

Cotton Innovate

A Monthly Newsletter from ICAR-Central Institute for Cotton Research, Nagpur



Cotton under High Density Planting
Photo: Dr. M. V. Venugopalan

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COTTON INNOVATE

Invited Research Note

Bt varieties for increasing cotton yields under rainfed ecosystem

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Bt cotton was developed as an alternate strategy to the previously used hazardous insecticides to circumvent bollworm problem in cotton. In contrast to other countries, Bt technology was introduced to India exclusively in the form of Bt hybrids. Area under cotton (76 lakh hectares to >120 lakh hectares) and yields (from 300 kg lint per hectare to >500 kg lint per hectare) were increased after the introduction of Bt cotton hybrids in India. This productivity enhancement achieved was a combined result of exploitation of heterosis in the form of hybrids, higher input use (water and nutrients) and yield protection from Bt technology. Even today, with more than 90% area is under Bt hybrids, the cotton productivity in India is low compared to world average (>750 kg/hectare) and is found stagnated at around 500 kg lint per hectare for past many years. One of the reasons attributed to this productivity stagnation is deployment of Bt technology in the form of Bt hybrids in rainfed conditions which accounts to more than 60% of cotton area in India. Generally, hybrids possess strong vigour and demands higher inputs. Majority of the popular Bt hybrids are long duration that suffer moisture stress at boll formation stage due to poor water retention of shallow soils in rainfed regions. Productivity enhancement in India can come from yield improvement in rainfed ecosystems through development and deployment of Bt cotton varieties. Bt varieties provide higher yields with an option of high-density planting, provide better protection against bollworms owing to presence of transgene in homozygous conditions with no further segregation, are less input demanding and more climate resilient. Seed of varieties can be saved for re-use next year.

A dedicated transgenic backcross breeding programme was initiated at ICAR-Central Institute for Cotton Research (CICR), Nagpur during 2006 using Bikaneri Narma Bt (BN Bt). Popular released varieties and parents of promising hybrids of different agro-ecological regions of the cotton growing zones were selected for conversion programme. They were crossed with Bikaneri Narma Bt as transgene donor and F1 thus produced was continuously backcrossed to their respective recurrent parent to eventually introgress Bt gene into elite genotypes. At each backcrossing, introgression of transgene was monitored through Cry1Ac - ELISA. During the crop season of 2016-17, a trial was constituted under 'ICAR – AICRP on Cotton' for testing Bt varieties/genotypes and accordingly 21 genotypes were tested across 18 locations in north, central and south zones of India. Based on the performance of these genotypes over checks, seven Bt varieties of ICAR-CICR were released for commercial cultivation by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agriculture Crops during the meeting held on 26th April 2017 for north zone and 17th July 2017 for central and south zone. ICAR- CICR 23 Bt was identified for release for rainfed conditions of south zone and CICR 16 Bt was identified for irrigated conditions of central zone by the Varietal Identification Committee meeting held on 12th December 2019 and notified by Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agriculture Crops during the 84th meeting of the committee held on 10th July 2020. Further, two more Bt genotypes viz., ICAR-CICR 25 Bt and ICAR-CICR 21 Bt were identified for release by the Varietal Identification Committee Meeting held on 9th April 2021. The performance of these varieties under ICAR – AICRP on Cotton trial is provided herewith.

These released Bt varieties are equivalent to Bt hybrids under cultivation in terms of resistance they offer against bollworms. The varieties are 100% effective against American bollworm (*Helicoverpa armigera*) during flowering stage. These released Bt varieties offer tolerance against sucking pests at early growth stages thus reducing cost of cotton cultivation with environmental benefit. The average benefit cost ratio worked out in multi-location trial under the aegis of 'ICAR – AICRP on Cotton' ranged from 1.24 to 1.68. However, at some of the location the benefit cost ratio ranged from 2.65-2.81.

Seed production of these Bt varieties is being undertaken under Mega Seed Project as well as National Seed Project at ICAR-CICR, Nagpur. Seed multiplication is also being undertaken through external agencies. ICAR-CICR, Nagpur has signed MoUs with Maharashtra State Seed Corporation (MAHABEEJ), Akola, Telangana State Seed

Corporation (TSSDCL), Hyderabad and Professor Jayashankar State Agricultural University (PJTSAU). Six MoUs were signed for multiplication and commercialization of notified Bt Cotton varieties released by ICAR-CICR.

S. No.	Name of the Bt variety	Year of Release	Seed cotton yield (kg/ha)	Fibre length (mm)	Fibre strength (g/tex)	Micro naire (g/inc h)	State for which released
1.	ICAR-CICR Bt 6 (RS2013)*	2017	3046	26.1	26.6	4.7	Irrigated conditions of Haryana
2.	ICAR-CICR Bt 14 (CPT2)	2017	3066	28.1	25.4	4.8	Rainfed conditions of Maharashtra
3.	ICAR-CICR Bt 9 (SRI1)	2017	3109	25.7	25.5	4.4	Rainfed conditions of Maharashtra
4.	ICAR-CICR GJHV 374 Bt*	2017	2577	28.2	26.8	4.4	Rainfed conditions of Maharashtra
5.	ICAR-CICR PKV 081 Bt*	2017	2743	28.5	27.9	3.9	Rainfed conditions of Maharashtra
6.	ICAR-CICR Rajat Bt*	2017	2660	26.8	26.1	4.5	Rainfed conditions of Maharashtra
7.	ICAR-CICR Suraj Bt*	2017	2407	29.1	26.0	4.3	Rainfed conditions of Maharashtra
8.	ICAR-CICR 16 Bt*	2020	2961 [§]	25.3	26.1	4.3	Irrigated conditions of Central zone (Maharashtra, Madhya Pradesh and Gujarat)
9.	ICAR-CICR 23 Bt*	2020	2849 [§]	27.6	26.8	3.7	Rainfed conditions of South zone (Tamil Nadu, Karnataka, Telangana and Andhra Pradesh)
10.	ICAR-CICR 21 Bt	2021 [#]	2715 [§]	27.2	27.8	4.3	Rainfed conditions of Central zone (Maharashtra, Madhya Pradesh and Gujarat)
11.	ICAR-CICR 25 Bt	2021 [#]	2325 [§]	27.0	26.4	4.3	Rainfed conditions of South zone (Tamil Nadu, Karnataka, Telangana and Andhra Pradesh)

Note: *Varieties have been notified through a gazette notification dated 7th October 2020 (Page 18); #Identified for release during annual meeting of 'ICAR-AICRP on Cotton' in April 2021; [§]Represents potential yield.



ICAR-CICR Suraj Bt



ICAR-CICR Rajat Bt



ICAR-CICR 23 Bt

During 2019-20, the performance of Bt varieties viz., ICAR-CICR Suraj Bt, ICAR-CICR PKV Rajat Bt, ICAR-CICR PKV081 Bt and ICAR-CICR GJHV374 Bt were evaluated through 80 demonstrations of 1 acre each under rainfed conditions in Mohgaon, Bhivgad, Chargaon, Surabardi, Muradpur, Bothali villages of Umred Tehsil of Nagpur District and Ambhora village of Karanja Tehsil of Wardha district, Maharashtra. The mean yield improvement across locations is depicted in Fig. 2. It was evident that across soils types and growing conditions, there was 9% to 18% yield increase with ICAR-CICR Bt varieties over the BG II hybrid of farmers' choice.

