COTTON RESEARCH INSTITUTE, MULTAN 2018-19

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OVERVIEW

Cotton is the backbone of Pakistan's economy. More than half of the export of Pakistan depends on cotton and cotton-based products. Punjab province produced 8.07 million bales in 2017-18, which is below the target of 10 million bales. Punjab province has the potential of 20 million bales. This wide gap is attributed to climate change resulting in water shortage, high temperature, increased pest infestation, and diseases. Major factors for low yield are water shortage, high temperature, whitefly, pink bollworms, cotton leaf curl disease, weeds infestation, and less rainfall. To mitigate the effects of all these factors there is dire need to emphasize on need-based research activities for enhancing cotton productivity of Punjab province.

Under Agriculture Sector Plan, the key goals to be achieved by year 2020 are:

- Raise the growth rate of agriculture sector from existing 1% to 5%.
- Improve service delivery to farmers with 75% farmer's access (100% by 2025) to evidence based and diagnostic driven extension services.
- Improve crop productivity by 25% for cotton (30% by 2025)".

Keeping in view all the above-mentioned goals and issues, Cotton Research Institute has planned his research work to address these issues. The salient features of research work of this institute are: increase in seed cotton yield, good fibre quality, resistance to diseases, insect pest and tolerance to drought and heat. The genetic material is being developed by employing traditional techniques. The most common methods 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 for harvesting maximum yield potential. Similarly, trials on entomological aspect are also being carried out to particularly address issues of whitefly and pink bollworm and efficacy of pesticides.

Annual Abridged Report 2018-19 contains salient features/achievements of Cotton Research Institute Multan and its allied research stations. During the year under report, three Bt. varieties viz., FH-152, RH-662, RH-668, SLH-08, and VH-327 were approved by Punjab Seed Council for general cultivation in Punjab province. Brief detail of these varieties is given as under:

Cotton Variety FH-152

FH-152 is the newly developed cotton variety at Cotton Research Station, Faisalabad. It has been developed through conventionsl breeding technique i.e., hybridization followed by pedigree method of selection.

The salient feature of new developed cotton variety i.e. FH-152 are:

Yield potential	4200-6400 kg/ha
Boll weight (g)	5
Drought tolerant	Moderate
CLCuV tolerance	high
GOT (%)	40.3
Staple length (mm)	28.87
Fibre fineness (µg/inch)	4.2
Fibre strength (tpssi)	91.8.

Fig.1. FH-152

Cotton Variety RH-662 (Bt.)

RH-662 is a Bt-cotton variety, developed at Cotton Research Institute, Khanpur. possessing superior characteristics of high yield potential and harmonious fiber quality traits. It ranked 1st position among 95 promising lines/strains comprising NCVT Trial 2017.

The salient feature of new developed cotton variety i.e. RH-662 are:

Yield potential	4000-5500 kg/ha
Boll weight (g)	4.5
Heat tolerance	High
Drought tolerant	Moderate
CLCuV tolerance	high
Number of bolls/plant	50-60
GOT (%)	39.9
Staple length (mm)	29.07
Fibre fineness (µg/inch)	4.3
Fibre strength (tpssi)	91.8

Fig.2. RH-662

Cotton Variety RH-668 (Bt.)

RH-668 is newly developed Bt-cotton variety developed by Cotton Research Institute, Khanpur.

The salient features of new developed cotton variety i.e. RH-662 (Fig. III) are:

Yield potential	4812 kg/ha
Boll weight (g)	3.7
Heat tolerance	High
Drought tolerant	Moderate
CLCuV tolerance	high
Number of bolls/plant	35-45
GOT (%)	39.4
Staple length (mm)	28.7
Fibre fineness (µg/inch)	4.5
Fibre strength (tpssi)	94.1

Fig.3. RH-668

Cotton Variety SLH-08

SLH-08 has been developed at Cotton Research Station, Sahiwal through hybridization. The variety is bollworm resistant, highly tolerant to heat, CLCV, and lodging. Variety SLH-08 (Fig. IV) has all the characteristics that can fulfill the demands of farmers.

The salient feature of new developed cotton variety i.e. SLH-08 (Fig. IV) are:

Yield potential	4000-5500 kg/ha
Boll weight (g)	4.5
Heat tolerance	High
Lodging tolerant	High
CLCuV tolerance	high
Number of bolls/plant	35-40
GOT(%)	40
Staple length (mm)	28.9
Fibre fineness (µg/inch)	4.8
Fibre strength (tpssi)	93.0

Fig.4. SLH-08

Cotton Variety VH-327

VH-327 is newly developed Bt-cotton variety, developed by Cotton Research Station, Vehari. possessing superior characteristics of high yield potential and improved fiber quality traits. VH-327 (Fig. V) is highly drought tolerant and lodging resistant.

The salient feature of new developed cotton variety i.e. VH-327 (Fig. V) are:

Yield potential	4500 kg/ha
Boll weight (g)	3.4
Lodging tolerance	High
Drought tolerant	High
CLCuV tolerance	high
Number of bolls/plant	80-90
GOT(%)	385
Staple length (mm)	30.5
Fibre fineness (µg/inch)	4.0
Fibre strength (tpssi)	90.0

