days after spray (DAS) and 15 DAS observations on the severity of sooty mold.
To work out severity, observations will be recorded according to the rating scale (0 to 4) as follows:
Where: 0=Free from the sooty mold, 1- 25% leaf area covered with sooty mold, 2- 50% leaf area covered with sooty mold, 3-75 leaf area covered with sooty mold and 4-100% leaf area covered with sooty mold.

The trials concluded at ICAR-CICR RS Sirsa and Junagarh this year trial (2021-22) recommended for inclusion in POP.

The trials at the Hisar, Faridkot and Coimbatore will be concluded this year 2022-23. Pooled data for three years along with economics are to be submitted.

**Path 3 (h). Evaluation of efficacy of bioagents against cotton diseases (From 2019-20)**
**Location/Centres: CICR, Nagpur, PDKV, Nanded, Akola and Surat**

The trial concluded at ICAR-CICR Nagpur, Nanded this year trial (2021-22):

The trial at Akola will be concluded this year 2022-23. Pooled data for three years along with economics are to be submitted.

**Treatment details:**
T1- Seed and soil application of *Bacillus aryabhattai*
T2- Seed and soil application of *Bacillus tequeilencis*
T3- T1+T2
T4- Seed and soil application of Commercial product *Bacillus subtilis*
T5- Seed and soil application *Pf*CICR
T6- Chemical seed treatment (Vitavax power @ 0.2%)

T7- Foliar application of Pyraclostrobin@0.1%
T8- Control

Note: All the bioagents will be supplied by ICAR-CICR, and Nagpur to different centers including the commercial product to maintain the uniformity of the trial.

- Seed application: $10^8$cfu/g @10g per kg of seed
- Soil application: 2.5kg/ha (30 & 60 DAS)

**Diseases:** Root rot, fungal leaf spots.

**Observations to be recorded:** Percent Incidence, PDI, and seed cotton yield
**Plot size:** 60 plants/plot
**Replications:** 3

**Path.3(i). Integrated Management of CLCuD through its vector management (2020-21) (New Experiment)**

**Locations:** Bathinda, Faridkot, Sriganganagar, Hisar and ICAR-CICR, Sirsa,

**Treatments:** 9

**Replications:** 3

**Plot size:** 140-150 plants/plot (10 rows), keep 2-meter space between every plot all around

**Treatment details:**

| | IPM/Biomodule | Fist spray based on ETL | Second spray based on ETL | Third spray based on ETL | Forth spray based on ETL | Fifth spray based on ETL |
|---|---|---|---|---|---|---|
| T1 | IPM existing module | Neem 300 ppm | Neem 300 ppm | Diafenthiuron /Flonicamid | Spiromesifen/Pyripoxyfen* | Repeat fourth spray treatment of respective module if required |
| T2 | IPM module-1 | Neem 300 ppm | Neem 300 ppm | Diafenthiuron /Flonicamid | CICR-RS-lj | |
| T3 | IPM module-2 | Neem 300 ppm | Neem 300 ppm | Diafenthiuron / Flonicamid | CICRRS-Bb | |
| T4 | IPM module- 3 | Neem 300 ppm | Neem 300 ppm | Diafenthiuron/ Flonicamid | CICRRS Ma | |
| T5 | Biomodule-1 | Neem 300 ppm | Neem 300 ppm | CICRRS-lj | CICRRS-lj | |
| T6 | Biomodule-2 | Neem 300 ppm | Neem 300 ppm | CICRRS-Bb | CICRRS-Bb | |
| T7 | Biomodule-3 | Neem 300 ppm | Neem 300 ppm | CICRRS-Ma | CICRRS-Ma | |
| T8 | Biomodule-4 | Neem 300 ppm | Neem 300 ppm | *L. lacanii commercial formulation* | *L. lacanii commercial formulation* | |
| T9 | Control | No spray | No spray | No spray | No spray | |