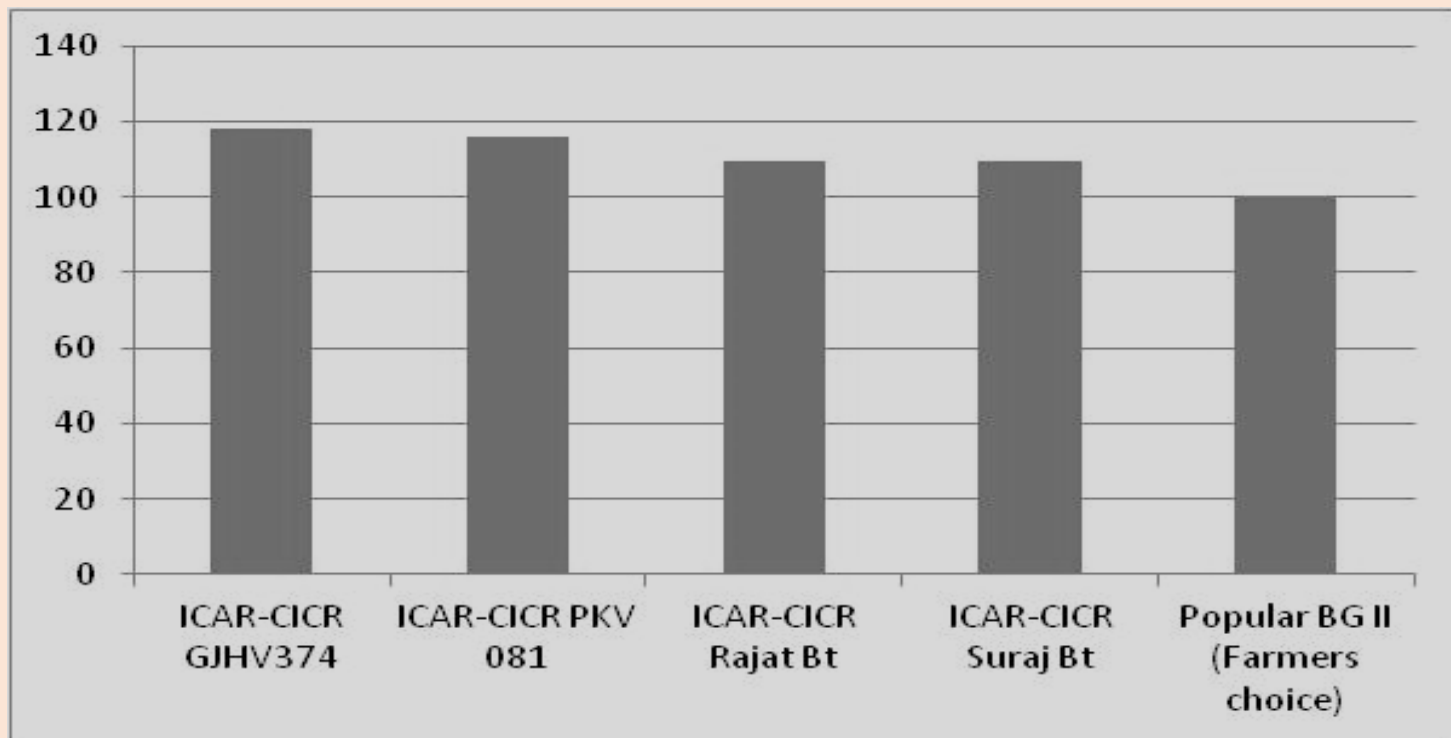


Fig. 2. Percent yield improvement of ICAR-CICR Bt varieties over the BGII Hybrid of farmers' choice

Additionally, field demonstration trials were taken up across Maharashtra (980 FLDs) and Sirsa (100 FLDs) under MGMG and NFSM programmes. Farmers were very satisfied with the performance of the ICAR-CICR released Bt varieties which outperformed non-Bt varieties and at some locations, they have performed better than the Bt hybrids. To popularize these Bt varieties, seeds were distributed to the farmers under FLD and CICR-Mera Goan Mera Gaurav (MGMG) programme. Training programmes were organized at village level as well as at the institute for farmers interested in seed production under participatory mode.

With more than 60% of cotton area in India is under rainfed conditions, Bt varieties can help double the yields with high density planting. To promote and upscale the Bt varieties to nearly 30% of rainfed area under cotton, ICAR-CICR is continuing to undertake rigorous efforts to achieve collaborations for seed production and marketing of Bt

Management of whiteflies on cotton in north India

Dr. Rishi Kumar and Dr. S. K. Verma

ICAR-Central Institute for Cotton Research (CICR) Regional Station, Sirsa, Haryana

Of the 1556 species of whiteflies recorded in the world, *Bemisia tabaci* (Gennadius) remains one of the most economically important pests of field, vegetable and ornamental crops worldwide. *B. tabaci* was first reported in Greece about 132 years ago on tobacco and became a major pest on cotton in India after 1984. Cotton losses due to whitefly were estimated to be in the range of 15-30%. Outbreak of whitefly in cotton is not new to India, as historical records indicated several outbreaks starting from Bihar (1905), Punjab (1930-43), Andhra Pradesh (1984-87), Tamil Nadu, Maharashtra and Karnataka (1985-87), Gujarat (1986-87), Punjab (1996) and in North cotton growing zone (Punjab, Haryana and Rajasthan during 2015-16). A combination of factors such as a) susceptible hybrids, b) hairy or bushy genotypes, c) late sowing, d) high nitrogenous fertilizers, e) inadequate phosphorus and potassium in the soil, f) indiscriminate use of insecticides and their mixtures, g) whitefly resistance to insecticides, i) disregard for proper choice of control measures, j) improper spray application methods and k) favorable weather were found responsible for the 2015-16 outbreak in North cotton growing zone of India. The infestation of whiteflies can be seen round the year on one or another host and from the emergence of seedlings to full grown crop in case of cotton. Hence sustainable management of whitefly is imperative to harvest better cotton yields.

Eggs: Female whitefly lays on an average 119 eggs. Eggs are yellowish white, laid singly on the under surface of leaves in a semi-circular or zigzag pattern. Eggs are stalked and sub elliptical in shape. During warmer period, eggs hatch in about 3-5 days and may require even more than 30 days in cool winter period.

Nymphs: After hatching, nymphs fix themselves to the underside of the leaves. Nymphs are yellowish and brownish coloured, sub elliptical and scale like and found in large numbers on underside of leaves. Nymphs molt thrice and their developmental duration varies from 9-14 days during summer and 17-19 days during winter. The first instar nymph is flat, oval and scale-like and is the only mobile nymphal stage. It moves to a suitable feeding location on the lower leaf surface where it becomes sedentary.