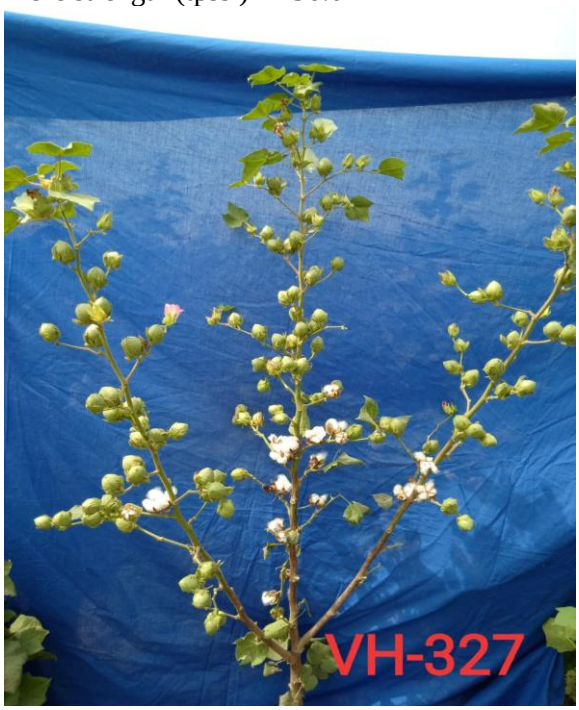

Fig.5. VH-327

BREEDING/VARIETAL EVALUATION

Maintenance, Enrichment of Germplasm, Hybridization and Study of Filial Generations

The first step in breeding phase is to create genetic variability and subsequently reducing or identifying the environmental effects on the phenotype so that true genetic differences among plants and families can be determined or estimated. So germplasm maintenance and enrichment is complementary part of any breeding programme. The objective of germplasm maintenance and enrichment is to broaden genetic base, its utilization in breeding programme and to generate new desired gene recombinations. Thus, a total of 1442 local and exotic accessions were maintained at CRI and its allied stations during the year 2018-19, and characterized for different morphological traits. The lowest CLCuD incidence, in germplasm maintenance trial, was 1% (Table 1). While the boll size and number of bolls plant^{-1} was 6 g and 155, respectively.

Similarly, among fibre traits, the maximum staple length and lint % was 35.2mm, and 47.1%, respectively.

Table 1. Maintenance and Enrichment of Germplasm during 2018-19.

Characteristics	CRI Multan	CRS SWL	CRS BWP	CRS FSD	CRS Khanpur	CRS Vehari
CLCuD Incidence (%)	1-100	15-60	3-60	1.5-95	0-100	10-100
Boll Weight (g)	2.3-5.5	2.5-4.0	1.75-4.5	1.7-5.8	1.5– 4.3	2.0 - 4.1
No. of Bolls/Plant	09 – 50	20-48	10 - 120	8-155	9–71	8-40
Plant Height (cm)	77-205	85-170	80-175	55-255	45 –160	32-190
G.O.T. (%)	37.0-47.1	32-42	33-42.5	35-47.5	33–45	30.7-45.5
Staple Length(mm)	24.1-33.7	28 - 31	25-31	26-32.5	25.2–32.3	25.8-32.0
Fibre Fineness (µg/inch)	3.8-5.8	3.7-5.6	3.4-6.0	3.6-5.3	3.4-5.7	3.8-5.7
Fiber Strength (g/tex)	26.3-45.7	25-37	20- 40	23-36	80-102	25-38

For acquisition of new gene re-combinations to combat (a)biotic stresses, 358 fresh crosses were attempted at CRI and its allied stations during the year 2018-19 for various purposes like yield, quality, disease resistance (esp. CLCuD), 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 comprises of 2443 entries (F_1 to F_6) were sown at all stations inclusive at Cotton Research Institute, Multan, and desired lines were selected at all stations. In filial generations (F_1 to F_6), (Table 2) the range of GOT, and staple length was 36.9-47.0%, and 27.8-34.3mm. Likewise, fibre fineness was 3.7-4.9 µg/inch and CLCuD ranged 3.0-37.5%.

Table 2. Range of CLCuV (%) and fibre quality traits in filial generations (F_1-F_6)

Trial	CLCuV (%)	GOT (%)	Staple Length (mm)	Fiber Fineness (µg/inch)	Fiber Strength (g/tex)
F_1	3.0-22.0	38.0-40.1	27.8-33.9	4.0-4.7	30.0-42.7
F_2	6.0-28.0	38.0-46.2	28.5-32.8	4.1-4.9	32.0-45.0
F_3	3.5-28.0	38.0-44.4	28-34.3	3.7-4.7	31.0-39.7
F_4	2.5-38.0	38.1-49.0	28-31.4	4.1-4.7	30.6-38.2
F_5	7.7-36.3	38.3-47.0	28-30.8	3.5-4.9	31.3-37.7
F_6	5-37.5	36.9-45.0	28-33.1	4.2-4.8	31.5-42.2

Preliminary Yield Trials

The primary objective of Preliminary Yield Trial (PYT) is evaluation of promising lines with superior qualities from the breeding nursery (filial generation) in order to establish their genetic yield potential, fiber quality and resistance/tolerance against cotton leaf curl disease. The trial is conducted in RCBD with three replications and cultivars included in this trial were subjected to a reduced selection pressure and the selected lines were progressed to the Advanced Yield Trials. The process of preliminary yield trials is a mandatory feature of any breeding programme.

Total 21 Preliminary Yield Trials, comprises 185 entries/lines, were conducted at CRI and its allied stations during the year 2018-19 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, superior fibre quality, disease resistance, and insect resistance. In Preliminary yield trial (PYT), (Table 3) the range of seed cotton yield was 1208-4424 kg/ha. Whereas, GOT, and staple length was 37.0-43.2%, and 28.5-32.2mm. Likewise, fibre fineness was 4.1-5.1 µg/inch.

The most promising lines include 6003/17 (4426 kg/ha) from CRI Khanpur, FH-453 (3921 kg/ha) from CRS, Faisalabad; CRI-121 (3899 kg/ha) from CRI Multan, 6015/17 (3896 kg/ha) from CRI Khanpur; CRI-122 (3513 kg/ha) from CRI Multan, respectively gave higher yield with desirable fibre traits than check varieties (Table 3). These top yielding lines will be evaluated in advanced yield trials during the coming year.

