Annual Program
2020-2021

GOLDEN JUBILEE CELEBRATIONS
1970 - 2020
50
Years of Excellence in
Cotton Research & Development
CENTRAL COTTON RESEARCH INSTITUTE, MULTAN

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CONTENTS

PREFACE

The Annual Programme of Research Work for the year 2020-21 of Central Cotton Research Institute, Multan has been prepared keeping in view the changing climatic conditions, insect pests and disease scenario, effectiveness of Bt gene and cropping pattern. The programme has been thoroughly reviewed and discussed with the scientists of Central Cotton Research Institute, Multan. The research studies will be focused on cotton production technology, high density trials, climate resilient varieties, CLCuV disease management, efficient fertilizer use, seed health improvement, insect pest management (especially Pink bollworm, Whitefly, Mealybug), insecticide resistance management, introduction and demonstration of advanced machinery including Mechanical Cotton Picker, Boll Picker, Seed Grader etc and technology dissemination.

In addition, the Institute has launched BCI Cotton Project through which farmers will be trained to produce environment-friendly and economically better cotton utilizing the latest technology in collaboration with the Better Cotton Initiative (BCI). Moreover, the Institute has also submitted various projects under the federal PSDP 2020 which includes supply of PB Ropes, farmers training programs and advancement of research programs for varietal development.

Suggestions for further improvement of the Programme will be highly appreciated and duly acknowledged.

DR. ZAHID MAHMOOD
Director
Central Cotton Research Institute
Multan

March, 2020

1. AGRONOMY SECTION

1.1 Effect of time of sowing on productivity of advanced genotypes

Objective:

To determine the optimum sowing time of different advance genotypes for productivity and CLCuD incidence

Treatments:

(a) Sowing Date = 7
[March 15, April 01&15, May 01&15, June 01&15]

(b) Genotypes = 4
[Cyto-226, Cyto-164, CIM-735, CIM-610]

Layout : Split plot
[Main plot: sowing date]
[Sub plot: genotypes]

Replications : 3
Plot size : 20' x 30'
Year of Expt. : Continuous

Observations:

- Plant structure
- Seed cotton yield and its components
- Data on CLCuD incidence
- Fibre characteristics

Previous Year's Results

- Crop planted on 15th April produced maximum yield (2440 kg ha^{-1}), while minimum by 15th June (1182 kg ha^{-1}).
- Averaged across the sowing dates, CIM-610 produced significantly higher seed cotton yield than Cyto-226 and Cyto-164.
- The reduction in yield was 9.2%, 25.5%, 42.6% and 51.6 % by delayed sowing.

1.2 Effect of time of sowing on productivity of transgenic genotypes

Objective:

To determine the optimum sowing time of different transgenic genotypes for productivity and CLCuD incidence

Treatments:

(a) Sowing Date = 7
[March 15, April 01&15, May 01&15, June 01&15]

(b) Genotypes = 7
[*Bt.* CIM-775, *Bt.* CIM-785, *Bt.* CIM-875, *Bt.* Cyto-533, *Bt.* Cyto-535,Cyto-A and *Bt.* Cyto-179]

Layout : Split plot
[Main: sowing date]
[Sub-plot: genotype]

Replications : 3

Plot size : 20' x 30'

Year of Expt. : Continuous

Observations:

- Plant structure
- Seed cotton yield and its components
- CLCuD incidence
- Fibre characteristics

Previous Year's Results

- Crop planted on 15th March produced maximum yield (4035 kg ha^{-1}), while minimum by 1st June (1643 kg ha^{-1}).
- Averaged across the sowing dates, CIM-678 produced higher seed cotton yield than *Bt.* CIM-303, *Bt.* CIM-785, *Bt.* Cyto-511, *Bt.* Cyto-179 and *Bt.* CIM-789.
- The reduction in yield was 21.4%, 36%, 38.1%, 48.8% and 59.3% by delay in sowing.

1.3 Yield response and nitrogen use efficiency of transgenic cotton cultivars to nitrogen application

Objective:

To determine the nitrogen requirement and nitrogen use efficiency of transgenic cotton

Treatments

(a) **Genotypes = 5**
[*Bt.* CIM-775, *Bt.* CIM-785, *Bt.* CIM-875, *Bt.* Cyto-535 and *Bt. GH-Himalaya*.]

