

## ABSTRACT

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### **Past, present and future of cotton species of *Gossypium arboreum* L - A Qualitative Perspective**

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**Abstract :** *Gossypium arboreum* L cotton is a viable source of quality medium staple fibre with added advantage of tolerance to biotic and abiotic stresses. The evaluation of available germplasm material suggests that the species possess enough variability and potential to allay the fears of cotton growers, researchers and processors. The improvement was observed in qualitative potential, recorded in terms of essential and desirable fibre quality traits, is noticeable and demonstrates its suitability for textile applications. The fibre bundle strength, however, needs further attention to bring desirable improvement and make the species more acceptable.

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### **Use of RAPD and ISSR markers for determining genetic diversity of cotton (*Gossypium hirsutum* L.) working germplasm**

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**ABSTRACT :** The present study attempts to evaluate twenty four working germplasm of *Gossypium hirsutum* (12, bacterial blight resistant and 12, jassid and bollworm resistant) for determining genetic diversity. Two PCR based marker systems viz., 40 random amplified polymorphic DNA (RAPD) and 19 inter simple sequence repeats (ISSRs) were used to assess the genetic diversity. The value of similarity coefficients of dendrogram calculated by RAPD and ISSR markers ranged from 0.55-0.94 and 0.39-0.98, respectively. The average polymorphic values for RAPD and ISSR were found to be 68.68 and 76.55 per cent, respectively indicating that ISSR marker is more informative than RAPD.

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### **Evaluation of *Bt* and non *Bt* cotton hybrids for fibre quality characteristics**

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**ABSTRACT :** A field experiment was undertaken for two years during *kharif* 2006-2007 and 2007-2008 at Cotton Research Station, Nanded to study the effect of sowing on the fibre characteristics in *Bt* and non *Bt* hybrids. Different *Bt* and non *Bt* cotton hybrids varied in respect of their quality characters. Bunny non *Bt* recorded highest staple length (31.1 mm) in late sown crop followed by Bunny non *Bt* (30.6 mm) in normal sown crop. While lowest staple length 23.1 and 23.6 mm was recorded in PHH 316 non *Bt* in normal and late

sown condition, respectively. Maximum uniformity ratio was (51 and 50 %) recorded in hybrid PHH 316 non *Bt* in normal sown crop and late sown crop, respectively, and minimum uniformity was recorded in Bunny *Bt* (46 %) in normal sown crop. The micronaire value recorded in Bunny *Bt* and RCH 2 *Bt* was lowest ( $3.1 \times 10^6$  mm/inch) in normal sown crop, while ( $3.2 \times 10^6$  mm/inch) was recorded in late sown condition. Maximum staple strength was recorded in Bunny non *Bt* (22.4 g/tex) in normal sown crop, while minimum in hybrid PHH 316 non *Bt* (18.9 g/tex) in late sown crop. The highest fibre elongation was recorded in hybrid PHH 316 non-*Bt* (6.5 %) in normal sown crop, while in late sown condition. RCH 2 *Bt* showed maximum staple elongation and lowest was recorded in hybrid RCH 2 non *Bt*, Bunny *Bt*, Bunny non *Bt* (6.0 %) in late sown condition. In general number of bolls/plant, boll weight, yield/plant, harvest index, 100 seed weight and GOT (%) were higher in normal sown crop and it decreased with late/delayed sowing. Normal sown crops showed higher staple elongation and micronaire value than late/delay sown crop, while uniformity ratio, staple length and staple strength were higher in late/delay sown crop.

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## **Studies on correlation and path coefficient analysis in *Bt* and non *Bt* cotton hybrids (*Gossypium hirsutum* L.)**

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**ABSTRACT:** Field investigations were undertaken to study the significant relationship between different yield components in *Bt* and non *Bt* cotton hybrids. In hybrid MECH 184 *Bt*, seed cotton yield/plant was positively and significantly correlated with independent characters namely, leaf area, dry matter accumulation, reflecting the importance source (leaf area) in yield formation in transgenic *Bt* cotton. Whereas, in case of both non *Bt* cotton hybrids, sympodia and boll weight were positively and significantly correlated with seed cotton yield. Moreover, multiple regressions and path analysis studies revealed that picked bolls and boll weight was more beneficial in increasing the seed cotton yield of MECH 184 *Bt*. Significant and positive correlation coefficient in PHH 316 hybrid were observed between seed cotton yield and dry matter accumulation, picked boll and boll weight which indicated that seed cotton yield of PHH 316 hybrid is mainly dependent on these parameters. Multiple regression studies of MECH 184 non *Bt* and PHH 316 indicated that picked bolls and boll weight was more beneficial in increasing the seed cotton yield.

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## **Fibre quality for trade variety**

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**Abstract :** Indian textile products have been well accepted throughout the world market and had already established a substantial market base. These all could become possible as the quality of these products remained world class and superior in many ways. The export as well as the demand of Indian textile products have been rising successively in the world market, so maintaining the world class quality of these products, is of prime importance. Apart from that with the globalization of economy and the need to meet stringent quality norms particularly for export, the cotton trade and spinning industry have come to realize the importance of objective testing of raw material. The quality of textile products lies in the quality of its raw materials as cotton, silk, jute, ramie, other natural fibres and the man made fibres as polyester, nylon, rayon etc. Accepting the demand from textile industry and trade, it was desired to evaluate the cotton quality where information on essential fibre quality attributes for trade varieties collected from different centers and parts of the country would have been analysed. The fibre samples of 37 cotton varieties received from the cotton growing locations have been tested for fibre quality parameters. The data have been presented

and analysed statistically. The frequency distribution curves for 4 cotton varieties have been drawn for these fibre quality parameters from their minimum to maximum values of 2.5 per cent span length (SL) of fibre in mm, uniformity ratio (U.R.) in percentage, micronaire (MIC) value in microgram/inch and bundle tenacity (3.2 mm) in g/tex. The samples belong to various locations of the three main cotton growing zones such as north, central and south of the country. As per the results and the technological data generated it could be stated that the present cotton varieties / hybrids cover a wide spectrum of fibre quality and spinnability ranging from 20 to 120s count. The varieties developed so far ranges from short staple cotton of 18.0mm to extra long cotton (ELS) up to 39.0mm length, which include very coarse to very fine cottons.

