

ABRIDGED ANNUAL REPORT CRI, MULTAN 2016-17



Dr. Saghir Ahmad
Director Cotton

COTTON RESEARCH INSTITUTE MULTAN

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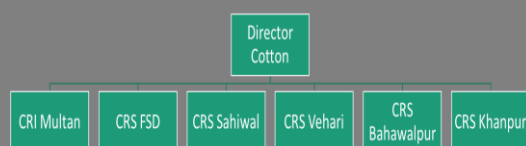
Email: dircrimn@gmail.com

PH:061-9200337

FAX:061-9200339

INTRODUCTION

Cotton Research Station Multan was established as a sub-station for testing the performance of varieties in relatively hotter Southern zone, during 1935, Cotton Research Sub-Station, Multan was upgraded in 1958 and in addition to testing of varieties developed at Lyallpur (Faisalabad), the task of developing varieties was also entrusted to this center. Further strengthening gave birth to several Cotton Research Stations in Punjab, as outlined below: -



Cotton Research Station Multan was upgraded into Cotton Research Institute Multan in 2016 and the office of Director Cotton was shifted from Faisalabad to Multan.

Overview

Cotton Research Institute is the leading Institute engaged in developing cotton varieties in Punjab. This Institute is working on combating various upcoming biotic and abiotic

threats. Cotton crop is one of the most difficult crops in terms of management point of view. During the past many years, CLCuV is the most devastating biotic factor in Pakistan that results in severe losses in production. Along with this threatening viral disease, Pink bollworm is also the second most disturbing factor during its reproductive phase. Dusky and red cotton bugs are also becoming major pests of cotton. Heat and drought are major abiotic stresses that badly affect the cotton plant growth and fruiting. Keeping in view all these factors, Cotton Research Institute is working on all these aspects i.e., yield improvement, disease resistance, insect pest resistance, drought tolerance, heat tolerance and better fiber quality. The material is being developed by employing various conventional and non-conventional techniques. Most common methods for the development of varieties being used are mass selection, pedigree selection, backcross breeding, introgression (for disease resistance), interspecific hybridization and heterosis breeding. Various agronomic trials are also being conducted to devise new production technology of the developed varieties. Similarly, trials on entomological aspect are also being carried out. Annual Abridged Report 2016-17 contains several exciting features. Three Bt. Varieties viz RH-647, VH-327 and FH-326 of Cotton Research Institute Multan were approved by

Punjab Seed Council for general cultivation. On Punjab basis, CRI line FH-152 (Fig.I) got 4th position in NCVT Set-D, FH-326 (Fig.II) in Bt. cotton NCVT (Set-B) got 9th position. RH-668 (2397kg/ha) got 3rd position in PCCT-2016-17, FH-444 (2387kg/ha) at 4th position, FH-152 (2316kg/ha) at 7th position and MNH-992 (Fig.III) got 8th position with the yield of 2295kg/ha. These are highly CLCuV resistant lines with good fiber traits. Several Bt. lines containing Cry1Ac gene remained under various stages of testing with impressive results. The results contained in the report will provide short to long term basis for the development of cotton varieties having inbuilt attributes useful to cotton stakeholders. Cotton Research Institute has developed / released 57 cotton varieties since its inception including MNH-886, FH-142 and FH-Lalazar covering most of cotton area in Punjab.



Fig.II FH-152



Fig. III MNH-992



Fig. I FH-326

The Annual Abridged Report 2016-17 contains different research benchmarks achieved during the year under report.

A. BREEDING/VARIETAL EVALUATION

1. Maintenance, Enrichment of Germplasm, hybridization and Study of Filial Generations

A total of 1428 local and exotic accessions were studied at CRI and its allied stations during the year 2016-17. Crossing of the promising lines for various purposes like yield, quality, disease resistance (esp. CLCuV), insect resistance, drought and heat tolerance was carried out to develop better varieties. After crossing the material was advanced by adapting various selection procedures. Generation advancement was carried out in greenhouse to cut short variety development period. Filial generations are developed at all stations inclusive of Cotton Research Institute, Multan. Various crosses and progenies (F₁ to F₆) were evaluated and desired lines were selected at all stations. No. of crosses studied for genetic potential at CRI, Multan and its allied stations were 345. Total No. of progenies studied for genetic potential at CRI, Multan and its 5 allied stations were 3009.