(b) **Nitrogen = 6**
[0, 50, 100, 150, 200, 250 kg N ha^{-1}]

Layout : Split plot
[Main: nitrogen]
[Sub-plot: genotypes]
Replications : 3
Plot size : 20' x 30'
Sowing date : 2nd week of May
Year of Expt. : Continuous

Observations:

- Plant structure
- Seed cotton yield and its components
- Agronomic nitrogen use efficiency

- Fibre characteristics

Previous Year's Results

- The seed cotton yield was significantly affected by genotype and nitrogen levels
- Crop fertilized with 300 kg N ha^{-1} gave increase in yield than 0, 75, 150 and 225.
- The genotype *Bt.*CIM-678 produced significantly higher seed cotton yield than *Bt.*CIM-789, *Bt.*GH.Hamalia, *Bt.*Cyto-511, and *Bt.*CIM-533.
- The genotype CIM-678 and CIM-789 gave the highest agronomic nitrogen use efficiency over rest of the genotypes.

1.4 Modeling the cotton genotypes performance at temporal variations

Crop growth model:

Decision Support System for Agro-Technology Transfer (DSSAT)

Objective:

To assess the impact of climate change on genotypes performance and their adoptability

Treatments:

Main plot: Temporal variations: 04

I. Mid March
II. Mid April
III. Mid May
IV. Mid June

Genotypes: 03

I. *Bt.* CIM-789
II. *Bt.* Cyto-511
III. *Bt.* Cyto-179

Layout: Split plot
Replications 3
Plot size: Available experimental area

Year: 3rd

Observations:

- Phenology
- Plant morphology
- Seed cotton yield and its component
- Fiber quality

Previous Year's Results

- Crop planted on 15th March produced maximum seed cotton yield (3983 kg ha^{-1}), while minimum yield by 15th June (1509 kg ha^{-1})
- Average across the sowing date, *Bt.*Cyto-511 produced significantly higher seed cotton yield than *Bt.* CIM-789 and *Bt.*Cyto-179.
- The reduction in yield was 36.2%, 51.8% and 62.1% by delay in sowing.
- Among sowing dates, April-15 took minimum days for squaring and flowering, while March-15 took minimum days for first boll split
- Among genotypes, *Bt.*Cyto-179 took minimum days for squaring, flowering and first boll split.

1.5 Cotton yield response to residues management and tillage systems in cotton-wheat cropping system

Objective:

To evaluate the effects of cotton sticks and wheat straw incorporation in combination with tillage systems on crop productivity

Treatments:

Main plot: Residues incorporation: 04

I. No residue incorporation
II. Wheat straw incorporation
III. Cotton sticks incorporation
IV. Cotton sticks and wheat straw incorporation

Sub-plot: Tillage system: 02

I. Conventional
II. conventional and chiseling

Layout: Split plot

Plot size: Available experimental area

Sowing time: Mid May

Variety: *Bt.* Cyto-179

Year: 3rd

Observations:

- Pre and post harvest soil organic matter contents
- Plant structure
- Seed cotton yield and its components
- Fiber traits

Previous Year's Results

- Among the tillage treatments. The combination of chiseling and conventional tillage produced significantly higher seed cotton yield than conventional tillage.
- The cotton sticks incorporation produced higher seed cotton yield than rest of treatments.

1.6 Cotton yield and fiber quality response to high density planting system (HDPS)

Objective:
To evaluate the impact of high density planting system on cotton yield and fiber quality

Treatments:

Row spacing: 3 (45 cm, 60 cm and 75 cm)

Plant spacing: 3 (15 cm, 22.5 cm and 30 cm)

Layout: Split plot

Main plot: Row spacing

Sub-plot: Plant spacing

Plot size: 20 X 30 ft

Replication: 03

Sowing date: 1st week of May

Genotypes: *Bt.* CIM-775 and *Bt.* CIM-875

Year of exp.: 2nd

Observations:

- Plant structure
- Seed cotton yield and its components
- Fiber quality

Previous Year's Results

- The genotype *Bt.* Cyto-313 produced more seed cotton yield than *Bt.* CIM-343.
- The row spacing 45 cm produced 15.1% and 21.4% more seed cotton yield than 60 cm and 75 cm, respectively.
- The plant spacing 15 cm produced 21.5% and 37.8% more seed cotton yield than 22.5 cm and 30.0 cm, respectively.

1.7 Agro-economic feasibility for cotton – based intercropping system.

Objective: To assess the economic feasibility of different cotton-based intercropping systems.

Treatments:

Main Plot : Cotton
Sub plot : Intercrops: (Mung bean, Fodder maize, Seasame)

Layout : Split plot
Plot size : 20'x30'
Sowing date : Mid March
Replication : 03
Variety : *Bt*. CIM-678
Year of exp : 1st
Observation :

- Plant structure
- Economic feasibility assessment
- Seed cotton yield and its components
- Fibre characteristics

1.8 Effect of planting and picking time on cotton seed quality

Objective: To evaluate the impact of planting and picking time on seed quality

Treatments:

Planting time: March 15, April 15, May 15 and June 15
Picking time: Last week of August, September and October
Layout: RCBD
Plot size: 20'x30'
Replication: 03
Variety: *Bt*. CIM-179
Year of exp: 1st
Observation: Daily germination count, Mean germination time, Germination index, Coefficient of velocity of germination, Seed index.