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## **Inheritance of flower colour in cotton (*Gossypium arboreum* L.)**

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**ABSTRACT :** Inheritance of flower colour in cotton (*Gossypium arboreum* L.) has followed a qualitative pattern. Yellow flower colour is dominant over white flower colour; pink flower colour is also dominant over white flower colour and white flower with pink petal margins at the top showed gene interaction when crossed with yellow flowered male resulting  $F_1$  had red flower colour. A segregation ratio of 3 yellow: 1 white flowers in  $F_2$  generations of two crosses indicated that white flower colour is controlled by a single recessive gene. Similar results were observed in pink and white flowered cross. Segregation ratio of  $F_2$ ; 1 yellow; 2 red; 1 white petal with pink margins indicated that white petal with pink margins is governed by a single gene with some modifier effect. These results were further confirmed by observed ratio in backcross generations.

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## **Heterosis studies on GMS based hybrids in *Gossypium hirsutum* cotton**

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**ABSTRACT :** A line x tester analysis was undertaken to estimate the magnitude of heterosis in *Gossypium hirsutum* for seed cotton yield, its component traits and fibre quality parameters in 15 GMS (genetic male sterility) based cross combinations. The analysis of variance indicated that the mean squares of genotypes were significant for all the characters except symopdial branches/plant. The results of micronaire value indicated the presence of variability among hybrids and their parents. The observation of the studies revealed that none of the cross combinations exhibited significant heterosis over the zonal check hybrid CSHH 198 for seed cotton yield. For the study of bolls/plant in GMS 15 x 002 NAH (13.8%), boll weight in GMS 20 x 945 DA (16.5%), monopods in GMS 20 x 001 NAH (31.1%), seed index in GMS 15 x 945 DA (16.8%), ginning percentage in GMS 15 x 001 NAH (15.5%) showed the highest and significant positive heterosis over the check hybrid. For quality traits, 2.5 per cent span length in GMS 20 x 002 NAH (18.9%) and for fibre strength GMS 20 x 002 NAH (12.4%) showed the highest and significant positive heterosis. The cross combinations involving female parent GMS 15 and male parent 001 NAH recorded significant positive heterosis for most of the characters. Thus, the female parent GMS 4 and the male parent 002 NAH can be used for exploitation of heterosis.

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## **Analysis of first degree statistics to estimate gene effects in cotton (*Gossypium hirsutum* L.)**

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**ABSTRACT:** The nature and magnitude of gene effects operative in the inheritance of seed cotton yield and component traits were estimated through generation mean analysis in two varietal crosses of cotton. Presence of epistasis was detected by scaling tests as well as joint scaling test for most of the characters studied. In the cross LH1832 x CIM446, scaling tests as well as joint scaling test detected the presence of epistasis for seed cotton yield, bolls/ plant, ginning outturn and 2.5 per cent span length. In cross LH1832 x CIM448, additive-dominance model was sufficient to explain variation in generation means for seed cotton yield and boll weight, although 'A' scaling test detected epistasis for boll weight. It was concluded that estimation of only additive, dominance gene effects ignoring epistasis will be misleading. As additive and non additive gene effects played a parallel role in the inheritance of different traits, sophisticated breeding procedures as recurrent selection and population improvement programmes were suggested to exploit both types of gene effects.

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## **Genetic parameters for yield and fibre quality traits in *desi* cotton (*Gossypium arboreum* L.)**

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**ABSTRACT :** Twenty four genotypes of *desi* cotton (*Gossypium arboreum* L.) comprised of four lines, four testers and their sixteen hybrids produced in a line x tester fashion were evaluated for yield and fibre quality traits. Results revealed that seed, cotton yield, fibre strength, micronaire value and maturity coefficient showed high heritability and high genetic advance which are due to additive gene effect and selection is rewarded. Moderate heritability coupled with moderate genetic advance was observed for bolls/plant, boll weight, ginning percentage, lint index, 2.5 per cent span length indicating the operation of both additive and non additive gene action in the inheritance of these traits. Plant height, monopodia and locules/plant, seed index showed low heritability as well as low genetic advance besides narrow range of variability restricting the scope for improvement through selection. Low heritability coupled with low genetic advance for these traits indicated that these traits are controlled by environmental effects and simple selection would be ineffective.

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## **Combining ability analysis for yield and fibre quality traits in upland cotton (*Gossypium hirsutum* L.)**

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**Abstract :** Present study aims to estimate general combining ability of the parents and specific combining ability of hybrids for yield and fibre quality traits. Three genotypes were crossed with ten genotypes in line x tester fashion. Analysis of variance for combining ability indicated the predominance of non additive variance for all the characters under study except 2.5 per cent span length and fibre strength. BC 68-2 was good general combiner for seed cotton yield/plant and its yield contributing traits. On the basis of *sca* effects, the cross combinations of G. Cot. 20 x 76 IH 20, GSHV 155 x LRA 5166, GSHV 155 x GSHV 112, G. Cot. 20 x GSHV 01/26, GSHV 155 x GISV 103 and GSHV 01/1338 x GISV 218 exhibited highest magnitude of positive significant *sca* effects for seed cotton yield and its components.

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## **Effect of crop geometry and fertilizer levels on seed cotton yield and nutrient uptake of *Bt* cotton under irrigated conditions**

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**ABSTRACT :** A field experiment was conducted at Research Farm, CCS, Haryana Agricultural University, Hisar during 2007 and its Regional Cotton Research Station, Sirsa during 2008 to find out the optimum crop geometry and fertilizer doses for *Bt* cotton (*Gossypium hirsutum* L.) hybrids RCH134. A closer spacing of 67.5×60 cm gave significantly higher seed cotton yield (3230 and 3906 kg/ha at Hisar and Sirsa, respectively) than other two spacing *i.e.* 100×45 and 100×60 cm at both the locations. The highest seed cotton yield (3061 and 3902 kg/ha at Hisar and Sirsa, respectively) was recorded with a fertilizer dose of 125 per cent RDF (187.5-75-75 kg/ha N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O) as compared to 75 per cent RDF and 100 per cent RDF at both the locations. The crop geometry, 67.5×60 cm and fertilizer dose of 187.5 kg/ha N, 75 kg/ha P<sub>2</sub>O<sub>5</sub> and 75 kg/ha K<sub>2</sub>O is ideal for getting higher seed cotton yield of *Bt* cotton RCH 134.