Table 3. Yield and fiber traits of promising strains in PYTS during 2018-19

Station	Family No.	Yield (kg/ha)	GOT (%)	Staple length (mm)	Fiber Fineness (µg/inch)	Fiber Strength (g/tex)
CRI, Multan	CRI-121	3899	41.2	31.5	4.3	39.8
	CRI-122	3513	41.2	30.4	4.6	34.2
CRS, FSD	FH-453	3921	41.1	30.2	4.1	26.9
	6035/17	2941	43.2	31.1	4.6	32.0
CRS, SWL	SLH-55	2768	41	29.5	4.4	34.0
	SLH-79	2718	42	30.0	4.5	32.5
CRS, BWP	BH-254	1208	41.0	28.5	4.5	35.2
	BH-318	1734	38.0	29.5	4.5	31.5
CRI, Khanpur	6003/17	4426	37.0	32.2	4.6	30.8
	6015/17	3896	38.7	30.9	4.4	33.8
CRS, Veh	VH-405	3268	38.5	28.2	5.1	37.7
	VH-420	3193	39.4	29.2	5.1	37.4

Advance Yield Trials

The objective of Advanced Yield Trials (AYTs) entails the evaluation of newly advanced cotton lines selected from the PYTs for yield and other important quantitative traits on bigger plot size. The trial is replicated and the selected lines were progressed to the multilocational trials i.e. PCCT, and NCVT.

Total 19 Advanced Yield Trials (AYTs), comprise 160 entries/lines, were conducted at CRI and its allied stations during the year 2018-19 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 advanced from PYTs keeping in view several features like yield, disease resistance, insect resistance and fiber quality.

In Advanced yield trial (AYT), (Table 4) the range of seed cotton yield was 2245-4328 kg/ha. Whereas, GOT, and staple length was 38.3-42.0%, and 27.9-31.7mm. Likewise, fibre fineness was 4.2-4.8µg/inch.

The most promising lines include FH-490 (4328 kg/ha), FH-416 (4136 kg/ha) from CRS, Faisalabad; CRSM-853 (3644 kg/ha), CRSM-854 (3595 kg/ha) from CRI, Multan; 34/15(3532 kg/ha), 43/14 (3471 kg/ha) CRI, Khanpur; VH-389 (3193 kg/ha), VH-348 (2870 kg/ha) CRS, Vehari; SLH-42 (2788 kg/ha), from CRS Sahiwal, performed better (Table 4) against standard varieties and these best performing strains will be included in Provincial and National Trials.

Table 4. Yield and fiber traits of promising strains in AYTS during 2018-19

Station	Family No	Yield (kg/ha)	GOT (%)	Staple length (mm)	Fiber fineness (µg/inch)	Fiber strength (g/tex)
CRI, Multan	CRSM-853	3644	40.2	31.7	4.5	35.5
	CRSM-854	3595	41.2	30.4	4.2	34.2
CRS, FSD	FH-416	4136	38.3	29.3	4.6	28.0
	FH-490	4328	42.0	28.3	4.7	30.5
CRS, Sahiwal	SLH-42	2788	41.5	28.2	4.8	30.0
	SLH-50	2502	40.5	28.5	4.7	30
CRS, BWP	BH-220	2617	39.0	28.5	4.4	32.5
	BH-11	2245	39.2	29.0	4.5	30.5
CRS Khanpur	43/14	3471	39.0	28.11	4.6	31.0
	34/15	3532	39.0	27.9	4.7	30.2
CRS Vehari	VH-348	2870	38.5	28.2	4.1	29.1
	VH-389	3193	39.5	28.9	3.7	35.0

Provincial Coordinated Cotton Trial (PCCT)

The Provincial Coordinated Cotton Trial has been executed at 13 locations of Punjab to check the adaptability and stability. PCCT-I consisted 35 Bt. varieties. The performance of new Bt. varieties in Provincial Coordinated Cotton Trial were compared with FH-142. The results of seed cotton yield tested at CRI Multan are presented in (Fig. 6).

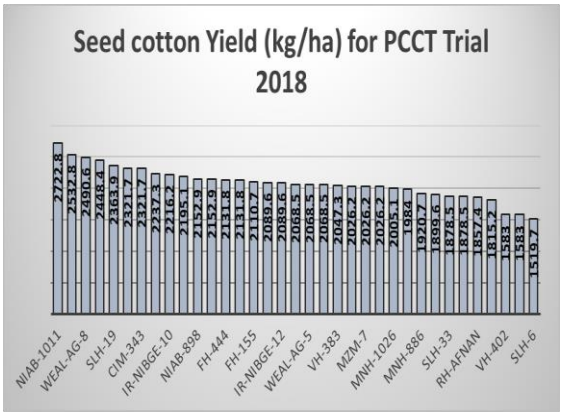

Fig.6. PCCT-1 (Bt.) Trial 2018

Pre-basic Seed Production Trial

The main objective of this trial is to produce Basic Nucleus Seed (BNS) of candidate/ approved varieties of each research institute/station by multiplication of pure and true to type plants from bulk population. Last year total 3890kg cotton seed were produced for 8 different cotton varieties (Table 5).

Table 5. Pre-basic Seed Production

Sr. No.	Variety	BNS (kg)
CRS Faisalabad		
1	FH-142	1590
2	FH-152	600
3	FH-Lalazar	1000
CRS Khanpur		
5	RH-662	100
6	RH-668	100
7		
CRS Vehari		
8	VH-305	100
9	VH-327	200
CRS Sahiwal		
10	SLH-8	200

Interspecific Hybridization

In interspecific hybridization, advanced material has been developed from crosses between *G. hirsutum* × *G. arboreum*, *G. arboreum* × *G. anomalum.* The material from interspecific hybridization is very out-standing i.e. GOT, staple length, and micronaire for interspecific lines is 44.8%, 33.7mm, 3.8 µg/inch, in filial generations (Table 6).