1.9 Weed diversity survey in cotton growing areas of the Punjab

Objective: To estimate the weeds distribution pattern in various cotton growing regions

Observation:

- Frequency
- Density
- Relative mean field density
  Relative abundance

1.10 Evaluation of the impact of mulching strategies on weed control and seed cotton yield

Objective: To study the feasibility of mulches for weed control and its impact on seed cotton yield

Treatments: No mulch, Wheat straw, maize straw, berseem straw, weed mulch and plastic mulch

Layout: RCBD
Plot size: 20'x30'
Replication: 03
Variety: *Bt*. CIM-179
Year of exp: 1st
Observation:

- Weeds control (%)
- Weeds biomass (g m^{-2})
- Seed cotton yield and its components

1.11 Impact of sowing method on seed cotton yield, insects population and water consumption

Objective: To study the impact of sowing methods on yield performance, insect behavior and water consumption

Treatments:

Drill sowing
Bed furrow
Conversion of beds into ridges at 45 DAS
Conversion of beds into ridges at 60 DAS

Layout: RCBD
Plot size: 20'x30'
Replication: 03
Variety: *Bt*. CIM-179
Year of exp: 1st
Observation:

- Plant population
- Water consumption
- Insects population
- Seed cotton yield and its components
- Cost of production

1.12 Screening of pre- and post-emergence weedicides in cotton

Objective:

To screen out pre- and post-emergence weedicides for effective weed control in cotton.

Treatments:

Weedicides : Variable
Layout : RCBD
Replications : 3
Plot size : 20' X 30'
Sowing time : Mid May
Variety : *Bt*.CIM -179
Year of Expt. : **Continuous**

Observations:

- x Weed density
- x Plant structure
- x Seed cotton yield and its components

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2. – BREEDING & GENETICS SECTION

Institute/ Station	Name of the Head	No. of Exp.	Study Title	Name of Scientist	Estt Cost
Central Cotton Research Institute, Multan	Dr. Muhammad Idrees Khan, Head PB& G Section	1	2.1. 1 Varietal Trial -1 Evaluation of long staple Bt. strains against commercial varieties.	Dr. Muhammad Idrees Khan /Dr. Khadim Hussain	**33000**
		1	2.1. 2 Varietal Trial -2 Evaluation of medium long staple and high GOT Bt. strains against commercial varieties.	Dr. Muhammad Idrees Khan/ Mr. Muhammad Akbar Mr. Saeed Muhammad	**33000**
		1	2.1. 3 Varietal Trial -3 Evaluation of virus resistant/tolerant Bt. strains against commercial varieties.	Dr. Muhammad Idrees Khan /Hafiz Abdul Haq	**33000**
		1	2.1. 4 Varietal Trial -4 Evaluation of medium long staple Non-Bt. strains against commercial varieties.	Dr. Muhammad Idrees Khan / Dr. Fazl-I-Dayim Shehzad	**33000**
		7	2.2. Micro-Varietal Trial -1-7 Evaluation of newly bulked medium long staple Bt. strains against commercial varieties	Mr. Muhammad Akbar, Dr Khadim Hussain, Hafiz Abdul Haq, Dr Fazl-I-Dayim Shehzad and Mr. Saeed Muhammad	**154000**
		1	2.3 .1 Standard Varietal Trial -1 Evaluation of commercial Non-Bt. varieties at CCRI Multan condition	Mr. Muhammad Akbar	25000