2. Preliminary Yield Trials

22 Preliminary Yield Trials were conducted for yield tests and fiber quality traits of the superior lines that have gone through the process of selection following pedigree method. These lines were selected from F₆ generation keeping in view several features like yield, disease resistance, insect resistance and fiber quality. The process of preliminary yield trials is the necessary feature of any breeding programme. These trials were conducted at all stations including Cotton Research Institute, Multan. A number of lines developed by the stations were tested in their respective locations in Preliminary Yield Trials during 2016 and lines performing better over check varieties were selected. These lines include 6004/15 (FH-152) (3802kg/ha) and FH-453 (4148kg/ha) from CRS, Faisalabad, CRS-112(1576kg/ha) &

CRS-104 (1543 Kg/ha) from CRS, Multan; lines RH-661 (3518kg/ha) & 14/11 (3495kg/ha) from CRI, Rahim Yar Khan; lines BH-499 (1934kg/ha) & BH-310 (1878kg/ha) from CRS, Bahawalpur; and SLH-30 (1681kg/ha) from CRS, Sahiwal and VH-375 (1797 kg/ha) from CRS Vehari respectively gave higher yield than check varieties. These top yielding lines will be evaluated in advanced yield trials during the coming year.

3. Advance Yield Trials

The testing of the varieties in Advance Yield Trials was conducted at all stations during 2016-17 to check the performance of selected lines from preliminary yield trials. A number of promising lines, included in these trials, were tested to check their performance under different ecological zones. The results of Advance Yield Trials depicted superiority of several lines over check. The lines viz FH-416 (2190kg/ha) & FH-419 (2540kg/ha) from CRS, Faisalabad; CRSM-23 (1754kg/ha) & CRSM-3 (1543 kg/ha) from CRS, Multan; BH-188 (2141kg/ha) & BH-186 (2057kg/ha) from CRS, Bahawalpur; SLH-6 (1614 kg/ha) from CRS, Sahiwal, 14/11 (3495 kg/ha) & 14/12 (2785 kg/ha) from CRI, Rahim Yar Khan and VH-327 (1623kg/ha) & VH-355 (1119kg/ha) from CRS, Vehari performed better against standard varieties and these best performing strains will be included in Provincial and National Trials.

4. Provincial Coordinated Cotton Trial (PCCT)

The Provincial Coordinated Cotton Trial was conducted at different locations of the province comprising several genotypes of various research centers and private seed companies of Punjab. This trial was conducted at 17 locations of Punjab in three sets i.e. PCCT-I

(Bt.) & PCCT-II (Non-Bt.) and PCCT-III (Bt) to check the adaptability. PCCT-I consisted 33 Bt. varieties whereas PCCT-II(Non-Bt) consisted 4 Varieties and PCCT-III(Bt.) consisted of 3 varieties. The performance of new Bt. varieties in Provincial Coordinated Cotton Trial were compared with the check varieties FH-142 & MNH-786. Among new varieties that were developed by Cotton Research Institute and its stations included in PCCT were RH-668, FH-444, FH-152, FH-Kehkashan (CRS Faisalabad), MNH-992, MNH-1016 (Multan), RH-668 & RH-662 (R.Y. Khan), VH-Gulzar & VH-363 (Vehari), BH-201 (Bahawalpur) and SLH-12 (Sahiwal). RH-668 and FH-444 ranked 3rd and 4th positions respectively and out yielded the check variety FH-142. These varieties showed high degree of CLCuV tolerance. Fiber quality traits of these varieties were also better than standard. The results of higher yielding than standards varieties in PCCT-I(Bt.) are shown in Fig. IV:

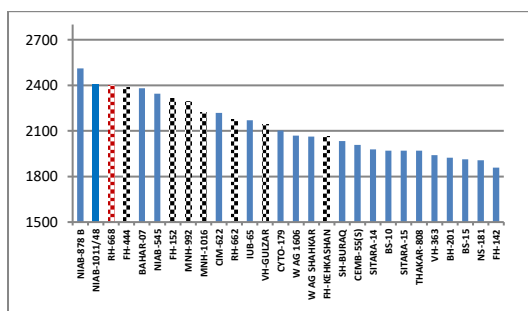


Fig.I PCCT-1 (Bt.)