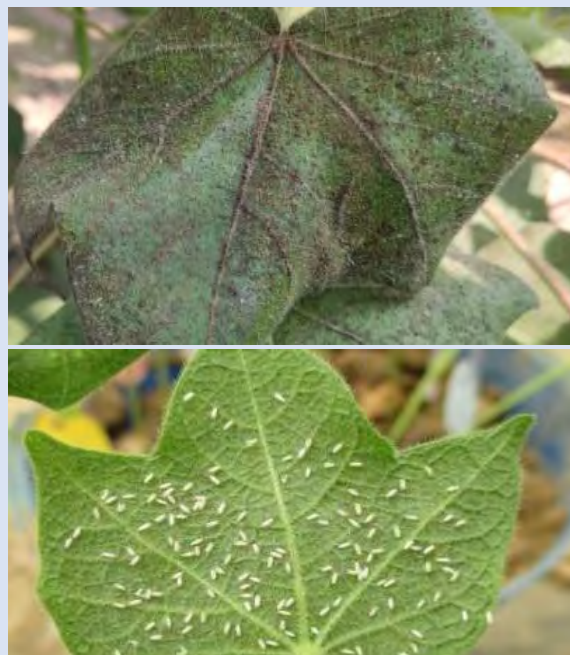
Pupa: The fourth nymphal stage is termed as puparium, which lasts for about 4 -6 days after which the adults emerge. A pupa also resembles nymphs in shape and has brownish opercula.

Adults: Adults are tiny and white in color. They have a yellow body dusted lightly with white waxy powder. Antennae of females are longer than male. Hind legs are larger than anterior pair of legs. Female lives for 5-8 days and male for 4-5 days. Adults of whitefly do not fly very efficiently but they can be transported over quite large distances by the wind. Adults act as vector for several diseases



Whitefly dwells in tropical and subtropical climate and is multivoltine, producing 11-15 generations per year under conducive tropical, subtropical, and fringe-temperate conditions. Wind dispersal of adult whiteflies can occur over both short and long distances. Total life cycle of whitefly is completed in 19-26 days. Though, the ideal conditions for growth are 27°C and 71% relative humidity, hot and humid conditions favours the rapid population built up of this pest. Morphologically, whitefly is small in size measuring about 1.1-1.2 mm in length and has distinct white wing colour, yellow body dusted lightly with waxy powder. Whitefly has four different life stages namely egg, nymphs, pupa and adult.

Nature of damage: Whitefly cause both direct and indirect damage; direct damage is caused by sucking the sap. Feeding results in leaf yellowing, leaf wilting, leaf drop and overall decline in seed cotton yield. It feeds on the phloem of its host plant, passing its stylet between host-plant cells until it penetrates the phloem, suck sap from under surface of leaves causes yellowing and upward curling of the leaves. Indirect damage results from excretion of sugary liquid called 'honeydew' on which sooty mould (black fungus) grows. The presence of sooty mould on leaves interferes with photosynthesis, results in shedding of leaves, affects the overall health and growth of the plant as well as lint quality. *B. tabaci* also known to transmit the dreaded cotton leaf curl virus disease in cotton.



Alternate hosts: *B. tabaci* is primarily a polyphagous pest that colonizes predominantly annual, herbaceous plants. Worldwide, it has been reported on more than 900 plant species and transmits a range of viral diseases in plants. Cotton, brinjal, chilli, cucurbits, mentha, okra, potato, rapeseed, sunflower, soybean and tomato are important field, vegetables, weeds, plantation and ornamentals crops infested by whitefly in India.

Natural enemies: Besides spiders which trap and utilize large numbers of adult whiteflies in their webs, there are eight species of natural enemies (five predators and three parasitoids). The predators include beetles, *Serangium parcesetosum* Sicard, *Brumoides suturalis* (Fab.), *Cheilomenes sexmaculata* (Fab.), *Coccinella septempunctata* L. and a neuropteran, *Chrysoperla* sp. The three parasitoids are *Encarsia lutea* (Masi), *Encarsia sophia* (Girault & Dodd) and *Eretmocerus* sp. They have been recorded to parasitize 10-64 per cent of nymphs under conducive conditions.

Integrated management of whitefly in cotton

Integrated Pest Management (IPM) intended to reduce ecological and health damage caused by chemical pesticides. The IPM program for *B. tabaci* includes biological control, crop plant resistance, physical and mechanical methods, and using selective chemical pesticides when necessary. Host plant resistance to whiteflies implemented through screening of GEAC approved Bt cotton hybrids of the North zone against *B. tabaci*, CLCuD and yield parameters. Mechanical methods (use of yellow sticky traps and growing physical barrier crops) to create unfavorable environments for pests were also involved. Cultural methods such as sowing dates, crop rotation, weed/alternate as well as irrigation and nutrient applications adopted. Based on the principle of IPM, pesticides are last choice for farmers to use when other options are not successful against the infestation of pests in crops. Insecticides, including neem based, neonicotinoids, insect growth regulators and new generation insecticides, were included to reduce non-target impacts, environmental contamination, and resistance of insect pests which ultimately enhanced activity of biological control agents. Management strategies for whitefly rely on following aspects.

Sampling	Whitefly (Nymphs and adults), Sooty Mould				
Effective Chemical Use	Action thresholds	Effective and selective chemistry		Resistance Management	
	4-6 adults/leaf for application of neem-based insecticides during earlier (0-70 DAS) window and 6-8 adults/leaf in general for chemical insecticides				
Avoidance	Area wide approach	Cross commodity Cooperation Approach	Crop Placements	Alternate host management	Inter crop movement
	Exploration of pest biology	Off season biology	Conservation of natural enemies	In-field mortality dynamics	Pest outbreak and prediction
	Planting and termination date management	Tolerant/ resistant varieties	whitefly and nitrogen interactions	whitefly and irrigation scheduling	Crop management

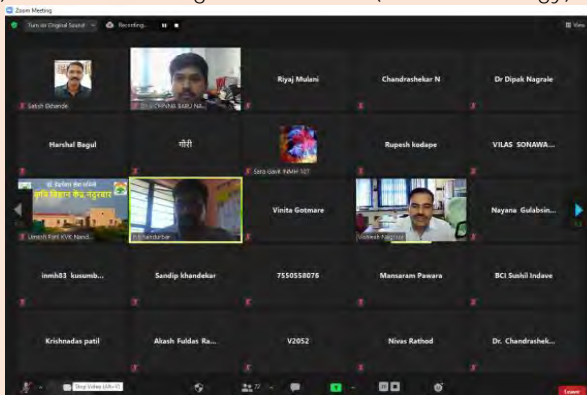
Whitefly management strategies in north cotton growing zone of India