Institute/ Station	Name of the Head	No. of Exp.	Study Title	Name of Scientist	Estt. Cost
Central Cotton Research Institute, Multan	Dr. Muhammad Idrees Khan, Head PB& G Section	1	2.3.2 Standard Varietal Trial -2 Evaluation of commercial Bt. varieties at CCRI Multan condition	Dr. Fazl-I-Dayim Shehzad	25000
		4	2.4 National Coordinated Varietal Trial-A to D To test the performance of candidate varieties from all over Pakistan	Dr. Muhammad Idrees Khan Mr. Muhammad Akbar, Dr Khadim Hussain, Hafiz Abdul Haq, Dr Fazal-i-Dayim Shehzad and Mr. Saeed Muhammad	160000
		2	2.5 Provincial Coordinated varietal Trial 1 to 2 To test the performance of candidate varieties from all over Punjab	Mr. Muhammad Akbar, Dr Khadim Hussain, Hafiz Abdul Haq, Dr Fazal-I-Dayim Shehzad and Mr.Saeed Muhammad	80000
		5	2.6 F_1 Hybrids To raise F2 population for further selection according to desirable traits	Mr. Muhammad Akbar, Dr. Khadim Hussain, Hafiz Abdul Haq, Dr. Fazal-I-Dayim Shehzad and Mr.Saeed Muhammad	102000
		5	2.7 F_2 generation Block 1-5 To select the segregates for further Filial generation according the desirable traits.	Mr. Muhammad Akbar, Dr Khadim Hussain, Hafiz Abdul Haq, Dr. Fazal-I-Dayim Shehzad and Mr. Saeed Muhammad	600000
		1	2.8 Early generation seed (Bt) To produce pre-basic seed of approved commercial varieties of CCRI Multan	Dr. Khadim Hussain	33000
		1	2.9 Early generation seed (Non-Bt) To produce pre-basic seed of approved commercial varieties of CCRI Multan	Mr. Muhammad Akbar	35000
		5	2.10 Fresh crosses	Mr. Muhammad Akbar, Dr Khadim Husain, Hafiz Abdul Haq, Dr .Fazal-i-Dayim Shehzad and Mr. Saeed Muhammad	102000
		1	2.11 Maintenance of genetic stock	Hafiz Abdul Haq	600000

OBJECTIVES.

1. Evolution of new varieties equipped with:

High yield potential, High lint percentage, Desirable fibre traits, Resistant/ tolerant to CLCuD, Early maturity, Heat & Drought tolerance, Resistance against insect pest, Wider climatic adaptability.

2. Testing of newly developed cotton strains in NCVT & PCCT.

3. Preservation/maintenance of cotton germplasm.

4. Research publication in National & International journals.

5. Provide facility of germination test to farmers.

6. GMOs testing

7. Collaboration with other research organizations/ Universities

2.1 Testing of New Strains Developed at CCRI, Multan

2.1.1 Varietal Trial-1

Objective		Evaluation of long staple *Bt.* strains against commercial varieties.
Strains	**5**	CM-1 to CM-5
Standards	**2**	IUB-13, *Bt.*CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 40'
Locations	**2**	(Multan, Khanewal)
Year of Expt.		Continuous

2.1.2 Varietal Trial-2

Objective		Evaluation of long staple with high GOT *Bt*. Strains against commercial varieties
Strains	**6**	**CM-6 to CM-11 (6+2 Std)**
Standard	**2**	IUB-13, *Bt.*CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 40'
Locations	**2**	(Multan, Khanewal)
Year of Expt.		Continuous

2.1.3 Varietal Trial-3

Objective		**Evaluation of Virus resistant/tolerant *Bt.* strains against commercial varieties.**
Strains	**08**	CM-12 to CM-19 (8+2 Std)
Standards	**2**	IUB-13, Bt.CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 40'
Locations	**2**	(Multan, Khanewal)
Year of Expt.		Continuous

2.1.4 Varietal Trial-4

Objective		**Evaluation of medium long staple non-Bt. strains against commercial varieties.**
Strains	**08**	CM-20 to CM-27 (8+2 Std)
Standards	**1**	CIM-610
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 40'
Locations	**2**	(Multan, Khanewal)
Year of Expt.		Continuous

2.2.1 Micro-Varietal Trial-1

Objective		Evaluation of newly bulked medium long staple *Bt. S*trains against commercial varieties
Strains	8	1/2020 to 08/2020
Standard	**1**	*Bt.*CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 30'
Year of Expt:		First

2.2.2 Micro-Varietal Trial-2

Objective		Evaluation of newly bulked high lint percentage *Bt.* strains
Strains	**8**	9/2020to 16/2020
Standard	**1**	*Bt.*CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 30'
Year of Expt.		First

2.2.3 Micro-Varietal Trial-3

Objective		Evaluation of newly bulked long staple *Bt*. Strains
Strains	**8**	17/2020to 24/2020
Standard	**1**	*Bt.*CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10'x 30'
Year of Expt.		First

2.2.4 Micro-Varietal Trial-4 (Non Bt)

Objective		Evaluation of newly bulked Non *Bt*. Strains
Strains	**8**	25/2020 to 32/2020
Standard	**1**	CIM-610
Design		Randomized complete block
Repeats	**3**	

Plot Size		10'x 30'
Year of Expt.		First

2.2.5 Micro-Varietal Trial-5

Objective		Evaluation of newly bulked Non *Bt*. Strains
Strains	**8**	33/2020 to 40/2020
Standard	**1**	CIM-610
Design		Randomized complete block
Repeats	**3**	
Plot Size		10' x 30'
Year of Expt.		First