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## **Isotopic investigations on the utilization of Jhabua rock phosphate as phosphorus source to cotton MCU 12**

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**ABSTRACT:** The effects of Jhabua Rock Phosphate (JRP) along with single super phosphate (SSP), *Phosphobacteria* (PB) and compost application on biomass yield, phosphorus uptake and phosphorus (P) utilization by cotton (MCU 12) under pot culture conditions were studied using <sup>32</sup>P tracer technique on a sandy clay soil. Three levels of JRP *viz.*, 100, 75 and 50 per cent of the recommended dose (80-0-40 kg /ha) and three levels of SSP *viz.*, 100, 50 and 25 per cent of the recommended dose along with *phosphobacteria* and compost in fourteen different combinations were replicated twice. Maximum beneficial effects in respect of biomass yield, and P uptake were observed in 50 per cent SSP + 50 per cent JRP + PB + compost. Among the three sources, the highest per cent utilization form RP was for the treatment that received 50 per cent SSP + 50 per cent JRP with compost. Higher dose of RP application lowered its utilization. Hence, the indigenously available JRP along with SSP, compost and PB can be effectively and profitably utilized as a P source for improving the yield and nutrient uptake of cotton.

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## **Rain water harvesting as strategic tool for drought mitigation in cotton**

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**Abstract :** Series of field trials were conducted during 1987-2010 at Central Institute for Cotton Research, Nagpur indicated that in shallow, medium and deep soils, it was estimated to collect 150 , 300 and 350 M<sup>3</sup> of runoff water/ ha in experimental ponds (200 M<sup>3</sup>) at down stream by September end, 56-82 per cent of the pond capacity, was stored. The recycling of this runoff water through supplemental irrigation during 1987-1993, improved additional seed cotton yield by 136, 290 and 387 kg /ha or 20, 28 and 26 per cent over rainfed cotton LRA 5166 in shallow, medium and deep soils respectively. The supplemental irrigations improved WUE by 34, 73 and 97 kg /ha cm respectively in shallow, medium and deep soils. Experimental pond (200 M<sup>3</sup>) size presently advocated, were not accepted by the farmers as they were economically non viable at field scale, but these can be helpful in improving the recharge of existing gravitational wells. Two supplemental irrigations at flowering stage along with deficient micronutrients improved seed cotton yields of 25-30 per cent higher in shallow and medium deep soils, respectively during 2002-2007 in NHH 44 non *Bt* hybrid cotton. It is difficult to provide life saving irrigations from farm ponds in first fortnight of July to seedling droughts. Large farm ponds at community levels can solve this problem of seedling droughts from the recharge of previous year in underground aquifers besides recharging the drinking water wells for summer shortages with 2-3 years of breakeven under multiple uses of water. Terminal droughts of August can overcome by supplemental irrigations from farm ponds of 10 ha catchment with a breakeven of 12 years. *Bt* hybrid cotton responded for two supplemental irrigations from harvested runoff water at seedling /terminal droughts in July (12-47 % runoff) or in mid September (23-80% runoff) @ 750 kg /ha seed cotton yield in vertisols.

## **Sustaining rainfed *Bt* cotton (*Gossypium hirsutum* L.) productivity through moisture conservation and integrated nutrient management techniques**

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**ABSTRACT :** Field studies were carried out at Department of Agronomy, Marathwada Agricultural University, Parbhani during, 2007 to 2010 to explore the suitability of different soil moisture conservation and integrated nutrient management (INM) techniques in relation to yield and economics of *Bt* cotton under rainfed conditions. The results revealed that opening of furrow in alternate row recorded significantly highest seed cotton yield (2758, 2214 and 1452 kg/ha) as compared to cotton + straw mulching (2421, 2003 and 1233 kg/ha) and intercropping of cotton with soybean (2036, 1626 and 1106 kg/ha) treatments during the three year of experimentation respectively. However, intercropping of cotton + soybean recorded significantly highest seed cotton equivalent yield and thereby net returns and B:C ratio over wheat straw mulch and opening of furrow in alternate row. As regards to integrated nutrient management (INM) 100 per cent calculated RDF (100:50:30 N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg/ha) + micronutrients (zinc, iron and boron) based on soil test recorded significantly highest seed cotton yield as compared to all other INM treatments. However, application of RDF with soil testing (75 per cent N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg/ha through inorganic + 25 per cent N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg/ha through vermicompost) was next best treatment which recorded significantly highest seed cotton yield over rest of the treatments

## **Integrated nutrient management packages for *desi* cotton (*G. arboreum*) in Gaorani cotton tract**

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**ABSTRACT:** Integrated nutrient management (INM) packages for *G. arboreum* cotton in shallow, red and medium deep black soils were tested for four years (2001-2005) at ARS, Mudhol and farmer's fields in Adilabad district. INM packages consists of four heat tolerant, five analogue resistant strains of *Azotobacter* (AR), one each local of isolate and a strain of *Azospirillum / Pseudomonas* alongwith *Bacillus megatherium* var. *phosphaticum* (PSB) as seed treatment + 50 per cent RDF + foliar sprays of 2 per cent urea at 60 and 80 DAS in randomized block design with four replications. Pooled analysis that found of results *chroococcum* (AR strain) Mac 27 or Nagpur 2 + PSB as seed treatment alongwith 50 per cent RDF + urea 2 per cent twice significantly improved seed cotton yields by correcting nitrogen deficiencies at peak flowering stage as compared to 100 per cent RDF in both shallow red and medium deep black soils. *A. chroococcum* (AR strain) Ala 27, *Azospirillum* (FS strain) in shallow red soils and *Azospirillum* Nagpur 2 for both shallow red and medium black soils along with PSB as seed treatment and 50 per cent RDF + 2 per cent urea as foliar spray twice produced seed cotton yields *at par* with 100 per cent RDF. These INM packages significantly improved seed cotton yield, C: B ratio, nutrient uptake, nutrient and fertilizer use efficiencies with a confirmatory impact from farmer's fields.