- 1) **Mass campaign:** Awareness and training through mass campaign helps in early detection of pest.
- 2) **Monitoring and management:** Monitoring and management of whitefly should be done from February onwards on all alternate hosts (vegetables, ornamentals and weeds).
- 3) **Cultivate recommended varieties/hybrids:** Grow recommended high yielding cotton genotype approved by the SAU/ICAR/Department of Agriculture having tolerance to whitefly and Cotton Leaf Curl Disease (CLCuD).
- 4) **Timely sowing:** Ensure timely sowing (up to 15 May for the American cotton hybrid/varieties and up to 30 April for *arboreum/Desi* cotton varieties) of the crop as timely sown crop tolerates whitefly and CLCuD. Maintain 8,000 –10,000 plants per acre of the American cotton hybrids in the field.
- 5) **Promote desi cotton varieties:** *Desi* cotton varieties/hybrids are tolerant to the whitefly and immune to the CLCuD.
- 6) **Fertilizer doses and applications:** Apply recommended dose of fertilizers as per the package of practices of respective SAU and after soil health inspection. Avoid excessive urea application during early vegetative phase of the crop. Apply half dose of urea up to squaring and remaining half dose may be applied between flowering and boll formation. The rest of the fertilizers (P&K) can be applied as basal dose. Apply 2 - 4 sprays of 2% potassium nitrate (13:0:45) at 7-10 days intervals starting from flower initiation onwards.
- 7) **Irrigation:** Apply first irrigation at 4-6 weeks after sowing followed by need based irrigation depending on rainfall and stop irrigation at 1/3rd of boll opening.
- 8) **Weed sanitation:** Keep fields, bunds and the vicinity free of weeds before and after the sowing of cotton. Destroy volunteer/ratoon cotton plants as well as the weed hosts growing near the irrigation channel/ canal and fallow lands during the off-season.
- 9) **Barrier crop:** Grow two dense rows of sorghum or pearl-millet or maize as border around cotton fields. Create ecological diversity by growing *desi* cotton and other non-host crops between the cotton fields.
- 10) **Yellow sticky traps:** Install low cost yellow sticky traps as per recommendations (40-50 / acre) of SAUs during July to August.
- 11) **Use botanicals:** Initially apply two sprays with 1.0% neem oil (0.03% or 300 ppm) + 0.5% laundry detergent emulsion followed by two sprays either of 1.0% castor or pongamia oil emulsion + 0.5% laundry detergent to reduce whitefly populations.
- 12) **Use insect growth regulators:** Buprofezin 25% SC (chitin biosynthesis inhibitor) @ 320 ml/acre, Pyriproxyfen 10% EC (juvenile hormone mimic) @ 400-500 ml/acre, Diafenthiuron 50% SC (oxidative phosphorylation inhibitor) @ 200 gm/acre, Spiromesifen 22.9% EC (Lipid synthesis inhibitor) @ 200 ml/acre if needed, can be used after mid-august. These insecticides are effective on whiteflies and are relatively safer to its natural enemies.
- 13) To manage the second flush of whitefly (later part of season during September) restricted use of Ethion (800 ml/acre) is also advisable.
- 14) If higher population of eggs and nymphs of whitefly is observed after 70 DAS under the leaves as indicated by sticky leaves, then application of Buprofezin (320 ml/acre), Spiromesifen (250ml/ acre) or Pyriproxifen (400-500ml/acre) is advisable.
- 15) If mixed infestations of whitefly and thrips are observed above ETL after 70 days of sowing, spray Diafenthiuron 50WP @ 200 g/acre or Spinetoram 11.7 SC @170 ml/acre to manage both the pest.
- 16) If the mixed infestation of whitefly and leafhopper is observed, apply Flonicamid 50WG (80 g/acre) or Dinotefuran 20SG (60 g/acre).
- 17) After 70DAS, use 200 litre spray solutions/acre for better crop coverage.
- 18) Never use insecticide mixtures. Some insecticides such as synthetic pyrethroids etc., are known to aggravate resurgence of whitefly when used indiscriminately.

CICR Happenings

One day farmers' training on cotton production technologies under TSP Scheme

ICAR-CICR, Nagpur in collaboration with KVK, Nandurbar organised one day farmers training program on improved cotton cultivation technologies on June 4, 2021 through virtual mode (video conferencing) for the cotton farmers from tribal community of Nandurbar district under Tribal Sub-Plan (TSP) scheme. Dr Y. G. Prasad, Director, ICAR- CICR, Nagpur chaired the programme and provided comprehensive guidance to the participating farmers. On this occasion, At the outset, Dr Nandini Gokte-Narkhedkar, Principal Scientist & Head, Division of Crop Protection, ICAR-CICR, Nagpur advised the farmers to follow IPM strategies devised by CICR for the effective management of pink bollworm and boll rot in cotton. Subject experts guided farmers on several topics. Dr. Vinita Gotmare, Principal Scientist (Genetics and Plant Breeding) spoke on improved varieties to increase cotton productivity. Dr. V. S. Nagrare, Principal Scientist (Entomology) detailed on IPM of pink bollworm. Dr. Ramkrushna, G.I., Senior Scientist (Agronomy) sensitized farmers on proper management of fertilizers and nutrients to enhance cotton production. Dr. Dipak Nagrale, Scientist (Plant Pathology) interacted on management of boll rot and grey mildew disease. Dr Chandrashekar, N., Scientist (Ag. Biotechnology), along with Dr Umesh Patil, Dr P.C. Kunde, KVK, Nandurbar participated in the programme. Shri. Rajendra Dahatonde, Programme Co-ordinator, KVK, Nandurbar facilitated the participation of farmers of the district. About 80 farmers attended the training program which was coordinated by Dr. V. Chinna Babu Naik, Senior Scientist (Entomology) and Nodal Officer (CICR-TSP) and Dr D.T. Nagrale, Scientist (Plant Pathology).



One day training program cum seed distribution to tribal farmers of Gadchiroli under TSP scheme

One day farmers training program on “Cotton cultivation technologies cum inputs distribution” was organised for tribal farmers of Gadchiroli district under TSP at KVK, Sonapur (Gadchiroli) on June 10, 2021. A team comprising of Dr. Dipak T. Nagrale, Scientist (Plant Pathology) and Sh. G. L. Nawaye, Supporting Staff coordinated the input distribution of paddy seeds and vegetable seed kits to tribal farmers. Dr. V. Chinna Babu Naik, Senior Scientist (Entomology) and Nodal Officer (CICR-TSP) briefed about implementation of TSP program and guided farmers in detail about insect-pest management in cotton through virtual mode. Similarly, Dr. Dipak Nagrale interacted with farmers and explained seed treatment procedures, identification of cotton diseases and their integrated management. During this program which was coordinated by Dr. V. Chinna Babu Naik and Dr. D.T. Nagrale leaflets on IPM of pink bollworm and safe handling of pesticides were distributed to 50 tribal farmers.



CICR Happenings

Training cum input distribution to SC cotton farmers in Wardha district under SCSP scheme

Critical inputs like cotton seeds (CICR Rajat Bt), pigeonpea seed and biofertilizers were distributed to the SC beneficiary farmers of Pimpalgaon (Lute) and Durgada villages of Deoli Taluka (Wardha district) under SC sub-plan on June 11, 2021. Dr. S. P. Gawande and Dr. N. S. Hiremani, Scientists (Plant Pathology) coordinated the input distribution program. Dr. Gawande explained about the SCSP scheme to the beneficiaries and also elaborated the application of biofertilizers and bioagents in crop production. Dr. Hiremani briefed about seed treatment with bio agents and IDM of cotton. Sh. Akshay Kamble, Sh. Ashwin Meshram and Sh. Vijay Gaikwad coordinated and facilitated the distribution of critical inputs.