5. National Coordinated Bt. Varietal Trial (NCVT)

National Coordinated Varietal Trials were conducted across Pakistan by PCCC, Multan. This trial comprised of 75 elite lines developed by various institutions working on cotton possessing good potential with respect to yield, disease and fiber quality traits. In the year 2016-17, this trial was conducted at different

locations to check the adaptability of the genotypes with respect to yield and other related traits. On the average of all locations, CRI variety FH-152 gained 3rd position in NCVT (Set-B) with seed cotton yield of 2688 kg/ha. This variety also showed high degree of CLCuV and heat tolerance, therefore, this may constitute part of future genetic shield. The results of better performing varieties than standards in NCVT are shown in Fig.V:

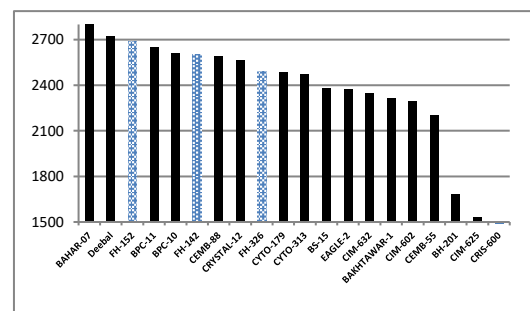


Fig.V NCVT (Set-B)

B. AGRONOMIC STUDIES

1. Varietal Behaviour on Different Sowing Dates.

After various testing procedures, estimation of appropriate sowing time for most promising genotypes is necessary. This trial was conducted at CRI Multan and all its attached stations. At CRS Faisalabad (FH-Noor, FH-490 & FH-Kehkashan), CRI Multan (MNH-992 & MNH-988), CRS Bahawalpur (BH-185 & BH-199), CRS Sahiwal (SLH-6, SLH-12 & SLH-18), CRS Vehari (VH-363) and CRI R. Y. Khan (RH-651 & RH-647) were evaluated from 15th Feb with 15 days interval for yield potential.

All the varieties showed different behavior on all locations at different sowing dates. At CRS Faisalabad, 15th March sowing remained top yielding (5058kg/ha) while at CRI Multan 15th Feb. proved the best by giving 4045 kg/ha. At CRS Bahawalpur & CRS Sahiwal maximum

yield (1630 & 1294 kg/ha) was produced by sowing on 1st April whereas at CRS Vehari maximum seed cotton (2126kg/ha) was obtained by sowing on 1st Mar. and at CRI Rahim Yar Khan maximum seed cotton yield was 2023kg/ha on 15th April.

2. Effect of Plant Spacing on Seed Cotton Yield

To achieve the maximum yield potential of a variety it is necessary to optimize the plant to plant distance. Plant Spacing trials were conducted at Faisalabad, Multan, Vehari, Rahim Yar Khan, Bahawalpur and Sahiwal stations. At Faisalabad (15cm plant spacing gave maximum yield 3848kg/ha) Bahawalpur, Sahiwal and R.Y.Khan; 30 cm plant spacing gave maximum yield (1542, 874 & 2512 kg/ha) whereas at Vehari 60 cm plant spacing gave maximum yield (1614 kg/ha).

3. Influence of Growth Regulator Application on CLCuD Infestation, Boob Retention (%) and Seed Cotton Yield.

The trial was conducted to evaluate yield performance of various growth regulator treatment with various fertilizer application. The experiment replicated thrice and was laid out according to split plot design the growth regulator were randomized as main plot and fertilizer as sub plot. FH-Noor was used as experimental material. The data showed that growth regulator, fertilizer doses and their interaction significantly affected the seed cotton yield. Irrespective fertilizer treatments Naphthalene acetic acid by yielding 4078kg/ha average seed cotton yield surpassed from both treatments. Irrespective of growth regulator 100-50-50 fertilizer treatment proved superior

by giving 4008kg/ha seed cotton from both fertilizer treatment but in occurrence of interaction. The best interaction was observed in between the 100-50-50 fertilizer treatment and naphthalene acetic acid 4359kg/ha seed cotton yield.

4. Irrigation and Nutrient Management Trial on Cotton

The objective of this trial was to evaluate of yield performance of various irrigation treatments with various fertilizer treatments. FH-lalazar was used as experimental material. Data showed that irrigation levels, fertilizer doses and their interaction significantly affected the see cotton yield. Irrespective of fertilizer treatment irrigation treatment in which irrigation was missed after 75 DAS by yielding 3812kg/ha average seed cotton yield, surpassed other both treatments. Irrespective of irrigation levels 100-100-100 kg/ha NPK fertilizer treatment proved superior by giving 3339 kg/ha seed cotton from all other fertilizer treatments but in case of interaction the best interaction was observed in between the 100-100-100 NPK fertilizer treatment and missed irrigation application after 75 days of sowing by yielding 4056kg/ha seed cotton yield.