2.2.6 Micro-Varietal Trial-6

Objective		Evaluation of newly bulked strains
Strains	**8**	41/2020 to 48/2020
Standard	**1**	*Bt.*CIM-602
Design		Randomized complete block
Repeats	**3**	
Plot Size		10' x 30'
Year of Expt.		First

2.2.7 Micro-Varietal Trial-7 (Non-Bt)

Objective		Evaluation of newly bulked strains
Strains	**8**	49/2019 to 56/2019
Standard	**1**	CIM-610
Design		Randomized complete block
Repeats	**3**	
Plot Size		10' x 30'
Year of Expt.		First

2.3.1 Standard Varietal Trial-I

Objective		To test the performance of commercial varieties under Multan conditions
Varieties	**7**	CIM-482,CIM-573, CIM-496, Cyto-124, CIM-620 CIM-608, CIM-610
Design		Randomized complete block
Repeats	**3**	
Plot Size		10' x 30'
Year of Expt.		Continuous

2.3.2 Standard Varietal Trial-II

Objective		To test the performance of commercial *Bt*. varieties under Multan conditions
Varieties	**12**	Bt. CIM-600, Bt. CIM-602, Bt. CIM-632, Crystal-12, RH-668,RH-662, NIAB-545, Sahara-150, Sitara-15, FH-142, NIAB-1048, FH-152
Design		Randomized complete block
Repeats	**3**	
Plot Size		10' x 30'
Year of Expt.		Continuous

2.4. Testing of Promising Strains of Cotton Breeders under National Coordinated Variety Testing Programme

2.4.1. National Coordinated Varietal Trial (Set-A)

Objective		To test the performance of *Bt*. strains
Strains		Variable (seed to be provided by PCCC)
Design		Randomized complete block
Repeats	**4**	
Plot Size		10' x 30'
Year of Expt.		Continuous

2.4.2. National Coordinated Varietal Trial (Set-B)

Objective		To test the performance of *Bt*. strains
Strains		Variable (seed to be provided by PCCC)
Design		Randomized complete block
Repeats	**4**	
Plot Size		10' x 30'
Year of Expt.		Continuous

2.4.3. National Coordinated Varietal Trial (Set-C)

Objective		To test the performance of *Bt*. strains
Strains		Variable (seed to be provided by PCCC)
Design		Randomized complete block
Repeats	**4**	
Plot Size		10' x 30'
Year of Expt.		Continuous

2.4.4 National Coordinated Varietal Trial (Set-D)

Objective		To test the performance of *Bt*. strains
Strains		Variable (seed to be provided by PCCC)
Design		Randomized complete block
Repeats	**4**	
Plot Size		10' x 30'

Year of Expt.		Continuous

2.5.1 Provincial Coordinated Cotton Trial-I

Objective		To test the performance of promising *Bt.* strains of the Punjab
Strains		Variable (Seed to be provided by Director, Cotton Research Inst., Faisalabad).
Design		Randomized complete block
Repeats	**3**	
Plot Size		20' x 10'
Year of Expt.		Continuous

2.5.2. Provincial Coordinated Cotton Trial-II

Objective		To test the performance of promising strains of the Punjab
Strains		Variable (seed to be provided by Director, Cotton Research Inst., Faisalabad).
Design		Randomized complete block
Repeats	**3**	
Plot Size		20' x 10'
Year of Expt.		Continuous

2.6. Raising Hybrids.

2.6.1 F_1 Hybrids

Objective		To raise F_2 seed for further selection and screening against CLCuD
Hybrids	**91**	**(H-2203 to H-2293)**
Standard	**1**	*Bt.*CIM-602
Plot Size		Variable
Year of Expt.		First

2.7.1. F_2 Generation Block 1

Objective		To select the desirable segregates and screening against CLCuD
Families	**18**	(H-2053 to H-2070)
Standard	**1**	*Bt.*CIM-602
Plot Size		10' x 50'
Locations	**3**	(Multan & Khanewal)
Year of Expt.		1st

2.7.2 F_2 Generation Block-2

Objective		To select the desirable segregates and screening against CLCuD
Families	**22**	(H-2071 to H-2092)
Standard		*Bt.*CIM-602
Plot Size		10' x 50'
Locations	**3**	(Multan & Khanewal)
Year of Expt.		First

2.7.3. F_2 Generation Block-3

Objective		To select the desirable segregates and screening against CLCuD
Families	**34**	(H-9293 to H-2126)
Standard		*Bt.*CIM-602
Plot Size		10' x 50'
Locations	**3**	(Multan, Khanewal, Kot Addu)
Year of Expt.		First