One day farmers' workshop cum input distribution at Umred under TSP scheme

One day farmers' workshop cum input distribution program on "Improved Cotton Production Technologies cum Inputs Distribution" was organised for tribal farmers of Umred taluka, Nagpur district under TSP at ICAR-CICR, Nagpur on June 15, 2021. A team comprising of Dr. V. Chinna Babu Naik, Senior scientist (Entomology) and Nodal Officer (CICR-TSP), Dr. Ramkrushna, G.I., Senior Scientist (Agronomy), Dr. Dipak T. Nagrale, Scientist (Plant Pathology) and Dr. Chandrashekar, N., Scientist (Ag. Biotechnology) coordinated the input distribution of cotton seeds (upland cotton varieties Suraj Bt and PKV081 Bt) and vegetable seed kits each to 20 tribal farmers during the event. At the outset, Dr. Y.G. Prasad, Director, ICAR-CICR, Nagpur addressed the participating farmers on importance of various issues like selection of quality seeds and varieties, good agricultural practices and adoption of CICR technologies and advisories etc. for improving cotton productivity. Dr. V. Chinna Babu Naik briefed about implementation of TSP scheme for the overall welfare of tribal farmers. He guided the farmers about IPM of pink bollworm in cotton. Similarly, Dr. Dipak Nagrale explained about integrated cotton disease management. Dr. M.V. Venugopalan, Principal Scientist (Agronomy), ICAR-CICR, Nagpur briefed about best practices for cotton production. During this event which was coordinated by Dr. V. Chinna Babu Naik and Dr. D. T. Nagrale, literatures on IPM of cotton pink bollworm and safe handling of pesticides were also distributed to tribal farmers.



CICR Happenings

Training-cum-input distribution to organic cotton farmers of Girad cluster of Wardha District under SCSP

Under Scheduled Caste Sub Plan (SCSP), 'Farmers training cum input distribution' programme was organized at organic farmers' training centre, Magan Sangrahalaya Girad on June 16, 2021. Seeds of Suraj (non-Bt) variety, biofertilizer kit and vegetable kits were distributed as critical inputs to the group of 20 Scheduled Caste farmers of Girad cluster, Tah Samudrapur of Wardha district for demonstration of 1 acre of organic cotton. Dr. Rachna Pande (Sr. Scientist Entomology) and Dr. Shailesh Gawande (Scientist, Plant Pathology) coordinated the programme. Dr. Rachna Pande guided the farmers about eco-friendly insect pest management using bioagents, other natural products and their importance in sustainable cotton production. Dr. Gawande explained about the SCSP scheme to the beneficiaries and also provided the information about the use of biofertilizers and biocontrol agents in management of insect pest and diseases in organic cotton. Farmers were also made aware about reduction in cost of cultivation by adoption of biological pest management strategies to maintain ecological balance and to minimize the hazardous effect of chemical pesticides.



Distribution of seeds of CICR-Suraj (Non-GM) to the Scheduled Caste farmers



Training conducted on organic cotton production

One day farmers' workshop cum seeds distribution program at Bhandara under TSP scheme

One day farmers training cum seeds distribution of paddy seed and vegetable kit program was organized under TSP scheme at Khapa Khurd, Tumsar Taluka, District-Bhandara on June 17, 2021. Critical inputs were distributed to tribal farmers from Khapa Khurd, Sitekasa, Vitpur and Lendezari villages of Tumsar taluka of Bhandara district Dr. V. Chinna Babu Naik (Nodal officer, CICR-TSP), Dr. D.T. Nagrale, Dr. Chandrashekar coordinated the workshop and N., Mr. Sujit Kumbhare, Mr. G.L. Nawaye from ICAR-CICR, Nagpur extended technical support.



Online state level training programmes for the cotton growers of north India

Three days online state level training programmes on "advanced technology for enhancing cotton production for the cotton growers of north India" was jointly organized by ICAR- CICR Regional Station, Sirsa and GSP Crop Science Pvt. Ltd. during June 28-30, 2021. The inaugural session was chaired by Dr. Y.G. Prasad, Director ICAR-CICR, Nagpur. He emphasized on the continuous surveillance and management of emerging pests of cotton like PBW, whitefly and nematodes, etc. Dr. S.K. Verma, Principal Scientist (Plant Breeding) and Head I/C, ICAR- CICR, Regional Station, Sirsa, delivered the lecture on the "Present cotton production scenario in north India". During the program, lectures were delivered by Dr. Rishi Kumar, Principal Scientist (Entomology) on Important & emerging insect pests in cotton with special reference to Pink Bollworm and their management, Dr. S.K. Sain, Principal Scientist (Plant Pathology) on Important & emerging diseases of cotton: Identification and their management, Dr. Amarpreet Singh, Scientist (Agronomy) on Agronomic practices for higher cotton production and Sh. Debashis Paul, Scientist (Seed Science and Technology) on Quality Seed production techniques in cotton.

CICR Happenings

A Q&A session was organized, and advisories were provided to the farmers. During three days, around 800 farmers from the different villages of Sirsa, Fatehbad, Hisar, Bhiwani and Jind districts of Haryana State and Hanumangarh and Sriganganagar districts of Rajasthan state participated in the training programme.



Training programme on advanced technology for enhancing cotton production

Seed sale report of ICAR-CICR, Regional Station, Sirsa

A total of 195 kg breeder seed of released varieties and parental lines of hybrids (*i.e.*, CICR Bt-6, CICR-1, CICR-3, CSH 3075, CSH 3129, parental lines of CICR-2) from ICAR-CICR, Regional Station, Sirsa, produced under the supervision of Plant Breeder and Seed Technologist during last season was sold to various Private Seed Companies, NSC and also among the progressive farmers of North India. The sale of the seeds generated revenue of Rs. 74,260/-.



Scientists' Corner

Publications, Awards, Recognitions and special assignments

- ✓ Blaise D, Velmourougane K, Savitha S. Manikandan A. 2021. Intercrop mulch affects soil biology and microbial diversity in rainfed transgenic Bt cotton hybrids. *Science of The Total Environment*, 148787. <https://doi.org/10.1016/j.scitotenv.2021.148787>

Technical Folders:

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Participation of Scientists in Training/Seminar/Conference/Symposia/etc.

- ✓ Celebration of World Milk Day and a technical session on “Animal Health and Productivity” was organized for the farmers by Krishi Vigyan Kendra, ICAR-CICR, Nagpur through virtual platform on June 01, 2021. Dr. Y. G. Prasad, Director ICAR-CICR, Nagpur and Dr. Lakhan Singh, Director, ICAR-ATARI VII, Pune presided over.
- ✓ Dr. Y. G. Prasad, Director attended the Preliminary meeting of proposed EFC pertaining to the Schemes of Crop Science SMD under the Chairmanship of Secretary, DARE & DG, ICAR through virtual platform on June 03, 2021.
- ✓ Dr. Y. G. Prasad, Director chaired the Scientific Advisory Committee (SAC) Meeting of KVK, ICAR - CICR, Nagpur on June 04, 2021. Dr. Sunil Rokde, Head KVK, Dr S S Patil, Mrs. Sunita Chauhan, Dr Sachin Wankhede, Krishi Vigyan Kendra, ICAR-CICR, Nagpur presented the work done report. Members of SAC from CICR, CCRI, SAU and line departments participated.
- ✓ A collaborative project – “Sucking pest management in North Cotton Growing Zone” was organized by Dr Babasaheb Fand Nodal Officer on June 07, 2021 which was chaired by Dr. Y. G. Prasad, Director ICAR-CICR Nagpur and participated by Scientists of ICAR-CICR & team of Bayer Crop Sciences Ltd.
- ✓ Dr. Y. G. Prasad, Director, Dr. D. Blaise, HoD, Crop Production, Dr. A.H. Prakash, Head & PC, CICR RS, Coimbatore, Dr. S.K. Verma, Head, CICR RS, Sirsa, Scientists Dr. M.V. Venugopalan, Er. G. Majumdar, Dr. Jayant Meshram, Dr. Ramkrusna GI, Dr. R Raja, Dr. Amarpreet Singh participated in the google meet on mechanical cotton harvesting organized by Tirth Agro Technology Pvt. Ltd. (Shaktiman) on June 10, 2021
- ✓ Dr. Y. G. Prasad, Director attended Evaluation Committee Meeting for CAS (KVK technical staff) organized by the Vice chancellor, Yashwantrao Chavan Maharashtra Open University (YCMOU) on June 11, 2021