*Spray any one alternatively according to whitefly nymphal/adult population

**Treatment Doses:**

- Foliar spray of neem 300ppm @ 1 litre/per acre in 200 water
- CICRRS-lj/ CICRRS-Bb/ CICRRS-Ma :$10^8$cfu/ml @ 1 litre/per acre 200 water
- Diafenthiuron 200 g / acre if whitefly & thrips incidences is there.
- Flonicamid 80 g/ acre if whitefly & hopper incidences is there and Spiromesifen 200 ml/acre

**Observations to be recorded:**

- CLCuD should be recorded in all plants at 60, 75, 90 and 115 DAS by the Plant Pathologist.
- Whitefly adult and Nymphal population should be recorded prior to spray and at 5 and 7 days after every spray by an Entomologist.
- Observations should be recorded from 10 plants in each plot (adults count from upper, middle and lower strata/ 3leaves/plant; nymphs must be counted from middle and lower strata/ three leaves from each plant).

**Data on plant vigour parameters like: (**120 DAS**)**

- Plant height and density,
- The number of fruiting branches per plant.
- Seed cotton yield

Note: All the bioagent formulations will be supplied by ICAR-CICR-Regional Station Sirsa, to different centers including the commercial product to maintain the uniformity of the trial.

The trial will be concluded this year (2022-23) and the pooled data for three years along with economics are to be submitted by each centre.

**Path 3(j): Management of boll rot and foliar diseases of Cotton through CIB&RC recommended new chemical pesticides and their Combinations (From 2020-21 and Modified experiment/treatments: 2022-3)**

**Objective:** To evaluate newer group of fungicides against economically important diseases of cotton.

**Locations/ Centres:** Six centres (two in each Zone)
**North zone:** Hisar and Bhatinda
**Central Zone**: Nagpur, Surat, Nanded (New centre proposed for inclusion from this year)
**South Zone**: Dharwad and Guntur, TNAU Coimbatore (New centre proposed for inclusion from this year)

**Treatment detail:**
T1 - Kresoxim-methyl 44.3% SC @1 ml/litre of water
T2 - Propiconazole 25% EC @1 ml/litre of water
T3 - Propineb70%WP @ 2.5 g/litre of water
T4 - Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 0.6g/litre of water.
T5 - Metiram 55% + Pyraclostrobin 5% WG @2 g / litre of water
T6 - Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @1 ml/ litre of water
T7- Copper sulphate 47.15%+Mancozeb 30% WDG)@5 g// litre of water
T8-Captan 70%+Hexaconazole 5% WP@1.5 g/ litre of water
T9-Copper oxychloride 50 %WP @2.5g of water + Salicylic acid treatment (200 ppm one spray at 60 DAS)
T10-Flonicamid (60 & 90 DAS)/ Difenthiuron/ Dinotefuron ((110-120DAS)
T11-Fluvalinate (for bugs)
T12- Control (Water spray)

Note- Three new treatment combinations i.e. T7, T8 &9 are proposed for managing bacterial pathogens as these were not included previously during 2021-22.

T9- Copper oxychloride 50 %WP @2.5g +Streptocycline @0.1 g /litre of water was modified as Copper oxychloride 50 %WP @2.5g of water + Salicylic acid treatment (200 ppm one spray at 60 DAS)

**Design of experiment:** Randomized block design (RBD)

- **Replications:** Three
- **Total no. plants per plot:** Minimum 60 plants/plot
- **Variety /Hybrid:** Popular BG-II hybrid (Zone wise similar)
- **Spacing:** As per the local recommendation
- **Spraying schedule:** Foliar spray at disease initiation and subsequent 1-2 sprays if the disease severity (PDI) crosses more than 10% PDI.
- **Observations to be recorded:** Disease incidence and severity should be observed on randomly tagged 10 plants in each plot following the respective disease scale at 15 days intervals starting from disease initiation.
- Seed cotton yield should be recorded and calculated on a hectare basis.
- **Note:** Percent disease index (PDI) should be calculated for each treatment and replication.