2.7.4 F_2 Generation Block-4

Objective		To select the desirable segregates and screening against CLCuD
Families	**14**	(H-2127 to H-2140)
Standard		*Bt.*CIM-602
Plot Size		50' x 10'
Locations	**3**	(Multan, Khanewal, Kot Addu)
Year of Expt.		First

2.7.5 F_2 Generation Block-5

Objective		To select the desirable segregates and screening against CLCuD
Families	**23**	(H-2163 to H-2163)
Standard		*Bt.*CIM-602
Plot Size		10' x 50'
Locations	**3**	(Multan & Khanewal)
Year of Expt.		First

2.8 Performance of Promising Strains in Bigger Block

2.8.1 Testing of advanced strains

Objective		To test the performance of advanced strains at Punjab Seed Corporation Farms, Khanewal
Strain	**6**	CIM-717, Bt.CIM-343, Bt.CIM-663,Bt.CIM-303, and Bt.CIM-678, Bt.CIM-789
Plot Size		0.5 hectare
Location		Khanewal
Year of Expt.		First

2.9.1 Selection of single plant from filial generation for high yield potential and CLCuV resistance/tolerance

Objective		Selection of promising single plants to develop further generation (F_3 to F_6)
Families		Variables
Design		Simple
Repeats	**2**	
Plot Size		Variables
Year of Expt.		Continues

2.10. Nucleus Seed Blocks

Objective		To produce pre-basic seed of approved commercial varieties of CCRI, Multan
Varieties	**7**	CIM-496,CIM-506,CIM-554, CIM-573, *Bt* CIM-598, *Bt.*CIM-599, *Bt.* CIM-602
Plot Size		Variable
Year of Expt.		Continuous

2.11.1. Early Generation Seed

Objective		To produce pre-basic seed of approved commercial varieties of CCRI, Multan
Varieties	**4**	CIM-610, CIM-496,CIM-554, CIM-620,
Plot Size		Variable
Year of Expt.		Continuous

2.11.2. Early Generation Seed (*Bt.*)

Objective		To produce pre-basic seed of approved commercial varieties of CCRI, Multan
Varieties	**4**	*Bt* CIM-602, *Bt.*CIM-600, Bt.CIM-632,
Plot Size		Variable
Year of Expt.		Continuous
Year of Expt.		1st

2.12. Fresh Crosses

Objective	Development and widening of genetic base for the inducing desirable traits for evolution of new varieties through: ❖ Direct crosses ❖ Back crosses ❖ Three-way crosses Crosses with exotic material
Year of Expt.	Continuous

2.13. Maintenance of Genetic Stock of World Cotton Collection

Objective	❖ Maintaining of Genetic stock ❖ Exchange of germplasm.
Germplasm	1500
Plot Size	5' x 12'
Year of Expt.	Continuous

2.14. Screening of cotton germplasm for CLCuV resistance/tolerance, economic traits, along with Heat and Drought tolerance

Objective	❖ To use tolerant germplasm in future breeding program
Genotypes	100
Plot Size	5' x 12'
Year of Expt.	Continuous
Collaboration	Pathology & Physiology

2.15. Mutation Breeding

Strains	**3**	Deebal, Bt. CIM598 and Hadi
Mutagens	**2**	Ethyl MethaneSulfonate (EMS), Na Azide
Plot Size		Variable
Locations	**1**	(Multan)
Year of Expt.		1st Year

2.16. Study of Gene Flow in cotton

Strains	**2**	CIM-632, CIM496
Markergenotype	**2**	Russian red leaf & petal spot
Repeats Treatments	**3**	
Plot Size		Variable
Locations	**1**	(Multan)

2. 17. ICARSA Cotton Project Material Screening of US germplasm for CLCuV resistance/tolerance.

Strains	**25+1**	USG-18-4156 to USG-18-4180CIM-496std
Repeats Treatments	**1**	
Plot Size		Variable

Locations	**1**	(Multan)
Year of Expt.		1st Year
Year of Expt.		1st Year

2.18. Coordination with other Sections

Section	Area of research
Agronomy	Agronomic assessment of advanced strains: • Sowing dates • Irrigation • Fertilizer • Spacing
Cytogenetics	Inter specific hybridization
Entomology	Screening of advanced strains for insect pest tolerance
Fibre technology	Testing of breeding material for fibre quality traits
Pathology	Screening of breeding material against CLCuD and other diseases
Physiology/ Chemistry	Screening of advanced strains: • Heat tolerance • Drought tolerance

3. CYTOGENETICS SECTION

3.1 Collection and maintenance of *Gossypium* germplasm

- Thirty-four wild species of *Gossypium* along with 5 diploid, and 5 tetraploid hybrids; 6 triploid and 4 hexaploid hybrids; 2 pentaploid hybrids, 3 tri-species combinations will be maintained
- Utilization of this wider genetic base for hybridization.
- Exotic collection of missing culturable species/ races for strengthening germplasm.