Scientists' Corner

- ✓ Dr. J.H. Meshram, Principal Scientist, ICAR-CICR, Nagpur attended a webinar on "India's Agriculture Education: Accomplishments, challenges and prospects" on July 15, 2021 under the chairmanship of Dr. H.S. Gaur, at ICAR-IARI, organized by India Agriculture Group Intl USA & US-India Agribusiness Forum.
- ✓ Dr. Y. G. Prasad, Director, Dr Nandini Gokte, HoD, Crop Protection, Dr M.V. Venugopalan, Head, PME, Dr SK Verma, Head, CICR RS, Sirsa, Scientists Dr V S Nagrare, Dr Babasaheb Fand attended online meeting regarding Field evaluation of IICT PBW Pheromone lures during 2021-22 season organized by CSIR-IICT, Hyderabad on June 17, 2021.
- ✓ Dr. Y. G. Prasad, Director organized virtual orientation cum interactive training session on Long linted desi cotton production on June 26, 2021. Dr Blaise, HoD, Crop Production, Ms Saleena Pookunju, Better Cotton Initiative (BCI), Mr Akhil Dev, BCI, Dr M V Venugopalan, Head, PME and Scientists Dr Chinnababu Naik, Dr Vivek Shah, Dr Neelkanth Hiremani interacted with field staff of BCI and implementing partners.
- ✓ ICAR-CICR, Regional Station, Sirsa and GSP Crop Science Pvt Ltd organized online state level training programme on advanced technology for enhancing cotton production for the cotton growers of North India on June 28, 2021. Dr S K Verma, Dr Amarpreet Singh, Dr Rishi Kumar, Dr S K Sain, Dr. Debasish Paul & team of GSP Crop Science Pvt Ltd participated along with Director, ICAR-CICR, Nagpur.
- ✓ Dr. Blaise Desouza, I/c Head, Division of Crop Production, ICAR-CICR, Nagpur attended following webinars/meetings during June 2021.
 - NAAS Foundation Day organized by NAAS, New Delhi on June 4, 2021.
 - 'XXVIII Annual Review Meeting of All India Coordinated Research Project on Weed Management', conducted by DWSR, Jabalpur during June 18-19, 2021.
 - 'Nanotechnology in agriculture: Opportunities and Challenges' organized by NAAS, Bhopal on June 21, 2021.
 - Webinar-6 on "Role of weed biology in improving weed management strategies" organized by Indian Society of Weed Science and ICAR-DWR on June 22, 2021.
 - 'Big data -Scope and Applications in Agronomy' organized by Indian Society of Agronomy on June 24, 2021.
- ✓ Dr. Rishi Kumar, Principal Scientist (Entomology) ICAR-CICR Regional Station, Sirsa attended One-day training programme on "Recent advances in sucking pest management in cotton" and delivered a lecture on 'Whitefly: pest status, IRM and IPM strategies' on June 30, 2021 through online mode for the employees of Bayer Crop Sciences Ltd. Total number of participants were 107 in the said programme.
- ✓ Dr A. Manivannan & Dr K. Baghyalakshmi, Scientist (Genetics and Plant Breeding) ICAR-CICR, Regional Station, Coimbatore attended International Webinar cum Workshop organized by TNAU and Indian Seed Sector on "Seed Quality Enhancement" under Indo-German Bilateral Collaborative Programme during 23-25 June, 2021 (online)
- ✓ Dr. S. Manickam, Principal Scientist, ICAR-CICR, Regional Station, Coimbatore was nominated as the External Examiner for conducting the final viva-voce examination of Ph. D. student Ms. Keerthi Patil of University of Agricultural University, Dharwad by the Dean, PG Studies. The viva-voce was on held on 26 June 2021 with the Advisory Committee of the student.

Farmers' Corner

Cotton with intercrops – an avenue for doubling of farmers' income (A Success Story from Haripar Village, Jetpur Taluk of Rajkot district, Gujarat)

Monocropping is an exception, while mixture (of species) is a rule of the nature. Ever increasing cost of cotton cultivation erodes the profitability of cotton farming and hence, getting additional income through intercropping may facilitate doubling the cotton farmers' income. Suitable intercrop with cotton thus provides an avenue for additional return to the farmers. Periodic and early harvest of intercrops results in less competition within the component of multi-tier crops leading to yield equal to cotton sole crop. Studies from CICR have revealed that multi-tier system of intercrops recorded 199 per cent higher gross return and 247 per cent higher net return respectively as compared to sole cotton (Sankaranarayanan et al. 2012).



Intercrop maize harvested field



Intercrop with sesame

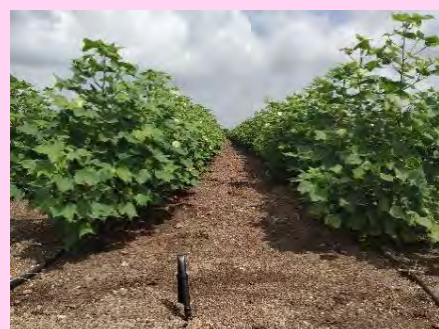


Intercrop maize for fodder

Shri. Bhurubheri Samjibheri Oobuniya, a farmer of Haripur village, Jetpur (Taluk), Rajkot district of Gujarat has reaped economic benefits by adopting cotton based intercropping system. Bt cotton is cultivated by following row spacing of 4.5 feet to 5 feet. Sesame, maize, black gram, green gram and cowpea were raised as intercrops with cotton. During 2019-20 crop season, he cultivated maize and sesame as intercrops with cotton using drip irrigation in two hectares. Phosphorus fertilizer was applied in soil and other nutrients through fertigation. Between two rows of cotton, he planted one row of sesame and alternatively planted maize. Four insecticides sprays were applied for management of sucking pests when they crossed economic threshold level. Maize was ready for harvest within two months and was used mainly for fodder purpose. Around 875 kg/ha of sesame was harvested in three months and sold at the rate of Rs. 8500/quintal and hence, the farmer realized Rs. 74,375/- as additional income from cultivating sesame as intercrop in one hectare. The expenditure incurred for cultivating sesame as intercrop in one hectare of cotton field was Rs. 24,375/- and hence, a net profit of Rs. 50,000/- was realized from this practice in addition to the net return of Rs. 75,000 from cotton as main crop which yielded 2750 kg of seed cotton yield per hectare with the expenditure of Rs. 76,250/-. In the duration of six months, the farmer could successfully earn the net income of Rs. 1,25,000/- from one hectare of cotton based intercropping system. Adoption of this cropping system demonstrated the potential for doubling of income from the same unit of 1 ha land along with green fodder production for enhancing milk productivity and additional income thereof.