5. Effect of Picking Time on Germination

The objective of this experiment was to determine the effect of picking time and storage period on germination %age of cotton seed. Three varieties were sown and their four pickings were done with one month interval each.

Results revealed that maximum germination %age i.e. 42 % was obtained by MNH-886 when picking was done on 1st November 2016; however minimum

germination of 32 % was obtained by MNH-988 & MNH-992 when picking was done on 1st August 2016. Storage period also affected germination of cotton. Maximum germination of 63 % was obtained by MNH-992 when seed cotton was stored at room temperature for 120 days then ginned and germination was tested. However minimum germination of 38 % was obtained by MNH-886 when seed cotton was stored at room temperature for 212 days then ginned and germination was tested.

C. ENTOMOLOGICAL STUDIES

1. Relative Resistance Test Against Bollworm & Sucking Pests Attack

Sucking insect pest population and pink bollworm infestation was recorded among 10 cotton strains at CRS Faisalabad. Among bollworm only *helicoverpa* population appeared which remained non-significant through out the year on all cotton strains. Thrips population was at highest peak on FH-lalazar (9.0/leaf) followed by FH-444 and FH-312 (8.2/leaf) while lowest population observed at FH-142 (6.3/leaf). Whitefly remained highest on FH-312 (7.2/leaf) and lowest on FH-444 (1.5/leaf) followed by FH-142 (2.6/leaf). Maximum jassid population observed on FH-312 (1.8/leaf) whereas population remained lowest on FH-444 and FH-326 (0.5/leaf).

2. EFFICACY OF DIFFERENT INSECTICIDES FOR STANDARDIZATION AGAINST INSECT PESTS OF COTTON

Some new chemistry insecticides from different companies were tested against whitefly, thrips and jassid. Population of pests before and after treatment application was recorded to determine the efficacy of insecticides on the basis of percentage mortality.

Jassid:

After 72hours of spray pesticides comprising of Pirox Super50% WDG, Pyramid10% SL, Foxal50% WDG, Pirate36% SC, Coniflex50% WP, Confidor20% SL exhibited more than 80.0 percent mortality of jassid. However at 7days after spray, only Pirox Super50% WDG, Foxal50% WDG, Pirate36% SC, Coniflex50% WP, Confidor20% SL demonstrated more than 80.0% mortality.

Whitefly:

In case of whitefly only lenolax30% WDG and priority10.8% EC exhibited mortality upto 80% as compared with other pesticides.

Thrips:

In case of thrips pesticides comprising of Vapco40% WDG, Foxal50% WDG, Pirate36% SC, Deltamax36% EC, Coniflex 50% W.P and Confidor20% SL exhibited mortality upto 80% as compared with control.

3. Population Dynamics of Red Cotton Bug and Dusky Cotton Bug on Cotton Crop.

This experiment was conducted at CRI Multan. The data regarding infestation of red cotton bug revealed that the pest population was negatively

correlated with temperature on all the varieties of cotton whereas the population of red cotton bug was positively correlated with humidity and rainfall on all genotypes of cotton.

The data regarding infestation of dusky cotton bug revealed that the pest population was negatively correlated with temperature on all the varieties of cotton. While, the population of dusky cotton bug was positively correlated with humidity and rainfall on all genotypes of cotton.

4. DETERMINATION OF BOLL WORM INFESTATION ON BT GENOTYPES OF COTTON

The experiment was conducted at CRI Multan. The data revealed that the maximum infestation of American boll worm was observed on cotton genotype MNH-988 (3.36%) and minimum American boll worm infestation was observed on cotton genotype MNH-886 (2.53%). The infestation of spotted boll worm was found maximum on cotton genotype FH-Lalazar (5.82%) and minimum infestation was observed on cotton genotype MNH-992 (4.62%). On the other hand, infestation of pink boll worm was found maximum on cotton genotype MNH-988 (33.07%) and minimum infestation was observed on cotton genotype MNH-992 (30.31%).

D. PROJECTS

1. Development of CLCuV Resistant Germplasm for Punjab by Using Traditional Breeding Approaches

A project was started with the collaboration of Pakistan, USDA and ICARDA during 2011. CRS Faisalabad, CRI Multan and CRS Vehari were the components of this project.