**New Experiment (2022-23).**

**Path 3 (k) Field evaluation (Rhizospheric fungi & chemicals etc.) for seed and soil borne disease management:**

**Locations:**
North Zone- Hisar, Sirsa, Bathinda
Central Zone- Nanded, Junagarh,
South Zone – Dharwad, Guntur and TNAU Coimbatore

**Treatments:**

1. *Trichoderma* spp. isolate (CICR-Rf-B/Th-11) as seed treatment @ 5 g/kg seed
2. *Trichoderma* spp. isolate (Rf-B/Th-11) as soil treatment @ 1 kg/acre with 100 kg well-decomposed FYM/Compost at sowing time
3. *Trichoderma* spp. isolate (Rf-B/Th-11) as seed + soil treatment at sowing time
4. *Trichoderma* spp. isolate (Rf-B/Th-11) as seed + soil treatment at sowing time and FS at 60 and 90 DAS @ 2/L
5. *Trichoderma* spp. isolate (Rf-B/Th-11) as seed + soil treatment at sowing time and FS at 60 and 90 DAS @ 2/L + MakAdjuvol (mineral paraffin oil ) @ 12ml/L
6. Seed treatment captan + thiram @ 3.5g/kg
7. Azoxostobin 18.2% + Difenconazole 11.4 @ 1ml/L at 60 and 90 DAS
8. Azoxostobin 18.2% + Difenconazole 11.4 @ 1ml/L + MakAdjuvol@ 12ml/L (mineral paraffin oil) at 60 and 90 DAS
9. MakAdjuvol (mineral paraffin oil) @ 12ml/L only
10. Untreated control

Note: **The standard agronomic package will be followed except for treatments/checks using the recommended *G. hirsutum* variety for the Zone/State.**

**Design of experiment:** Randomized block design (RBD)

- Replications: Three
- Total no. plants per plot: ~50 plants/plot
- Variety /Hybrid: Popular *G. hirsutum* variety (Zone/State wise similar)
- Spacing: As per the local recommendation

**Observations to be recorded:**

- Germination percent at 7 DAS
- Plant Mortality at 30, 60, 90 and 120 DAS
- Incidence and PDI of important fungal/bacterial foliar diseases at 60, 90 and 120 DAS
- Plant growth parameters
- Seed cotton yield (calculated on a hectare basis)

**Note:**All the **bioagents (Rf-B/Th-11) and Max Adjuvant (paraffinic oil)**will be supplied by ICAR-CICR RS Sirsa to different centres and uniformity will be maintained for fungicides products at all the centres.

## Path. 4. Crop loss estimation

### Path.4 (e) Crop loss estimation due to CLCuD and distribution pattern of CLCuD in North Zone (Since 2011-12)

### Path.4. (1a): To work out the relationship between Disease index and yield reduction due to cotton leaf curl virus disease.

**Note:** Estimation of yield loss due to CLCuD*vis-a-vis* management practice (New modification proposed as this will help in estimation of the overall effect of management practices on the reduction in CLCuD/SCY improvement at farmers' fields in North Zone).

**Centers:** Hisar, Faridkot and Ganganagar

**Variety/hybrid:** Local Popular Bt hybrids

**Treatment details and observations**: At the research farm 4 local popular hybrids will be sown in half an acre area under unprotected and protected conditions (implementing recommended IPM/IDM module/package for the management of whitefly and CLCuD for the state).

Diseased and healthy plants will be tagged grade-wise and also healthy vs diseased plants and data on Disease Index, yield loss and quality parameters will be recorded and analyzed.
Data must be recorded as per the disease ratting scale: the yield loss (Disease Index, yield loss and quality parameters) must be estimated corresponding to the respective disease grades.
**Continue with same hybrids for this year (2017-18 to 2020-21)**

| | | | |
|---|---|---|---|
| US51 | RCH 773 BGII | NCS 9013 BGII | ACH-177-1 |

### Path 4. (1b): Study on the distribution pattern of cotton leaf curl virus disease on local popular Bt hybrid at farmer's field. (Since 2009-10)

**Identification of Hot spot areas and development of management strategies for CLCuD including *G. arboreum* as border row.**