Shri. B S Oobuniya, the successful cotton farmer



Crop growth under drip irrigation



Interaction of CICR scientists and acquisition of information

Information provided by,
Dr. C. Karpagam and Dr. K. Sankaranarayanan
ICAR-Central Institute for Cotton Research, Regional Station, Coimbatore

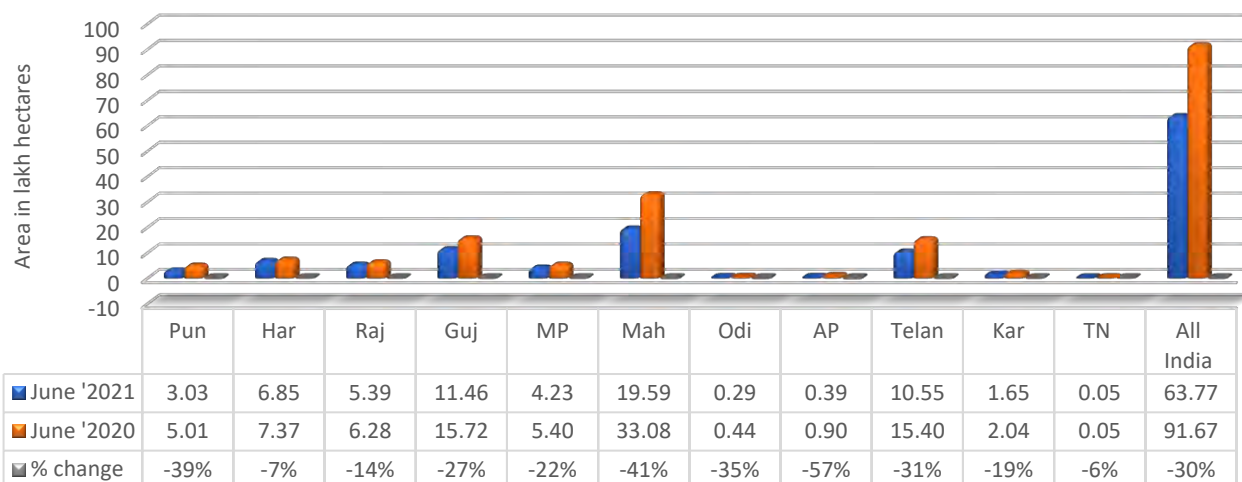
Cotton Statistics and Trade

Domestic cotton scenario during June 2021

Isabella Agarwal and A R Reddy

As the monsoon got delayed in many parts of India after a timely start, the sowing of major kharif crops has seen a dip. The country received rainfall which is 6% below the normal with the deficit in spatial distribution except for the first two weeks of June. Still, the sowing in Central and South Zones are expected to catch up with the normal area under cotton.

Kharif 2021 Cotton sowing in June 2021 (Area in lakh hectares)



Source: Ministry of Agriculture and Farmers Welfare, Government of India

According to the Ministry of Agriculture and Farmers Welfare's (MoA&FW) report, the overall cotton sowing for Kharif 2021 reached 6.37 million hectares, 30 percent lower than last year, and 48 percent lower than the five-years area average. The pace of sowing has picked up in recent weeks, however, it still lags due to the delayed harvest of winter crops coupled with delayed monsoon.

Domestic Market Scenario during June 2021

Market Arrivals and Price of Cotton during June-2021

States	Cotton Arrivals (in tonnes)		Cotton price (Rs./Qtl.)		
	June 2020	June 2021	June 2021	June 2020	% increase over previous year
Punjab	8.58	-	NA	-	-
Haryana			7000		
Rajasthan	58.96	-	NA	-	-
Gujarat	88.52	410.09	6905.43	4289.93	60.97
Maharashtra	0.36	671.96	5499.44	4898.53	12.27
Madhya Pradesh	6.25	144.13	5513.29	4726.67	16.64
Andhra Pradesh	2.9	12.5			
Telangana			5550	-	-
Karnataka	17.85	164.15	6347.82	4493.52	41.27
Tamil Nadu	10.99	25.93	6775.48	4369.38	55.07

Cotton arrivals during the month of June 2021 were comparatively higher in almost all the states, especially in the Central zone comprising of Gujarat, Maharashtra and Madhya Pradesh. The scenario was almost same in the South Zone especially, Andhra Pradesh and Tamil Nadu wherein, the arrivals in the market did not show any phenomenal increase in quantity comparatively over the previous year.

In case of price scenario, Gujarat farmers relished a marked increase in the prices to the tune of 61% over the previous year followed by Tamil Nadu (around 55%) Maharashtra (12%), and Madhya Pradesh (17%). There has been a remarkable increase in the price received by cotton farmers in almost all the cotton growing States.

The Hinduva, 14.06.2021

Agriculture Department cracks down on unapproved HTBt cotton seeds

This season, the quality control team of the department has seized unapproved HTBt cotton seeds worth Rs 1.90 crore till June 9

Staff Reporter

EVEN as the farmers are busy with Kharif season agricultural activities, Agriculture Department has started crack

down against unapproved herbicide-tolerant (HT) Bt cotton seeds across Maharashtra. And, while the action is being taken against HTBt cotton seeds, Shetkari Sanghatana has announced that it will facilitate provision of the seeds to farmers at their doorstep as part of its 'disobedience movement'.

As per the official data, Quality Control Squad of State Agriculture Department has seized unapproved HTBt cotton seeds as well as Soybean, Gram, and Tur grains being sold as seeds in an unauthorised manner, and registered total 19 police cases in this regard in various parts of Maharashtra. Of these 19 cases, 18 relate to unapproved HTBt cotton seeds. The cases relating to cotton have been registered in Nagpur, Yavatmal, Chandrapur, Gadchiroli,

Washim, Amravati, Dhule, Jalgaon, and Nandurbar districts.

In above-mentioned six districts of Vidarbha region alone, 11 of these cases about unapproved HTBt seeds have been registered. Of these 11, three each are in Nagpur and Yavatmal districts, two each in Chandrapur and Gadchiroli districts, and one each in Amravati and Washim districts. Of the total stock of unapproved HTBt cotton seeds seized, the highest 11,110 packets were seized in Saoner tehsil of Nagpur district, followed by 2,270 packets in Aheri tehsil of Gadchiroli district, and 1,600 packets in Chandrapur city. The total estimated worth of the HTBt cotton seeds seized in the State up to June 9, is Rs 1,90,77,000/.

Apart from the HTBt cotton seeds, the department's squad

Agriculture Department cracks down on...

The Hinduva, 14.6.2021

(Contd from page 1)

seized 6.181 packets of Soybean, Gram, and Tur grains being sold as seeds in an unauthorised manner at Dharwad (11) and Solapur districts (10) respectively. This season's stock has been estimated to be worth Rs 1,92 crore.