Table 6. Interspecific filial populations (F_1-F_6)

Generation	Family No	GOT (%)	Staple length (mm)	Fiber fineness (µg/inch)	Fiber strength (g/tex)
F_1	191001	44.4	32.5	4.6	39.2
	191021	44.8	32.5	4.4	36.7
F_2	192003	447	33.3	4.7	35.1
	//	43.1	32.2	4.7	40.8
F_3	193004	44.2	33.5	43	43.6
	193011	44.1	33.7	3.8	36.5

AGRONOMIC STUDIES

Varietal Behavior on Different Sowing Dates

After various testing procedures, estimation of appropriate sowing time for most promising genotypes is necessary. In sowing date trial, 3 varieties viz., MNH-1020, MNH-1026, MNH-886 were tested in 8 different sowing date i.e. 1st March, 16th March, 1st April, 16th April, 1st May, 16th May, 1st June, and 16th June and data were collected for number of bolls/plant, average boll weight, and seed cotton yield. The results showed that maximum seed cotton yield, No. of Bolls, Boll weight and staple length was obtained when MNH-1026 was sown on 1st March 2018. However minimum seed cotton Yield and No. of Bolls per plant were produced by MNH-886 when sown on 16th June 2018.

Table 7. Effect of Sowing Date on Seed Cotton Yield of New Strains of Cotton

Treatment	Treatments	Avg. no. of bolls	Av. Boll weight (g)	Yield Kg / Ha
D1 = 1st March 2018	MNH-1020	48	3.9	4269.7
	MNH--1026	50	3.9	4987.3
	MNH-886	44	3.7	4245.8
	MNH-1035	46	3.8	4495.8
D2 = 16th March 2018	MNH-1020	46	3.9	4215.1
	MNH--1026	45	3.8	4365.4
	MNH-886	42	3.6	4138.2
	MNH-1035	43	3.7	4253.6
D3 = 1st April 2018	MNH-1020	43	3.8	3986.7
	MNH--1026	42	3.9	4050.5
	MNH-886	40	3.8	3572.1
	MNH-1035	42	3.5	3938.8
D4 = 16th April 2018	MNH-1020	38	3.9	2663.1
	MNH--1026	41	3.5	3301.0
	MNH-886	40	3.3	2870.4
	MNH-1035	41	3.9	3285.0
D5 = 1st May 2018	MNH-1020	39	3.9	2567.4
	MNH--1026	37	3.4	2838.5
	MNH-886	34	3.7	1918.7
	MNH-1035	36	3.4	2407.9
D6 = 16th May 2018	MNH-1020	35	3.8	2120.9
	MNH--1026	31	3.5	2152.8
	MNH-886	29	3.1	1897.7
	MNH-1035	34	3.0	2136.9
D7 = 1st June 2018	MNH-1020	26	3.8	1977.4
	MNH--1026	20	3.6	2216.6
	MNH-886	18	3.0	1817.9
	MNH-1035	24	3.0	2105.0
D8 = 16th June 2018	MNH-1020	24	3.9	1754.1
	MNH--1026	20	3.5	1929.5
	MNH-886	18	2.9	1578.7
	MNH-1035	23	3.3	1754.1

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 Multan, Vehari, Khanpur, Bahawalpur and Sahiwal stations (Table 8). At CRI Multan, three varieties viz., MNH-1020, MNH-1026, and MNH-1035 were tested with four inter plant spacing i.e. S-1(22.5cm), S-2(30.0cm),
S-3(37.5cm), and S-1(45.0 cm). Maximum seed cotton yield of 2668 Kg/ha was obtained when MNH-1020 was planted at plant distance of 30 cm with boll weight of 3.85 g.

Table 8. Testing New Strains under Different Plant Spacing

Treatment	Treatments Spacing	Avg. no. of bolls	Av. Boll weight (g)	Yield Kg / Ha
MNH-1020	S1 (22.5 cm)	11.20	3.68	2266.00
	S2 (30.0 cm)	17.10	3.85	2668.00
	S3 (37.5 cm)	20.30	3.72	2582.00
	S4 (45.0 cm)	21.10	3.82	2278.00
MNH-1026	S1 (22.5 cm)	10.40	3.66	2152.00
	S2 (30.0 cm)	12.00	3.83	2552.00
	S3 (37.5 cm)	19.00	3.81	2415.00
	S4 (45.0 cm)	19.80	3.97	2123.00
MNH-1035	S1 (22.5 cm)	12.70	2.93	2125.00
	S2 (30.0 cm)	17.50	3.00	2449.00
	S3 (37.5 cm)	23.00	3.00	2335.00
	S4 (45.0 cm)	24.00	3.05	2035.00

Nutrient Management Trial on Cotton

The main objective of this trial was to evaluate yield performance under various fertilizer treatments and to optimize the dose of NPK for new strains of cotton.

At CRI Multan, three varieties viz., MNH-1020, MNH-1026, and MNH-1035 were tested with five NPK levels i.e. T-1(114-0-0 kg/ha), T-2 (114-57-0 kg/ha), T-3 (198-57-94 kg/ha), T-4 (250-57-94 kg/ha), and T-5 (306-57-94 kg/ha). Results showed that maximum no of bolls per plant, boll weight, and seed cotton yield was obtained by MNH-1026 in T4 fertilizer application, however minimum number of bolls, boll weight and seed cotton Yield was obtained by MNH-1020 in T1.

The results from the experiment suggest that application of fertilizers should be recommended accordingly to the fertility level of the soil and the selected variety to be planted.