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## **Effect of seedling transplanting systems on seed cotton yield and profit in *Bt* cotton (*Gossypium hirsutum* L.) under semi arid conditions of Punjab**

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**ABSTRACT :** A field study was conducted at Punjab Agricultural University, Regional Station, Bathinda during *khariif*, 2006 and 2007. During 2006, the results showed that the survival of 20 days old seedlings was comparatively higher than 10 days and 15 days seedlings under both the dates of transplanting /sowing. During *khariif*, 2007, the results showed that three week old seedlings grown in polythene bags exhibited a significant influence on the cotton survival percentage in comparison to seedlings grown in trays. The transplanting of seedlings grown in polythene bags gave significantly higher seed cotton yield than transplanting of seedlings grown in ice trays. The sowing of crop by using two seeds/hill gave better yield than one seed / hill. The net returns/ha were highest in polythene bag transplanted cotton crop and the lowest in tray transplanted crop.

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## **Performance of cotton genotypes under different planting dates in south western Punjab**

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**ABSTRACT:** A field experiment was conducted at Punjab Agricultural University, Regional Research Station, Faridkot during *khariif*, 2009 and 2010 to evaluate the effect of planting dates on growth, yield attributes and seed cotton yield of different cotton genotypes in split plot design replicated thrice. Four cotton genotypes including two *hirsutum* and two *arboreum* (*i.e* *Bt* cotton hybrid RCH 134, *hirsutum* variety LH 2076, *desi* cotton hybrid PAU 626 H and *desi* cotton variety LD 694) were planted on four dates *i.e.* April, 20 and 30, May 10 and 20. Pooled data indicated a significant decline in seed cotton yield of all the tested genotypes with any delay in planting beyond May, 10. Cotton planted on April 20 and 30 and May 10 recorded significantly better seed cotton yield (SCY) as compared to May 20 planting during both the years. This increase in SCY was mainly due to improvement in boll number, boll weight, monopods and sympods/plant. Statistically least SCY was recorded under May 20 (2390.2 kg/ha) as a result of significant reduction in yield contributing characters were such as bolls and boll weight/plant. Among genotypes, PAU 626 H (3166.2 kg/ha) recorded highest seed cotton yield followed by RCH 134 *Bt* (3072.9 kg/ha) as compared to LH 2076 (2562.0 kg/ha) and LD 694 (2506.5 kg/ha) owing to higher number of bolls/plant. Two year study indicated that farmers should prefer PAU626H and RCH 134 *Bt* among the tested genotypes and must complete the planting by May, 10.

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## **Response of summer irrigated cotton (*Gossypium hirsutum*) to foliar nutrition of potassium**

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**ABSTRACT:** Field experiment was carried out in summer 2007 and 2008 to evaluate the response of summer irrigated cotton to foliar nutrition of potassium as an alternative to soil application. The results revealed that highest seed cotton yield of 1854 kg/ha was recorded only with the soil application of recommended level of potassium in 4 equal splits at sowing, seedling, flowering and boll development stage. This was comparable with 4 sprays of KNO<sub>3</sub> (2 %) at 60, 75, 90 and 105 days after sowing (1665kg/ha). The economics of cultivation also revealed that soil application of recommended level of potassium in 4 splits was advantageous with the highest BC ratio of 2.11 indicating the superiority of soil application of potassium over foliar application.

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## **Performance of *Bt* and non *Bt* cotton hybrids at wider spacing in north western plain zones**

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**ABSTRACT:** A field experiment was conducted, during 2002-2003 and 2003-2004 at the Research Farm of Project Directorate for Cropping Systems Research, Modipuram, Meerut, to study the growth behaviour and the productivity of *Bt* and non *Bt* (*NBt*) cotton hybrids under normal (67.5 x 60 cm) and wider (100 x 60 cm) spacing in cotton wheat system in north western plain zones. Four *Bt* cotton hybrids, MECH 915 (*Bt*), MECH 915 (*NBt*), MECH 162 (*Bt*), and MECH 162 (*NBt*) were grown during *khariif*, along with three *hirsutum* hybrids (check), Om shankar, LHH 144 and Ankur 651. Two wheat genotypes, HD 2687 and Raj 3765 were sown after harvesting of cotton during *rabi* season. Significantly higher rate of field emergence (95-97%) was observed in MECH 915 (*Bt*), MECH 162 (*Bt*), MECH 162 (*NBt*), Om shankar and LHH 144 as compared to MECH 915 *NBt* and Ankur 651 (84-88%). Variations in LAI shoot length, seed cotton yield and boll weight due to spacing were not significant but biomass production and boll numbers were significantly increased at wider spacing (36.8 and 8.9 %, respectively). Seed cotton yield was significantly highest in MECH 162 *Bt* (24.3 q/ha) followed by Om shankar (2.31 q/ha) and lowest in Ankur 651 (16.6 q/ha). The increase in seed cotton yield at wider



spacing was higher in MECH 915 *Bt* (26.3 %) and MECH 162 *NBt* (20.7 %), and lower in MECH 162 *Bt* (7.3 %) and Om shankar (11.5 %). Wheat yield of was significantly higher in HD 2687 under both timely and late sown conditions (51 and 49 q/ha, respectively). Marginal reduction (3-5%) in wheat yield was observed with late planting. However, overall systems productivity, in terms of wheat equivalent yield (WEY), increased (10-12 %) with the late sowing of wheat. WEY (q/ha) of different *Bt* cotton based systems was significantly higher with cotton MECH 162 *Bt* (119), and Om shankar (118) followed by wheat and lowest with MECH 915 *Bt* (9.8) followed by wheat.