3.2 Interspecific hybridization

3.2.1 Development of new hybrids involving species of different genomes by incorporating specific genes of wild species i.e. CLCuD resistance, drought and resistance or tolerance and fibre quality traits into upland cotton.

The following crossing programme will be attempted depending upon the availability of flowers.

Diploid x Diploid

- *G. arboreum* x *G. gossypioides*
- *G. arboreum* x *G. laxum*
- *G. arboreum* x *G. stocksii*
- *G. arboreum* x *G. somalense*
- *G. arboreum* x *G. areysianum*
- *G. arboreum* x *G. longicalyx*
-

Diploid x Tetraploid

- *G. hirsutum* x *G. capitis viridis*
- *G. hirsutum* x *G. somalense*
- *G. hirsutum* x *G. gossypioides*
- *G. hirsutum xG. laxum*
- *G. hirsutum* x *G. areysianum*

Tetraploid x Tetraploid

- *G.hirsutum* x 2 (*hir.x anomalum*) xG. *hir.*
- *G.hirsutum* x 2(*G.arbo. x G. anomalum*) xG. *hir.*
- 2(*G.hirsutum* x *G. stocksii*) x ^{2}*hir.*

Cytological and morphological studies will be carried out by doubling of chromosomes number where necessary.

Year of Expt: Continuous

3.3. Colchiploidy

Objectives:

- To make the species auto-tetraploid by doubling the chromosome numbers
- *Gossypium somalense*
- *G. hirsutum* x *G. gossypiodes*
- *G. hirsutum* x *G. austral*

Year of Expt: Continuous

a. Seed treatments:

i. 0.01% for 24 hours
ii. 0.05% for 48 hours
iii. 0.10% for 72 hours

b. Shoot Treatments:

i. 0.01 % for 24- hrs
ii. 0.01 % for 48-hrs
iii. 0.01% for 72-hrs
iii. 0.05 % for 24-hrs
iv. 0.05 % for 48-hrs
vi. 0.05 % for 72-hrs
vii. 0.10% for 24 hours
viii. 0.10% for 48 hours
ix. 0.10% for 72 hours

*according to Dhamayanthi and Gotmare, 2010 for the induction of polyploidy in *Gossypium*.

3.4. Search for *Bt* homozygous resistance against CLCuD under field conditions

3.4.1 F_1 Generation

Objective:

To raise F_1 seed for further selection and screening against CLCuD

Methodology:

Hybrids: **80** (1-1/20 to 80-1/20)
Standard: (Cyto-179)
Plot size: Variable
Year of Exp. Continuous

3.4.2 Screening of F_2 material

Objective:

To select the desirable segregates having *Bt.* with concurrent tolerance against CLCuD

Methodology:

Families: **275** (1-2/20 to 275-2/20)
Standard: (Cyto-179)
Plot size: Variable

Year of Exp. Continuous

3.4.3 Screening of F_3 material to obtain homozygous plants

Objective:
To select the desirable segregates having *Bt* gene with tolerance against CLCuD

Methodology:
Families: **380** (1-3/20 to 380-3/20)
Standard: (Cyto-179)
Plot size: Variable
Year of Exp. Continuous

3.4.4. Screening of F_4 material to obtain homozygous plants

Objective:
To select the desirable segregates having *Bt* gene with tolerance against CLCuD
Methodology:
Families: **365** (1-4/20 to 365-4/20)
Standard: (Cyto-179)
Plot size: Variable
Year of Exp. Continuous.

3.4.5. Screening of F_5 material to obtain homozygous plants

Objective:
Testing and screening of promising families in F_5 generation

Methodology:
Families: 425 (1-5/20-425-5/20)
Standard: (Cyto-179)
Plot size: Variable
Year of Exp. Continuous

3.4.6. Screening of F_6 material to obtain homozygous plants

Objective:
Testing and screening of promising families in F_6 generation.
Methodology:
Families: 175(1-6/20-175-6/20)
Standard: (Cyto-179)
Plot size: Variable
Year of Exp. Continuous

3 .5 Testing of Cyto-material in Micro-Varietal Trials.