Table 9. Impact of NPK on the Growth and Yield of New Genotypes of Cotton

Variety	Treatments NPK kg / Ha	Avg. no. of bolls	Av. Boll weigh t (g)	Yield Kg / Ha
MNH-1026	T1 = 114-0- 0	25.33	3.80	2208.00
	T2 = 114-57- 0	26.60	4.01	2251.00
	T3 = 198-57- 94	33.16	3.63	2325.00
	T4 = 250-57- 94	34.96	4.08	2552.00
	T5 = 306-57- 94	31.70	3.96	2527.00
MNH-1020	T1 = 114-0- 0	24.40	3.00	1994.00
	T2 = 114-57- 0	26.43	3.77	2221.00
	T3 = 198-57- 94	26.70	3.87	2276.00
	T4 = 250-57- 94	38.50	3.98	2540.00
	T5 = 306-57- 94	37.80	3.96	2350.00
MNH-1035	T1 = 114-0- 0	33.20	3.00	2128.00
	T2 = 114-57- 0	35.50	2.99	2135.00
	T3 = 198-57- 94	40.10	3.00	2221.00
	T4 = 250-57- 94	42.80	3.00	2266.00
	T5 = 306-57- 94	39.80	3.10	2239.00

Effect of Picking Time and Storage Period 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 five pickings were done with one-month interval each.

Results revealed that maximum germination %age i.e. 87.3 % was obtained by MNH-1026 when picking was done on 1st September 2018; however minimum germination of 65.7 % was obtained by MNH-1020 when picking was done on 1st August 2018 (Table 10).

Table 10. Effect of Picking Time and Storage Period on Germination of Cotton Seed

Picking time	Storage Period (days)	Varieties	Germination (%)
1st Aug	212	MNH-1016	65.7
		MNH-1020	68.0
		MNH-1026	67.3
1st Sept	180	MNH-1016	85.7
		MNH-1020	87.3
		MNH-1026	87.3
1st Oct	150	MNH-1016	85.3
		MNH-1020	82.7
		MNH-1026	82.0
1st Nov	120	MNH-1016	80.7
		MNH-1020	81.3
		MNH-1026	81.0
1st Dec	90	MNH-1016	80.3
		MNH-1020	75.3
		MNH-1026	77.3

Storage period also affected germination percentage of cotton. Maximum germination of 87.3 % was obtained by MNH-1020 & MNH-1026 when seed cotton was stored at room temperature for 180 days then ginned and germination was tested. However minimum germination of 65.7% was obtained by MNH-1016 when seed cotton was stored at room temperature for 212 days then ginned and germination was tested (Table 11). The findings

of experiment suggest that 1st September is the best date for picking of cotton and store at room temperature with proper aeration & ventilation for maximum germination percentage.

Effect of Different Management Practices on Yield of Cotton

In this experiment four management practices were studied. The decrease in yield due to missing of Fertilizer, Irrigation, weed management, pest management and all these was 39.2, 67.4, 64.7, 42, and 895.5 % respectively. Maximum seed cotton yield of 2565.3 Kg/ha was obtained in T1 while decrease in seed cotton yield was 39.2,67.4,64.7 and 42 % due to deficiency of fertilizer, irrigation, weed management and pesticide application respectively.

Table 11. Role of Different Management Practices on Growth and Yield of Cotton Crop

Treatment	Fertilizer	Irrigation	Weed Mgt	Pest Mgt	Avg. No. of bolls	Av. Boll weight (g)	Yield Kg / Ha	% Decrease over T_1
T_1	+	+	+	+	27.1	3.8	2565.3	-
T_2		+	+	+	22.3	3.6	1559.5	39.2
T_3	+		+	+	9.8	3.1	836	67.4
T_4	+	+		+	4	2.9	904.1	64.7
T_5	+	+	+		19.5	3.2	1488.9	42
T_6					2.8	2.2	114.8	95.5

Determination of Efficacy of Different Weedicides on Cotton Weeds and their Impact on the Growth and Yield of Cotton

An experiment was conducted at Cotton Research Institute Multan to study the effect of different weedicides on yield of cotton. Six weedicides treatments were tested. The maximum seed cotton yield of 2568.8 kg/ha (Table 12) was obtained when Dual gold @2.0 L/ha (pre-emergence) & Glyphosate @ 4.7 L/ha (post-emergence) was used. It is concluded that Dual gold @ 2.5 L/ha as pre-emergence and Glyphosate @ 4.7 L/ha as post-emergence can be utilized for effective weed control in cotton.

Table 12 Determination of Efficacy of Different Weedicides on Cotton Weeds and their Impact on the Growth and Yield of Cotton

Treatments	Avg. No. of bolls	Av. Boll weight (g)	Yield Kg / Ha
T1 Stomp (Pendimethaline) @ 2.5 L/ha	**27.7**	**3.4**	**2222.2**
T2 Dual Gold 960 EC@2.0 L/ha	**29.0**	**3.4**	**2282.0**
T3 Stomp (Pendimethaline) @ 2.5 L/ha + Glyphosate 490 G /L@ 4.7 L/ha	**31.1**	**3.5**	**2349.1**
T4 Dual Gold 960 EC@2.0 L/ha + Glyphosate 490 G /L@ 4.7 L/ha	**33.9**	**3.7**	**2568.8**
T5 Acetochlor @ 0.875 L + Pendimethaline @ 2.0 L/ha	**27.4**	**3.4**	**2105.1**
T6 Glyphosate 490 G /L@ 4.7 L/ha	**26.4**	**3.4**	**2099.0**
T7 Manual+ Mechanical hoeing	**22.8**	**3.2**	**1876.9**
T8 Manual l hoeing	**16.3**	**3.2**	**1430.2**

Role of Organic Matter on the Yield of Cotton by Incorporating Cotton Sticks and Wheat Straw into Soil

A field experiment was conducted at Cotton Research Institute Multan to study the role of incorporation of wheat straw and cotton sticks, in addition of organic matter into the soil and its impact on yield of cotton. Experiment was replicated thrice and arranged in Split Plot Design. 6% increase in yield was observed by incorporation of wheat straw and cotton sticks into soil (Table 13) as compared with that soil from which wheat straw and cotton sticks were removed.