68 accessions received from USDA were screened for CLCuD at CRS Faisalabad during 2016-17. Out of 68 accessions, two accession showed tolerance to CLCuD, 29 accessions showed susceptible and 35 accessions remained high susceptible to CLCuV at 120 DAS. At CRS Vehari 183 USDA accession were studied during 2016-17. Out of 183 *Hirsutum* accessions⁷ showed resistance, 11 highly tolerant, 19 susceptible and 146 were highly susceptible against CLCuV, 23 F₂ and 11 F₃ progenies were sown in field. All progenies showed highly tolerant behavior against CLCuV even at maturity. 151 accessions of USDA were screened at CRI Multan. Out of these lines, 4 showed highly tolerance one susceptible and 146 highly susceptible behavior. 22 introgressed families were tested against CLCuV. 3 families showed highly tolerant, 6 tolerant, 12 susceptible and highly susceptible at CRI Multan.

2. Genetic Improvement of Cotton for Herbicide and Bollworms Tolerance.

This project was approved by PARB and is being running in collaboration with Centre of Excellence in Molecular Biology (CEMB), Lahore and CRS Vehari. Transgenic cotton tolerant to bollworms and glyphosate herbicide through incorporation of CEMB Bt (Cry1AC & Cry2A) and Gt gene in VH-281, VH-289, VH-290 and MNH-786 will be developed. Seed of above varieties have been supplied to CEMB for transformation. Field evaluation of these transgenic varieties containing CEMB Bt and Bt gene was done at Cotton Research Station, Vehari during coming year. CEMB supplied seed of

transformed version of VH-281, VH-289, VH-290 and MNH-786 varieties to CRS Vehari for Evaluation against Glyphosate tolerance in coded form.

E. DESI COTTON

The desi cotton *Gossypium arboreum* is currently grown for domestic use. It is less attractive for industry than *hirsutum* types because of short fibers. Desi cotton is also going through the phases of germplasm collection (175 accession), its maintenance, study of filial generations, preliminary and advanced testing with specific breeding objectives like high yield, big boll size, disease resistance and insect resistance along with improvement in GOT, fiber length, strength and fineness.

1. Crosses and Filial Generation Studies

A total of 9 crosses were harvested to produce variability and to develop improved genotypes possessing higher yield, GOT%, disease and insect pest resistance, as well as short & coarse fiber from intra specific crosses.

165 progenies were selected on the basis of morphology, yield and fiber traits from F₁ to F₆ generations.

2. Preliminary Yield Trial

In PYT-I trial 11 “desi” cotton lines along with 2 standard varieties FDH-170 and FDH-228 were tested for their yield potential, high ginning outturn, short and coarse fiber quality. FDH-687 was at the top giving maximum yield of 1053kg/ha.

3. Advance Yield Trial

Objective of this study was to test different desi cotton lines for seed cotton yield and other quality traits. A total of 18 genotypes were

tested along with two standard varieties FDH-170 & FDH-228 in two advance yield trials (AYT-1 & 2). In AYT FDH-675 out yielded all the lines and gave 2514 kg/ha seed cotton and in AYT FDH-659 gave 1444kg/ha).

F. Salient Achievements During the Year

1. Scientific Publications	=	06
2. Urdu Articles	=	08
3. Radio/TV Talks	=	12
4. Advisory Services	=	820
5. Seed Production (kg)	=	9880

G. Senior Scientists

Dr. Saghir Ahmad

Director/Cotton Botanist, Multan
Cell No.0303-6660277
E-mail saghirahmad_1@yahoo.com

Dr. Muhammad Tasdiq Hussain Shahid,

Cotton Botanist, Faisalabad
Cell No. 0300-8667659
E-mail cbcrcfsd@gmail.com

Dr. Ghulam Sarwar

Cotton Botanist, Vehari
Cell No. 0300-7939064
E-mail cbcrcsvr@yahoo.com

Mr. Muhammad Yasin

Cotton Botanist, Rahim Yar Khan
Cell No. 0300-6804855
E-mail criryk101p@gmail.com

Mr. Shaukat Ali

Cotton Botanist, Bahawalpur
Cell No. 0334-6538501
E-mail crsbwp@gmail.com

Ch. Irshad Ali,

Cotton Botanist, Sahiwal
Cell No.0302-314926
E-mail crs_sahiwal@yahoo.com

H. METROLOGICAL DATA