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## **Agronomic studies on promising *arboreum* hybrid in relation to spacing and phosphorus levels in canal command area of north west Rajasthan**

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**ABSTRACT:** A field experiment was conducted during *kharij*, 2003 to 2005 at Agricultural Research Station (ARS) Sriganganagar. The pooled results revealed that *arboreum* hybrid at 67.5 x 45 cm spacing gave significantly higher seed cotton yield (2856kg/ha) over 67.5x 30 cm spacing (2473 kg/ha) but it was statistically *at par* with 67.5x60 cm spacing (2765 kg/ha). The higher yield under this treatment is mainly due to significant increase in bolls/plant and boll weight over 67.5x30 cm spacing. As regards phosphorus level, 40 kg P<sub>2</sub>O<sub>5</sub> / ha increase the seed cotton yield significantly over 20 kg P<sub>2</sub>O<sub>5</sub> /ha. Further increase in dose could not show its impact on seed cotton yield. The difference in yield between 40 kg and 60 kg P<sub>2</sub>O<sub>5</sub> /ha were found non significant. All the yield attributing characters *i.e* boll weight, bolls/plant and plant height were also increased with the increased levels of P<sub>2</sub>O<sub>5</sub>. *Arboreum* hybrid Raj DH 9 gave higher seed cotton yield over RG 8.

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*J. Cotton Res. Dev.* **25** (2) 224-232 (July, 2011)

## **Growth analysis, dry matter and water amount allocation amongst boll components in two cotton genotypes**

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**ABSTRACT :** Two cotton genotypes H 6 (*Gossypium hirsutum*) and G. Cot, (*Gossypium arboreum*) varying widely in their seed index and fibre length were selected for growth analysis. The analysis was performed in terms of fresh weight, dry weight (DW), and water amount (WA) and fibre length throughout the seed developmental period. From the growth analysis kernel, seed coat and fibre were divided into four distinct growth phases (i) cell division (ii) cell elongation (iii) dry matter accumulation and (iv) maturation. Both the genotypes followed the same developmental phases but rate and duration of dry matter accumulation was remarkably higher in H 6 boll components as compared to G. Cot. Considerable overlap between elongation and dry matter accumulation was observed in seed components. Rate of dry matter accumulation (DMA) and rate of fibre elongation showed close correlation with WA during fibre development period. Growth kinetics from the day of anthesis to maturation of protective structures *i.e.* boll wall and bracts revealed that initially 40-50 per cent dry matter was stored in boll wall and 50-60 per cent dry matter in bracts but at maturity, it decreased up to 10-17 per cent and 1-1.5 per cent in boll wall bracts, respectively. The per cent dry matter allocation and per cent WA allocation amongst boll components indicated that protective structures play an important role in sink development, seed index and final yield.

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## **In vitro antibacterial activity of cotton boll wall against gram positive and gram negative bacteria**

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**ABSTRACT :** To check antibacterial activity of dried cotton boll wall, different solvents like methanol, acetone, petroleum ether along with crude extracts were prepared. These extracts were evaluated for antibacterial activity against five gram positive bacteria *i. e. Staphylococcus aureus, Bacillus polymyxa, B. megaterium, B. subtilis, and Streptococcus faecalis* and five gram negative bacteria *i.e. Pseudomonas aeruginosa, Escherichia coli, Proteus vulgaris, Shigella, Enterobacter areogen*. *In vitro* antibacterial activity was performed by standard agar ditch method and after 24 h, clear zone of inhibition was measured with minimum three replicates. All the extracts showed antibacterial activity except crude extract. The susceptible bacteria to all three tested solvent extracts were, *S. aureus, B. polymyxa, B. megaterium, Shigella, S. faecalis, E. coli, E. areogen* and the most resistant bacteria were, *P. vulgaris, P. aeruginosa* and *B. subtilis*. Methanol extract showed significant activity as compared to acetone and petroleum ether. Hence, cotton boll wall can be further subjected to isolation of the therapeutic antimicrobials and to further pharmacological evaluation.

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## **Effect of spacing and fertilizer on growth, yield and quality of different cotton genotypes**

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**ABSTRACT :** A field experiment was conducted at Department of Agronomy, CCS Haryana Agricultural, University, Hisar during *kharij*, 2006 to evaluate the effect of spacing and fertilizers on growth, yield and quality of cotton genotypes in split plot design with three replications. The combinations of three spacing and three fertilizer levels were kept in main plots and three hybrids were kept in sub plots. The increase in fertilizer dose by 25 per cent over 150: 60: 60 kg/ha N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively did not affect the growth, yield attributes, yield and quality of cotton significantly, except plant dry weight at boll formation and first picking stages. However, reduction of fertilizer doses by 25 per cent reduced the growth, yield and protein content significantly. Wider spacing of 100x60 cm had taller plants, more sympodial branches and dry matter accumulation/plant but the seed cotton yield was significantly lower as compared to 67.5x60 and 100x45 cm. Fiber quality in terms of fibre strength increased significantly at wider spacing over closer spacings. Protein and oil content in seed were increased significantly in 100x60 over 67.5x60 cm spacing. Among the three genotypes JKCH1050 *Bt* hybrid performed better in plant height and dry matter but the yield was statistically *at par* in all the three hybrids.

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*J. Cotton Res. Dev.* **25** (2) 240-242 (July, 2011)

## **Effect of different irrigation schedules on yield and water use efficiency of American cotton (*Gossypium hirsutum L.*)**

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**ABSTRACT :** A field experiment was conducted at Punjab Agricultural University, Ludhiana during *kharif*, 2004. The treatments comprised of four irrigation schedules (irrigation application at 75, 95, 115 and 135 mm of cumulative pan evaporation) and four dates of irrigation termination (10, 20, 30, September and 10, October). Maximum seed cotton yield was recorded at 95 mm (16.23 q/ha) followed by 75 mm (16.22 q/ha) CPE and these two irrigation regimes were being *at par* with one another, were significantly superior to 115 mm (13.98 q/ha) and 135 mm (12.66 q/ha) CPE. Termination of last irrigation on October, 10 produced highest seed cotton yield (15.64 q/ha) as compared to other treatments. The water use efficiency for seed cotton was maximum under 135 mm (29.42 kg/ha/cm) CPE. The highest water use efficiency was obtained when last irrigation was terminated at September, 10 (29.76 kg/ha/cm).