**Centres:** Hisar (Sirsa - sub-centre to collect data of Sirsa and Fatehabad districts), Faridkot, Ganganagar and Bhatinda

**Observations:**

CLCuD occurrence (PDI) should be recorded in two villages (minimum 2-3 hybrids in each village) in each block (district wise) will be recorded during the cropping season for popular hybrids. The locations will be evenly spread over the entire state. **At each location, 4 sets of observations (25 plants each, totalling 100 plants) will be recorded in a field.** GPS location may be used while data recording. The data recording should be uniform at all the centers**.**

Data from farmers' fields and research farm must be recorded during the early, mid and late season as per the earlier finalized AICRP standardized protocols.

While making CLCuD disease maps the following disease scale may be followed: Very severe > 50 %, Severe- 30.1-50 % (combining MS & S of Disease scale), Moderate- 20.1-30 %, Low-10.1-20 %, Traces-0.1-10 % in place of that presently being followed.

All the scientists are requested to publish research papers in the reputed /good rating journals. Any publication being brought out from the AICRP work should duly be communicated to the PC with a copy to the PI. This year at least 1-2 papers must be published by each centre during 2022-23 and zonal data must be compiled for publication rather than publishing the data from each center.

# Proceedings of the Valedictory Session of AICRP on Cotton -AGM 2022

**Chairman:** Dr B.M. Khadi, Member, Programme Advisory and Monitoring Committee

**Co-chairman:** Dr P.K. Chakrabarthy, Member, ASRB, New Delhi

**Rapporteurs:** Dr S. Hari Ramakrishnan, Asst. Prof (Breeding), ARS, Kovilpatti

Dr P. Valarmathi, Scientist, ICAR-CICR (RS), Coimbatore.

The three days Annual Group Meet on cotton came to an end with valedictory session on 8th April 2022 under the chairman of Dr B.M. Khadi, Member, Programme Advisory and Monitoring Committee and Dr P.K. Chakrabarthy, Member, ASRB, New Delhi. The session started withwelcome address given by the chairman. Felicitation to nine retiring scientists of AICRP on Cotton from different centres were doneon behalf of the organizing committee. This is followed by the presentations by conveners of different panels. The Plant breeding panel was presented by Dr. S. Manickam, PI-Plant breeding. He presented the technical programme and zone wise proceedings of plant breeding panel in detail. He emphasized on the different trials carried out and activities of pre-breeding in AICRP. Then he discussed about the on-line submission of data and training programme to be organized. The agronomy panel was presented by Dr. K. Sankaranarayanan, PI- Agronomy. He presented about the technical programme and discussion held during individual panel of agronomy. Various details about the organic cotton technology, soil crust management, effect of bio-stimulants, drought & water logging system and use of defoliants were presented. The better chemicals tested in the trials may be forwarded to AICRIP trials.

The Entomology panel was presented by Dr. Rishi Kumar, PI-Entomology. He presented about the screening of breeding material for resistance to key pests of cotton in different zones. Different trails such as survey & surveillance for key & emerging pests in cotton, Zone wise management in IPM, evaluation of refugia for Bt trials, evaluation of label claimed insecticides on bollworm complex were discussed. He explained about sponsored technology on microbial based volatiles for sucking pest management. He urged more emphasis for pink bollworm management and Fall armyworm to be more vigilant.

The Plant Pathology panel was presented by Dr. Sathish K. Sain, PI- Plant Pathology. He presented about the various trails such as areawide approach observations of occurrence of diseases, crop losses due to mixed infection of foliar diseases, artificial screening facilities on CLCuV, BLB, ALS, *Corynespora* and Grey mildew. He emphasized on data analysis and best fit prediction models for disease forecasting in consultation with scientists from IASRI. Since streptocycline, antibiotic has been banned as an alternate salicyclic acid can be recommended

for managing diseases. He discussed about the initiation of new trails in managing of diseases. All the PI of different sessions emphasized about the publications of manuscripts from all centres with due acknowledgement in their publications.