HTBt cotton seeds have been a matter of debate for the past few years. National Seed Director, T. Thirumathi, Agriculture Minister had informed the Lok Sabha in April 2019 that the HTBt seeds were not approved for use in the country. However, he had accused the incidents of sale of HTBt seeds to be a 'disobedience movement'.

Beware of HTBt cotton seeds: Agriculture Deptt

AGRICULTURE Department has appealed to the farmers in Maharashtra (Hb) not to go for HTBt cotton seeds as they have not been approved by the Central or State Government. Farmers should buy only the highly available approved cotton seeds, it said.

According to Deputy Agriculture Officer of Maharashtra, Prabhakar Samra, farmers in the state have been misled by unapproved HTBt cotton seeds for past few years. Farmers think that their expense reduce by using HTBt cotton seeds. However, as these seeds have not been approved by the Centre or the State Government, they are not approved. Farmers cannot approach the Government for compensation as they are not eligible to get any of the benefits of the HTBt cotton seeds, he added.

Sakal Agro-One, 9 June 2021

सकाळ अग्रोवन

सुधारित कापूस लागवडीवर संशोधन संस्थेतर्फे मार्गदर्शन

तज्ञांद्वारे विविध विषयांवर शेतकऱ्यांशी ऑनलाइन पद्धतीने चर्चा

सुधारित कापूस लागवडीवर संशोधन संस्थेतर्फे मार्गदर्शन. तज्ञांद्वारे विविध विषयांवर शेतकऱ्यांशी ऑनलाइन पद्धतीने चर्चा. (Text in Marathi describing the online consultation service for improved cotton cultivation.)

Sale of illegal HTBt cotton seeds doubles

The Hindu, 20 June 2021

Industry lobbies demand action against offenders

PRISCILLA JERARAJ

KAN DELHI

The illegal cultivation of herbicide-tolerant (HT) Bt cotton has seen a huge jump this year, with seed manufacturers claiming that the sale of illegal seed packets has more than doubled from 30 lakh last year to 75 lakh this year.



The sales doubled from 30 lakh last year to 75 lakh this year.

there is no accountability of the quality of seed, it pollutes the environment, the industry is losing legitimate seed sale and the government also loses revenue in terms of tax collection," he added, noting that HTBt seeds are often produced in Gujarat and then moved to Maharashtra.

"It will not only decimate small cotton seed companies but also threatens the entire legal cotton seed market in India," National Seed Association of India president Prabhakar Rao said on Friday. "Regulators are only limiting their checking to licensed dealers and seed companies while this illegal activity of HT seed sales is carried mostly by unorganised and fly by night operators. The focus must be shifted to catching them and taking exemplary and strong punitive action."

Deputy Seeds Commissioner Dilip Srivastava admitted that such complaints had become widespread. "Centre has made the policy to ban this variant. But it is the State governments that must take action. We are issuing advisories from time to time," he told The Hindu.

Another official said following Central advisories to all cotton-growing States, Maharashtra, Gujarat and Telangana have seized HTBt stock and taken punitive action against the culprits.

Seed Industry Urges Govt to Curb Surge in Illegal HTBt Cotton

Indian Express, June 3, 2021

Our Bureau

Hyderabad: The Federation of Seed Industry of India (FSII) and the National Seed Association of India (NSAI) have sought the government's immediate intervention to curb the surge in illegally cultivated HT (herbicide tolerant) Bt (biotechnology) cotton.

The seed industry bodies said illegal cultivation of HTBt cotton poses a "serious threat to the environment, farmers, legitimate seed companies and the government revenue." India currently allows Bt cotton, known as a pest-resistant cotton seed that combats bollworm, but the use of genetically modified HTBt cotton is prohibited.

The illegal cultivation of HTBt cotton doubled this year to around 7 million packets across India and was prevalent in major states like Maharashtra, Andhra Pradesh, Telangana and Gujarat, the seed industry associations pointed out.

"It seems that the major seed production of this cotton is in Gujarat and then the seed is moved to Maharashtra," they said.

Soon after the issue of farmers cultivating unapproved HTBt cotton hybrids illegally in many states was raised in Parliament in 2017, the Prime Minister's Office had appointed the Field Inspection and Scientific Evaluation Committee (FISEC) under the Department of Biotechnology.

Apart from confirming that HTBt cotton was being illegally grown across the country, the FISEC panel tested thousands of samples and concluded that nearly 15% of unapproved HTBt cotton was in Maharashtra, Andhra Pradesh, Telangana and Gujarat.

"One of the main reasons why Indian cotton fails to command premium prices in the world markets is because of quality concerns with the raw material available to produce the bales," said Mahajan.

The Smart Cotton project, Mahajan said, aims at a complete value chain transformation to help

WORLD BANK-SPONSORED PROJECT

Smart Cotton initiative aims to turn state produce into complete brand, fix quality issues

PARTHA SARATHI BISWAS PUNE, JUNE 2

IT IS the largest grown crop in the state but the cotton produced in Maharashtra often faces serious quality concerns, which affects the realisation of farmers. Maharashtra accounts for over 30 per cent of the cotton grown in the country but state farmers fail to compete with their counterparts in Rajasthan, Gujarat or Telangana.

Indian cotton commands a premium price in the world market. Right from seed selection to picking, there needs to be more quality parameters across the whole lifecycle of the crop, said Mahajan.

It is not just in total yield where farmers in the state fail to meet quality parameters, they also report higher trash content in their raw material. During cotton picking, a lot more trash content is added to increase the weight but at the end of the process, this dampens chances of the finished produce, both bale or yarn, to fetch a premium price in the world market.

"Our project aims to do is to bring about a change in the way the farmer grows his crop so the pressed bale is sold at a premium price," he explained.

In order to help ginners and press unit owners produce uniform quality of cotton bales, the project would push farmers to grow the same variety in the village. "In developed cotton-growing countries, farmers have large land holdings which allow

the production of uniform bales. Indian cotton growers have small holdings and with each going for different varieties, chances of producing uniform bales are low," he said.

A single farmer producing quality cotton would not make much difference so the project is being implemented across 60 talukas in 20 cotton-growing districts, said Mahajan.

In the next five years, the project aims to see Maharashtra produce 10 lakh bales (each bale with 170 kg pressed ginned cotton) of banded cotton from these village clusters. The bales would be branded by the government of Maharashtra, which will act as a third party auditor.

The project will have an extensive technology arm with block-chain traceability being the backbone of the same. Mahajan is hopeful that the technological aspect will provide complete backward traceability of cotton.

Citing the example of US Cotton, Mahajan said it was used even while branding the final products. "Our aim is to develop Smart Cotton on similar lines... a simple scan of the QR code would show this cotton has originated in distressed districts of Maharashtra," he said.

Cotton Innovate

A Monthly Newsletter from ICAR-Central Institute for Cotton Research, Nagpur



COTTON INNOVATE



Cotton under High Density Planting
Photo: Dr. M. V. Jethava

Invited Research Note

BT Cotton Varieties for Increasing Cotton Yield
by Dr. S B Singh et. al.

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CICR Happenings

Celebrations, Training programmes, Meetings, Visits, etc.

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Cotton with intercrop - an avenue for doubling of farmers' income

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