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## **Validation of eco friendly integrated pest management (IPM) packages in *Bt* cotton at farmer's participatory field**

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**ABSTRACT:** Integrated Pest Management (IPM) module developed for transgenic cotton was compared with Recommended Package of Practices (RPP) on *Bt* cotton (RCH 134) during 2008 and 2009 at farmer's field in Sirsa, district of Haryana. The incidence of leafhopper, (*Amrasca biguttula biguttula* Ishida), Thrip (*Thrip tabaci* Lindeman) as well as mealybug (*Phenacoccus solenopsis* Tinsley) was significantly low in IPM as compared to RPP, except of whitefly (*Bemisia tabaci*, Gennadius). The predator's population was more in IPM modules than RPP. The populations of spider (0.33 and 0.28/plant), lady bird beetle (*Coccinella septumpunctata*, Linnaeus 0.18 and 0.12 /plant) and lacewing (*Chrysoperla carnea*, Stephens 0.29 and 0.23 /plant) in IPM and RPP, respectively were recorded frequently throughout the season. The damaged fruiting bodies, rosette flower, loculi damage, green boll damage were higher in RPP than IPM. On contrary, the number of good opened boll was more in IPM and bad opened bolls were more in RPP. Seed cotton yield was more in IPM (11.90 q/ha) as compared to RPP (11.47 q/ha) with Cost: Benefit ratio of 1:4.29 and 1:3.75 in IPM and RPP, respectively. The better performance of *Bt* cotton was recorded in both IPM modules and RPP but reduced insecticides usage to the 38 per cent in IPM (4.0 sprays in IPM and 6.5 in RPP).

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## **Synchrony in *Helicoverpa armigera* (Hub) adult emergence from *Bt* cotton in comparison with non *Bt* cotton and other alternate host crops**

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**Abstract :** Influence of different host plants were evaluated in comparison with *Bt* and non *Bt* cotton for the emergence of *H armigera* moths under caged conditions at Main Agricultural Research Station, Raichur. The study revealed that in terms of per cent moth emergence, it was also very low in *Bt* cotton (6.60) while in non *Bt* cotton it was 42.80 per cent. Maximum per cent of moth emergence was noticed in redgram (96.5%) followed by bengalgram (80.2%) and sunflower (57%). The pooled data indicated that, *Bt* cotton recorded minimum per cent moth emergence (6.20%) when compared to non *Bt* cotton. Among the other host crops, red gram recorded maximum moth emergence (91.90%) followed by bengal gram and sunflower which recorded

80.20 and 57.60 per cent, respectively during early season. Similarly in late season also *Bt* cotton recorded minimum per cent moth emergence (8.80 %) while in non *Bt* cotton it was 49.40 per cent. Per cent moth emergence was high in red gram (81.40%) followed by bengal gram and sunflower which recorded 76.60 and 53.80 per cent moth emergence

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## **Effect of transgenic *Bt* cotton mature leaves on consumption utilization indices of *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fabricius) larvae**

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**ABSTRACT** : Studies on the effect of transgenic *Bt* cotton leaves on consumption utilization indices of *Helicoverpa armigera* and *Spodoptera litura* larvae were carried out in the laboratory, Department of Entomology, CCS Haryana Agricultural University Hisar during 2006. Eleven genotypes including five *Bt* (Ankur 2534 *Bt*, Ankur 651 *Bt*, RCH 134 *Bt*, RCH 317 *Bt* and MRC 6304 *Bt*) and their corresponding non *Bt* hybrids with one local hybrid HHH 223 were selected for the study and were grown by adopting recommended package of practices. Fourth instar larvae of *H. armigera* were used to study various consumption-utilization indices on leaves at an interval of 70, 100 and 130 days of crop age. There was significant reduction in consumption index (CI), growth rate (GR), efficiency of conversion of ingested food (ECI), approximate digestibility or assimilation efficiency (AD/AE) and efficiency of conversion of digested food (ECD) among *Bt* genotypes at 70 and 100 days of crop age. At 130 days of crop age, no significant effect of *Bt* was observed on *H. armigera* larvae. On the other hand, there were no significant differences in CI, GR, ECI, AD/AE and ECD of larvae of *S. litura* in *Bt* and non *Bt* genotypes at 75, 105 and 135 days of crop age.

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## **Pest status and cry protein content in transgenic cotton**

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**ABSTRACT:** Studies on insect pest status and cry protein expression levels of transgenic cotton hybrids were undertaken at Raichur, during 2008-2009. The experiment consisted of two second generation *Bt* cotton hybrids (NCS 145*Bt*, MRC7918*Bt*) with Cry 1Ac + Cry 2Ab gene and two first generation *Bt* cotton hybrids (NCS 145 *Bt*, MRC6918 *Bt*) with Cry 1Ac gene. The experiment was laid out in compact block design. *Bt* cotton genotypes under protected condition responded similarly for sucking pests with no differential susceptibility and there was no variation in the egg of the population of *Helicoverpa armigera* (Hubner) among the different genotypes. With respect to larval incidence and damage due to *H. armigera*, *Earias vittella* (Fabricius), *Spodoptera litura* (Fabricius) and *Pectinophora gossypiella* (Saunders) all the BG (Bollgard) II *Bt* cotton genotypes performed better over BG genotypes under unprotected conditions. Cry protein levels were high in leaves followed by squares and boll rind at early stages of crop growth (100 DAS) which went on decreasing and reached minimum at 160 DAS. The second generation *Bt* cotton genotypes recorded higher content of cry protein in all plant parts as compared to corresponding first generation *Bt* cotton genotypes both in interspecific and intraspecific *Bt* genotypes. There was no significant difference with respect to natural enemies, grub and adults of coccinellids; *Chrysoperla carnea* (Stephens); spiders and anthocorids among different *Bt* cotton genotypes.