Table 13. Role of Organic Matter on Seed Cotton Yield of Cotton by Incorporating Cotton Sticks and Wheat Straw into Soil

Treatments	Avg. no. of bolls	Av. Boll weight (g)	Yield Kg / Ha	% age increase
T1 Cotton Sticks and wheat straw removed	17.2	3.2	2393.1	0.0
T2 Cotton Sticks and	18.2	3.3	2536.6	6.0

wheat straw incorporated				
T3 Cotton sticks incorporated and wheat straw burnt	17.9	3.3	2490.0	4.0

ENTOMOLOGICAL STUDIES

Monitoring of *Lepidopterous* Pests of Cotton through Pheromones Traps

Moth catches of lepidopterous insect pest was carried out throughout the year by using pheromone traps. Peak population of moth catches of pink bollworm (2.14/trap), spotted bollworm (10.62/trap), and armyworm (1.60/trap) was observed during the month of April, October, and November, respectively (Fig VII). We recommend that October is the most crucial for the monitoring of bollworms by pheromone traps.

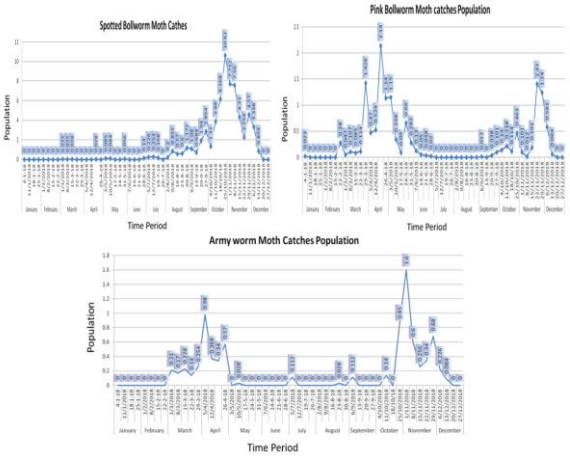

Fig.7.

Screening of Different Insecticides with Different Brands (Generic, National and Multinational) against Cotton Whitefly

The data of whitefly was taken from leaves before and 24, 48 and 72 hours after spray. Three out of 10 tested insecticides remained effective. Results revealed that all the insecticides that were screened out failed to give mortality above 80% however, Admiral (Pyriproxifen) gave maximum mortality (48.1%) against Whitefly after 72 hours of application followed by Polo (Diafenthuron) which gave 45.1% mortality (Table 14).

Table 14. Screening of Different Insecticides with Different Brands (Generic and Multinational) Against Whitefly

Name of Insecticides	Dose/acre	Pre-treatment Pop. /leaf	% Mortality after		
			24 hours	48 hours	72 hours
Legend 0.5% AS (Metrin), Kanzo Ag	500 ml	8.20	28.3	34.2	38.2
Mavrik (Metrin), Suncrop	500 ml	8.67	21.3	24.2	32.2
Movento (Spirotetramate), Bayer	150ml	8.13	32.5	37.3	41.3
Ulala (Flunicamid), ICI	80g	10.20	19.5	22.8	31.3
Buprofezin (generic)	600g	11.43	23.4	27.0	35.4
Buffer (Buprofezin) Jaffer Brothers	600g	10.37	26.0	38.4	45.2
Priority (Pyriproxifen) Kanzo Ag	500 ml	8.37	23.5	27.5	33.5
Admiral (Pyriproxifen) FMC	200ml	11.43	38.6	42.7	54.1
Diafenthuron (Generic)	200ml	11.30	23.1	26.8	38.2
Polo (Diafenthuron) Syngenta	200ml	10.20	33.2	42.3	52.1
Check	-	11.30	0.00	0.00	0.00
LSD @ 5%			13.72	8.36	12.20

Screening of Different Insecticides with Different Brands (Generic, National and Multinational) against Pink Bollworm

Results demonstrated that maximum mortality (48.2%) of pink bollworm was observed by Proaxis after 7 days post application (Table 15).

Table 15. Screening of Different Insecticides with Different Brands (Generic and Multinational) against Pink Bollworm

Insecticides	**Dose/ Acre (ml)**	**% Control After**		
		3-Days	**5-Days**	**7-Days**
Curator (Triazophos+Bifenthrin)	600	31.4	36.1	47.3
Coragen (Chlorantraniliprole)	50	29.2	31.1	38.5
Trizone (Triazophos)	800	28.6	31.9	43.6
Raddiant (Spintoram)	100	21.3	26.1	32.3

Belt (Flubendamide)	50	24.3	28.2	34.1
Proaxis (Gamacyhalothrin)	120	38.2	42.1	59.2
Talstar (Bifenthrin)	400	18.4	22.4	28.2
Cedox (Triazophos+Deltamethrin)	600	29.4	34.5	42.7
Bolton (Chlorpyriphos+Betacyfluthrin)	600	26.1	31.7	36.8
Capital Plus (Triazophos+Betacyfluthrin)	600	30.9	34.3	43.5
Control	-	0.00	0.00	0.00
LSD @ 5%		9.12	6.47	8.59

Efficacy of Different Seed Dressing Insecticides/Fungicides against Sucking Insect Pest and Disease Incidence on Cotton

The objective of this trial was to screen out most effective seed treatment against sucking insect pest. Six insecticides/fungicides were included in this experiment. Results demonstrated showed no significant results and were statistically at par to each other. Disease incidence like root rot or wilt did not observed on any treatment (Table 16).