The Co-chairman Dr. P.K. Chakrabarty, Member, ASRB, New Delhi in his remarks asked scientists to widen the research outlook by exploiting new or innovative technology for management and end products of antagonistic potential of biocontrol agents. Further he stressed theimportance of bio stimulants and its market unraveled. He informed that only eight bio stimulants were registered and 6000 bio stimulants were yet to be registered. He spoke about the mating disruption technology as wonderful one over the management of cotton pests. He urged to work on sensor-based technology for decision making process. He further said that 297 pesticides were registered for 554 crops as of now of which 18 % only registered to be label claimed. He added that the use of only label claimed pesticides for cotton crop and the issues to be addressed. He urged the scientists to use of latest technology such as drones in monitoring and spraying of chemicals to the fields.

Session Chairman Dr B.M. Khadi, Member, Programme Advisory and Monitoring Committee emphasized more on pre-breeding programme and high-density planting system in cotton. He urged that only 3 centresare working on Bt varieties and still it has to be strengthened. He asked to give more emphasis on research on pink bollworm and Fall armyworm. He advised the scientists to work as a team in AICRP to come out with good technology for farmers. He emphasized the scientists to come up with varieties with higher GOT and medium to long staple length.

Dr. A. H. Prakash, Project Coordinator and Head, AICRP on cotton emphasized on the publications of all centers and to work as public private partnership mode. Finally, he proposed vote of thanks wherein he thanked all the dignitaries presented over the workshop and all persons involved in organizing the workshop whomade it a great success. The rapporteurs of the valedictory session were Dr S. Hari Ramakrishnan, Asst. Prof (Breeding), ARS, Kovilpatti and Dr P. Valarmathi, Scientist, ICAR-CICR (RS), Coimbatore.

**The final Recommendations:**

Based on the deliberation in different sessions, following action points and recommendations were made:

1. The work on Pre-Breeding should be hastened and by 2023 the introgressed lines should be shared with all the Centres
2. All the AICRP centres should start converting their elite lines with deregulated event. The Breeders may utilise the expertise of ICAR-CICR in the process.
3. The work on developing compact genotypes amenable for machine picking should be taken on priority for increasing the productivity
4. The entries with less than the bench mark yield of 15q/ha in rainfed and 20 q/ha under Irrigated should not be promoted in the trails.
5. Entries with higher GOT (ie 37 % GOT and above) may be promoted if the yield, disease and pest incidence and fibre quality is on par with Check.
6. In Compact hybrid trails, time and dosage of growth regulator has to be revisited
7. All the Breeding trials and Bt evaluation trail should be strictly conducted under the supervision of Breeders and all the associated disciplines should take all critical data in the same trial.
8. If respective discipline scientist's posts are vacant, the Entomology and Pathologist from other AICRP or University should be deputed to generated the data as per the protocol.
9. The Project Coordinator should constitute a monitoring team which will visit all the centres including the trails laidout by the Private company, at critical periods to monitor the trails.
10. The sowing report, monthly, quarterly and half yearly report should be submitted in time. Similarly, the vacancy position should be filled immediately so that the Research work is not hampered.
11. No data from the AICRP should be published without the consent of the PC. While publishing individual centre data should not be published and due acknowledgement should be given to AICRP on cotton.
12. Pest and disease tolerant lines should be deposited with ICAR-CICR, Nagpur to integrate in to Breeding program.
13. The demonstration under NFSM-FLD should be conducted with the varieties/ hybrids developed in the respective centres.
14. All the AICRP centres should conduct field day on regular basis to showcase their stable Breeding lines to share among the Public and Private sector.
15. AICRP should develop an on-line data submission module, Project Coordinator in consultation with ICAR-ISARI may develop the module.
16. Statistical analysis (SEd and CD (%)) to be followed commonly and CV values is to be reported in all Agronomy trials
17. All Agronomists should takeup sowing on priority for Pre-released agronomic evaluation trails, for timely submission of samples to ICAR-CIRCOT for spinning test