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## **Impact of adoption of insecticide resistance management strategies in irrigated *Bt* cotton in Punjab**

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**ABSTRACT :** Insecticide Resistance Management (IRM) strategies module developed by Punjab Agricultural University, Ludhiana for *Bt* cotton pest management was implemented and evaluated in 225 cotton growing villages of Punjab during 2008-2009 and 2009-2010. Six cotton growing districts *i.e.* Mansa, Muktsar, Ferozepur, Bathinda, Faridkot and Barnala were covered under this programme. Non IRM villages were also selected for ascertaining the impact of adopted strategies. The impact of adoption of IRM strategies resulted in reduction in insecticidal sprays (32.36 and 33.62 %) in IRM villages over non IRM villages during 2008 and 2009, respectively. The population of sucking pests like jassid (leaf hoppers) / 3 leaves (0.46, 0.68 in IRM and 0.80, 1.83 in non IRM), whitefly / 3 leaves (0.44, 0.83 in IRM and 0.86, 2.24 in non IRM) and mealybug / 2.5 cm of central shoot (0.56, 0.13 in IRM and 1.10, 0.44 in non IRM) differed significantly between IRM and non IRM villages in 2008 and 2009. The population of natural enemies/plant was significantly more in IRM (0.83 and 0.38) as compared to non IRM villages (0.40 and 0.19). Seed cotton yield was higher where IRM strategies were adopted (2423 and 2586 kg/ha) as compared to non IRM villages (2096 and 2043 kg/ha) during 2008 and 2009. The average net profit / ha was more in IRM villages (Rs. 46491 and 55026 ha) as compared to non IRM villages (Rs. 35660 and 37236/ha) during 2008 and 2009, respectively. The additional profit of IRM villages over non IPM villages was Rs. 10831 and 17790 / ha.

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## **Monitoring of insecticide resistance in American bollworm (*Helicoverpa armigera*, Hubner) in cotton belts of Haryana**

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**ABSTRACT:** Studies were conducted to findout the level of insecticide resistance against *Helicoverpa armigera* to insecticides belong to five major classes *viz.*, organochlorines (endosulfan), organophosphates (quinalphos), carbamates (methomyl), synthetic pyrethroids (cypermethrin) and naturalytes (spinosad) at Central Institute for Cotton Research, Regional Station, Sirsa during 2005-2007. The study was revealed that field population of various locations of five districts *viz.*, Sirsa, Hisar, Fatehabad, Jind and Bhiwani of Haryana state developed 1.080- to 130.978- folds mean resistance against different insecticides. However, the population of Hisar was found highly resistant to cypermethrin (126.495 folds) and methomyl (18.345 folds). The highest mean resistance against cypermethrin (130.978- folds) was observed in Fatehabad population. The populations collected from Jind and Bhiwani areas were found comparatively susceptible to all the insecticides except cypermethrin, where resistance index was 32.33 and 26.916, respectively. Comparative resistance of *H. armigera* to endosulfan, quinolphos and spinosad was 2.290, 2.40 and 1.08 folds, respectively. However, population of Hisar and Sirsa were found comparatively more resistant to cypermethrin. Bhiwani population showed low level of resistance (1.080- to 26.916- folds) to all the insecticides under test except cypermethrin.

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## **Occurrence and prediction of cotton leaf curl virus disease in northern zone**

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**ABSTRACT:** Cotton leaf curl virus disease (CLCuD), caused by single stranded circular begomovirus and transmitted through whitefly (*Bemisia tabaci*) is an important disease in north Indian states. Disease incidence, its progress, whitefly population and weather parameters were recorded from 27<sup>th</sup> to 37<sup>th</sup> meteorological weeks for eleven years (1999 - 2009) under screening nursery and simple correlations and multiple regression analysis were worked out to find out the influence of weather factors on whitefly population and progress of the disease. During 37<sup>th</sup> week, maximum disease incidence (98.0%) was observed during 2001 followed by 2000 (95.4%) and 2006 (93.8%) where as it was minimum during 2008 (2.7%) followed by 2004 (18.5%) and 2007 (35.4%). Minimum whitefly population of 0.1/3 leaves was noted in 27<sup>th</sup> week during 2002, 2004, 2005, 2007 and 2008 and maximum of 2.3 was observed in 37<sup>th</sup> week during 2009. Multiple regression analysis was worked out to identify the factors helpful in progress of disease during 27 to 31, 32 to 37 and 27 to 37 weeks. Best fitted multiple regression equation of 27<sup>th</sup> to 31<sup>st</sup> standard week was:  $Y_{10} = 199.50 - 6.26X_{120} - 3.33X_{121} + 0.68X_{133} + 0.55X_{140} + 0.40X_{144} - 4.33X_{153} + 0.43X_{161} + 0.44X_{162}$  with  $R^2 = 0.82$ . It was observed that minimum temperature and sunshine hours have significant negative correlation whereas morning relative humidity and rainfall have positive correlations with incidence and progress of the disease and this regression equation will be helpful in understanding the factors affecting disease development and its prediction.

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## **Morphological characters and virulence studies of *Sclerotium rolfsii* Sacc. on *Bt* and non *Bt* cotton genotypes**

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**ABSTRACT :** Growth rate of *Sclerotium rolfsii* isolates varied significantly at 6 DAI and isolates of U.A.S Dharwad 2 and Lokur were fast growing i.e. @ 8.85 cm of both the isolates. Sclerotia production, size and colour also varied significantly. Garag isolate produced maximum sclerotia (174) followed by Lokur isolate (135). Relatively bigger sized sclerotia (2.0-2.5 mm dia.) were produced by UAS, Dharwad 1 and 2, Chandanamatti 2, Kallur, Mallapur and Tadakod isolates. The colour of the sclerotia did not showed significant variation. It was mostly dark brown at maturity with an exception of Amminabhavi isolate, being reddish brown even after maturity. Among the seventeen isolates tested, Lokur isolate showed least mean per cent germination of seedlings (13.33%) followed by Tadakod isolate (16.67%). Marewad and Lokur isolates had mean death of seedlings (89.17%) followed by Tadakod isolate (87.50%).