Table 16. Efficacy of Different Seed Dressing Insecticides/Fungicides against Sucking Insect Pest and Disease Incidence on Cotton

Name of Insecticides	Mean population/leaf			% Disease incidence
	Whitefly	Jassid	Thrips	(Root Rot)
Confidor 70 WS + Thionfenate methyl	1.06	0.81	0.43	Nil
Imidacloprid 70 WS + Thionfenate methyl	1.20	0.79	0.53	Nil
Actara ST + Thionfenate methyl	1.26	0.93	0.51	Nil
Hombre Excel 37.25 FS	1.32	0.69	0.54	Nil
Argyl Super	1.20	0.81	0.59	Nil
Asset 70 WS + Thionfenate methyl	1.22	1.09	0.71	Nil
Control	2.37	1.37	2.05	Nil
LSD @ 0.5%	0.40	0.26	0.36	

Effect of Row Spacing for the Management of Whitefly

The objective of this trial was to find out row spacing effect on whitefly population. Results demonstrated that 1 row spacing after 6 rows gave better whitefly management throughout cropping season as compared to rest of the treatment. (Table 17).

Table 17. Effect of Row Spacing for the Management of Whitefly

Treatments	Whitefly population/leaf (Avg.)			
	July	August	September	October
T1 (2.5 feet spacing after 4 rows of cotton)	2.37	4.23	8.53	11.80
T2 (2.5 feet spacing after 6 rows of cotton)	3.30	4.20	9.17	13.67
T3 (2.5 feet spacing after 8 rows of cotton)	2.40	4.47	9.93	14.77
T4 (2.5 feet spacing after 10 rows of cotton)	3.47	4.60	11.30	15.77
T5 (No Row Spacing)	2.93	4.87	12.30	17.50

Varietal Screening of Different Advanced Lines of Cotton against Cotton Whitefly

The objective of this trial was to determine the susceptibility and resistance level of different advanced lines against whitefly. Results revealed that a positive correlation was observed of whitefly population between leaf area and trichome density. While, negative correlation was observed between leaf thickness and gossypol gland (Table 18).

Table 18. Varietal Screening of Different Advanced Lines of Cotton against Cotton Whitefly

Entry	Mean Whitefly	% Pink BW infestation	Leaf lamina thickness (mm)	Leaf area (cm2)	Trichome density / sq. cm	No. of Gossypol glands /sq. cm
MNH-1068	3.85	10.40	0.365	9.27	67.667	88.333
MNH-1016	3.75	9.49	0.369	8.04	81.333	66.667
MNH-1035	3.74	10.45	0.258	9.67	71.000	83.667
FH-142	3.91	10.47	0.328	10.52	76.000	82.000
FH-Lalazar	4.65	10.42	0.316	8.03	88.333	81.667
FH-62	3.81	7.31	0.394	8.36	52.333	85.000
MNH-886	4.14	13.39	0.191	9.48	78.667	68.667
LSD (0.05)	0.48					

Bio-Assay Study of Different Insecticides against Cotton Whitefly *(Bemisia tabaci)*

The objective of this trial was to find out the causes of insecticidal resistance against whitefly. Results revealed that among the tested insecticides regarding toxicological studies under laboratory bioassay Movento, Ulala, and Buprofezin gave better results against whitefly. LC50 value of these insecticides ranged from 0.0 to 0.57. While, in case of Priority LC50 ranged from 0.029 to 116.0. 24, 48 & 72 Hours after treatment. (Table 19).

Table 19. Bio-Assay Study of Different Insecticides against Cotton Whitefly (*Bemisia tabaci*)

Insecticides	Time After	LC_{50} [a] (ppm)[b]	95% FL[c]	Slope (± SE[d])	χ^{2e}	df[f]	P[g]	N[h]
Movento	24 Hours	0.04	0.02-0.06	6.2	1.0	3	0.8	25
	72 Hours	0.015	0.0-0.03	1.0	0.8	3	0.6	25
	168 Hours	0.01	0.0-0.02	2.2	3.0	3	0.6	25
Priority	24 Hours	116.7	0.0-5.0	22.04	0.1	3	1.00	25
	72 Hours	0.029	0.0-6.0	22.04	0.5	3	1.00	25
	168 Hours	91.3	0.41-3.36	1.17	2.87	3	0.41	25
Ulala	24 Hours	3.5	1.0-6.0	8.5	0.5	3	0.6	25
	72 Hours	1.5	2.1-3.5	6.2	0.8	3	0.8	25
	168 Hours	1.0	1.6-2.3	7.7	0.6	3	0.8	25
Buprofezin	24 Hours	0.07	0.35-4.9	1.32	2.6	3	0.45	25
	72 Hours	46.7	0.00-6.0	22.0	0.0	3	1.00	25
	168 Hours	0.13	0.57-3.88	1.48	0.91	3	0.82	25

Bio-Assay Study of Different Insecticides against Pink Bollworm *(Pectinophora gossypiella)*

The objective of this trial was to monitor insecticidal resistance against pink bollworm. Results depicted that among the tested insecticides under laboratory bioassay, Triazophos, gave better results against pink bollworm. Minimum LC-50 value of 27.948 of Triazophos demonstrated maximum toxicity against pink bollworm moth followed by Deltamethrin and Bifenthrin with LC-50 43.299 and 61.978 as compared with chlorpyrifos 255.239
(Table 20).