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## **Bio evaluation of *Bt* cotton hybrids against bollworm complex under rainfed conditions**

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**ABSTRACT :** Ninety seven *Bt* cotton hybrids were evaluated alongwith two *Bt* and three non *Bt* check hybrids against bollworms under unprotected conditions at Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *khariif*, 2008-2009. The results revealed that, all the *Bt* cotton hybrids evaluated were significantly superior to non *Bt* checks ( i.e. NHH 44, PKV Hy 2 and PKV Rajat ) in checking the bollworm damage at harvest. Open boll damage, loculi damage due to bollworm complex and loculi damage due to pink bollworm in *Bt* hybrids was in the range of 0.00 to 6.67, 0.00 to 5.38 and 0.00 to 2.31 per cent, whereas, in non *Bt* hybrids, it was in the range of 36.67 to 60.00, 13.56 to 34.11 and 8.20 to 16.46 per cent, respectively.

Amongst BG I and BG II hybrids of the same genotype tested, all the BG I hybrids, except, Encounter *Bt*, showed at par efficacy with BG II, as regards to bollworm complex damage at harvest. Highest seed cotton yield (1750 kg/ha) was obtained in TCHH 9 *Bt*, being at par with MRC 7347 BG II, MRC 6301 *Bt*, TCHH 4 *Bt*, SP 503 *Bt*, MRC 7351 BG II, MRC 7301 BG II and NECH 14 *Bt*.

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## **Field evaluation of cotton genotypes against bacterial blight caused by *Xanthomonas axonopodis* pv. *malvacearum***

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**ABSTRACT :** One hundred and eighty two genotypes of cotton were evaluated against bacterial blight under field inoculated conditions (artificial screening) at Regional Agricultural Research Station, Guntur during 2007-2008 to 2009-2010. Twenty one genotypes viz., NDL 762, TCH 1716, RS 2527, P 1752, HAG 1015, CNDTS 55, RAH 61, ARBHH 51, RAHH 255, INDAM 1020, NSPL 423, TCHH-2, HHH 455, LMSH 263, HAGHH 2064, JKCH 2516, PHH 177, ARBH 2040, RAHH 138, MRC 7361 and DHH 852 were recorded resistant and 70 showed moderately resistant reactions. These resistant genotypes can be used in breeding programmes.

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## **Evaluation of genotypes against bacterial blight of cotton (*Gossypium hirsutum* L.)**

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**ABSTRACT:** Two hundred and thirty two cotton cultures/varieties were evaluated against bacterial blight of cotton caused by *Xanthomonas axonopodis* pv. *malvacearum* (*xam*) under artificially inoculated condition at Cotton Research Station, Srivilliputtur during winter, 2009. Only variety SVPR 3 expressed resistance reaction and seven entries recorded moderate resistance reaction and the remaining entries were either susceptible or highly susceptible to bacterial blight.

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## **Total factor productivity and input utilization in cotton production in Maharashtra**

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**Abstract :** An analysis was carried out to study the input utilization and factor productivity of inputs used in the production of cotton. Productivity of individual input as well as total factor productivity was estimated to know the sustainability of cotton production. The Tornqvist-Theil indexing procedure was used to work out total factor productivity indices. Human, machine labour and fertilizers showed a positive growth while animal labour, manures, seeds and plant protection chemicals showed a negative growth during the period of analysis.

Productivity of land, human labour, animal labour, manures and seed showed a positive growth while productivity growth of machine labour was negative. The growth of total factor productivity was positive and significant indicating the sustainability of cotton production in the state. In significant growth of total input index indicates that there are serious bottlenecks in input usage which needs to be corrected to achieve higher output growth.

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*J. Cotton Res. Dev.* **25** (2) 296-297 (July, 2011)

## **Extent of adoption of production technologies in *Bt* cotton by growers in Kovilpatti block of Tamil Nadu**

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**ABSTRACT :** The study was conducted at Kovilpatti block of Tuticorin district of Tamil Nadu with the specific objective of studying extent of adoption of production technologies in *Bt* cotton by the growers. The area was selected based on the major cultivation of *Bt* areas and production of *Bt* cotton under irrigated condition. The selected respondents for this study were 90, who have adopted *Bt* cotton and non *Bt* cotton i.e 45 growers in each category by using simple random sampling method. The collected data were analyzed using percentage analysis. All the growers adopted *Bt* varieties and 95.55 per cent of the growers adopted appropriate time of planting. About 80.00 per cent of the growers adopted spacing. Three fourths (77.77 %) of the growers adopted regular plucking intervals during harvest and 75.55 per cent of the growers adopted proper irrigation management followed by pest and diseases management (73.33%). More than fifty (66.66%) of the growers adopted preparation of fields to required tilth and formation of trenches followed by manures and fertilizers (62.22%) and number of split doses (57.77%). Out of ten technologies nine technologies were adopted more than fifty per cent by the growers due to the reasons that private firms have agreed to buy the produce from the farmers offering a minimum support prices. State Department of Agriculture has also introduced contract farming to assure remunerative prices to farmers.

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*J. Cotton Res. Dev.* **25** (2) 298-301 (July, 2011)

## **Cotton Blends - An avenue for entrepreneurship**

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**Abstract :** The study has been aimed to produce low cost products, which could be taken up to promote cottage industry. Blended fabrics are knitted to obtain the better quality and low priced fabrics. The work was planned to select and blend the best spinnable cotton variety for weft knitted blended fabric. Six cotton varieties HS 6, H 1117, H 1098, HHH 81, HHH 223 and H 974 were taken for the study. The fibre properties (fineness, mean fibre length, bundle strength, maturity coefficient and uniformity ratio) of all the cotton varieties were analyzed to select one of the best spinnable variety. After testing all the properties it was found that none of the varieties was superior in all the parameters. So, to select one best variety among all these, fibre quality index (FQI) was calculated and it was observed that FQI was maximum i.e., 47.23 for the H 1098. Hence, on the basis of FQI, variety H 1098 was selected as the best variety that was used for further work. Moreover, this variety had maximum mean fibre length, bundle strength and maturity coefficient value. Based on the preference of respondents and experts polyester fibre was selected for blending with cotton and spinning on open end (OE) mechanism. The cost of 50:50, polyester/cotton (p/c) blended yarn as well as fabric was lesser as compared to 100 per cent cotton. The identified blend can be taken up for establishing an enterprise for supplementing the family income. Being the producer of cotton, the rural masses can take up or adopt knitting as an income generating source, to set up a small scale enterprise.

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