Table 20. Bio-Assay Study of Different Insecticides against Pink Bollworm *(Pectinophora gossypiella)*

Name of Insecticide	*LC 50 (FL)*	*Chi Square*	*DF*	*Slope*
Bifenthrin 10 EC	*61.978 (46.925 – 77.716)*	*1.396*	*2*	*2.209 ± 0.354*
Triazophos 40EC	*27.948 (20.369-34.928)*	*0.196*	*2*	*2.490 ± 0.414*
Deltamethrin 2.5EC	*43.299 (30.146-56.167)*	*0.011*	*2*	*1.906 ± 0.345*
Chlorpyrifos 40 EC	*255.239 (183.583-411.917)*	*1.143*	*2*	*1.426 ± 0.319*

PROJECTS

A Comprehensive Integrated Scientific Approach for the Development of Sustainable Management Strategies of Pink Bollworm (*Pectinophora gossypiella*)

It is PARB funded project in collaboration with UAF, Entomological Research Institute, Faisalabad, Cotton Research Institute, Multan, MNSUA, NIBGE and CCRI Multan. The objectives of this mega project are to manage Pink Bollworm on sustainable basis. The main theme of this project is monitoring and management of insecticide resistance problem in pink bollworm. Insecticides showing maximum resistance will be replaced with insecticides that effectively manage Pink bollworm.

Management of Whitefly by Integrated Strategies and Development of Resistant Cotton Germplasm through Genetic Engineering

It is also PARB funded project in collaboration with UAF, Entomological Research Institute, Faisalabad, Cotton Research Institute, Multan, MNSUA, NIBGE and CCRI Multan for the management of whitefly by using integrated pest management techniques. The main objective of this project is to screen out resistant germplasm against whitefly. The effect of different agronomic practices likewise timing, stage of spray and plant-based insecticides will also be observed for the proper management of whitefly.

Commissioned Research for Development of Cotton Seed

"Commissioned Research for Development of Cotton Seed" is sponsored by the Punjab Government in which a climate smart variety of cotton will be developed. It has 2 components, CRI Multan and MNSUA, Multan. This project has five year duration starting from 01-07-2016 to 30-06-2021. The breeding material under this project is at filial generation F_4 with promising fibre quality traits i.e. GOT = 40.1%, Staple length = 28.3 mm, Mike = 4.2 µg/inch , Fiber Strength = 31.4 g/tex. The new technology i.e. GMO + glyphosate resistance genes will be purchased by Punjab Agricultural Research Board Lahore , that will be efficiently incorporated into our local adopted cotton varieties.

Development of High oil Content Cotton Lines/Genotypes through Conventional Breeding Strategies

A CGS project was approved by Punjab Agricultural Research Board (PARB) for CRS Faisalabad and CRI Multan to improve seed oil content of cotton Genotypes/Varieties for producing more edible oil along with other economic traits. Under this project 110 lines were tested for oil contents variation. A total of 10 varieties/accession were found that have oil contents above 20%. Results of this project are as under:

Accessions (7 to 10% oil content)= 3
Accessions (10 to 15% oil content) = 47
Accessions (15 to 20% oil content) = 50
Accessions(20 and above oil content)= 10

Development of Cotton Variety Suitable for Mechanical Picking

A CGS project was approved by Punjab Agricultural Research Board (PARB) for CRS Faisalabad and CRI Multan keeping in view the increasing demand of cotton variety suitable for mechanical picking. Under this project short stature cotton variety with plant height 90-110 cm has been developed for mechanical picking. Soon it will be available for commercial scale.

ISO Accreditation of Fiber Testing Lab at CRS Faisalabad

The project "Accreditation of AARI laboratories for ISO 17025:2005" was initially started in 2016 for two years. Cotton Research Institute Fiber Testing Laboratory (CRIFTL) is also a part of this project. During 2017-18, pre-assessment of lab was conducted on 13-05-2018 by lead assessor of Pakistan National Accreditation Council (PNAC). The lead assessor appreciated efforts of lab management and raised few NCs. NCs were closed immediately after conducting Management Review Meeting. Lab record was maintained as per requirements of the ISO standard 17025:2005. Lead assessor pointed out lack of trainings to lab staff which was over-come by a series of trainings throughout the year. Full assessment of lab was conducted on December 15 to 16, 2018 by lead assessor and technical expert of PNAC and raised 8 NCs in total. NCs were closed after discussion in Management Review Meeting and sent to PNAC for award of certificate. The lab has successfully completed all requirements of PNAC for certification. The lab also tested about 13000 cotton lint samples during 2017-18.

A. MISCELLANEOUS ACTIVITIES DURING THE YEAR

1. Scientific Publications = 22
2. Urdu Articles = 10
3. Radio/TV Talks = 08

B. MoUs & International Trainings

- Anyang Cotton Research Institute and Uzbekistan signed an MoU with CRI Multan

C. Meetings of Cotton Research and Development Board

Four meetings were held for Cotton Research and development board.

D. Seminars/exhibitions

- Participation in eight mega cotton seminars in Punjab and also deliver lectures on cotton
- Participated in exhibitions (BZU, MNSUAM, Kissan Mela, Ghazi University)

E. Area covered by CRI Varieties

The varieties of CRI Multan and its allied research station occupied 38% area in Punjab during 2018.

F. Other Activities

- Quarterly meeting of Cotton Research and Development Board meetings
- Developed Cotton Production Plan for the year 2018
- For farmers guidelines a manual published on cotton production technology
- Technical Advisory Committee
- Weekly crop situational report
- Monitoring of farmers training program conducted by Agriculture Extensions.

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DELEGATES VISIT CRI MULTAN

Meeting of cotton Research and Development Board in 2018

Secretary Agriculture Mr. Wasif Khursheed Visits Cotton Research Institute Multan

Visit of Additional Secretary Agriculture

Visit of Chinese Scientist to CRI Multan