3.5.1 Micro Varietal Trial-1.

Objective:
Testing of virus tolerant material for economic and fibre quality traits
Treatments:
Strains: 6 (M-1/20 to M-6/20)
Standard: **1** (Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt. 1st

3.5.2 Micro Varietal Trial-2

Objective:
Testing of newly bulked Long staple material for economic and fibre quality traits
Treatments:
Strains: 6 (M-7/20 to M-12/20)
Standard: **2** (Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt. 1st

3.5.3 Micro Varietal Trial-3

Objective:
Testing of newly bulked White fly tolerant material for economic and fibre quality traits
Treatments:
Strains: 6 (M-13/20 to M-18/20)
Standard: **1** (Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt. 1st

3.5.4 Micro Varietal Trial-4

Objective:
Testing of newly bulked early maturing material for economic and fibre quality traits
Treatments:
Strains: 6 (M-19/20 to M-24/20)
Standard: **1** (Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt. 1st

3.5.5 Micro Varietal Trial-5

Objective:

Testing of newly bulked heat tolerant material for economic and fibre quality traits

Treatments:
Strains: 6 (M-25/20 to M-30/20)
Standard: **1** (Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt. 1st

3.6. Testing of Cyto-material in varietal trial-1

3.6.1 `VT-1

Objective:

Testing of new advance B_t strains against commercial varieties

Treatments:
Strains: 6 (V1-V7)
Standard: 2 (FH-142 & Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt.

3.6.2 VT-2

Objective:

Testing of new advance *Bt* strains against commercial varieties

Treatments:
Strains: 7(V8- V14)
Standard: 2 (FH-142 & Cyto-179)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt. 1st

3.6.3 VT-3 (Non *Bt*)

Objective:

Testing of new advance non-*Bt* strains against commercial varieties

Treatments:
Strains: 5(V15-V19)
Standard: **2** (Cyto-124)
Lay-out RCBD
Repeats: 3
Plot size: 30′x10′
Year of Expt.

3.7. Mapping population development for fiber quality

Objectives:

Development of mapping population for fiber quality

Methodology:

Hybrids: Long satlpe x Short satple

Year of Expt. 2nd

F_1 plants will be sown in the field for the enhancement of population.

3.7. Early Generation System

Objective

To produce pre-basic seed of approved commercial varieties

Varieties: 5(Cyto-124, CIM-608, Cyto-177, Cyto-178 & Cyto-179)
Plot Size: Variable
Year of Expt: Continues

3.8 Evaluation of new strain under varied ecological zones

Objective:

1. Strain *Bt*. Cyto-536 will be included in NCVT during cropping season 2019-20 for its adaptability.
Year of Expt. 1st

2. Strain Non-*Bt*. Cyto-227 will be included in NCVT during cropping season 2010-21 for its wider adaptability.
Year of expt. 1st

3.9 Biotechnological Studies

i) Utilization of genes for developing resistance against biotic stresses (insect pests, diseases) and abiotic stresses (drought and nodulation for nitrogen compensation).
ii) Cotton Fiber Culture Technology for fibre development under *in-vitro* aseptic conditions.
iii) Weeds resistance program
iv) Liaison with national and multinationals for biotechnological cooperation (exchange of technologies, gene acquisition, training, collaborative projects).
v) Strengthening of laboratory (manpower, equipments, chemicals & glasswares)

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4. ENTOMOLOGY SECTION

4.1 Studies on Pink Bollworm

4.1.1 Pink bollworm infestation in green bolls in major cotton growing area

Objective:

- To conduct survey for pink bollworm infestation in green bolls.
- Comparison of PBW infestation with previous years.
- Presence of Bt toxin.

Locations : Variable
Year of Expt. : Continuous

Survey timing : **3**
i. September
ii. October
iii. November

Observations:

- Collection of susceptible green bolls from Bt & non-Bt cotton varieties.
- Dissection of collected bolls to record PBW infestation.

Previous Year's Results

Maximum boll infestation and live larvae were found in district Vehari followed by Multan as compared to other districts. Comparatively variety BS-20 seems more vulnerable to pink bollworm infestation.

4.1.2 Studies on inclination of PBW to cotton genotypes

Objective

To assess preference and non-preference of PBW towards different promising genotypes of cotton under field and lab. conditions.

Cultivars : Variable

Field studies
Treatments:
Set-I Untreated
Set-II Plant protection against PBW
Layout : RCBD
Replications : 3
Plot size : 30' x 30'

Lab. studies
Bolls bioassays: 60, 90,120 DAS
Year of Expt. : First

Observations:

- Collection of susceptible green bolls from field at biweekly intervals.
- Record PBW infestation.
- Collection of bolls from glass house for PBW F1 generation bioassays.
- Correlation of mortality with Bt toxin.

4.1.3 Behavioral studies of Pink Bollworm

Objective:

To study behavior and population dynamics of PBW on Bt and non-Bt paired plots.

Year of Expt. : First
Cultivars : 2 Bt and 2 non-Bt
Replications : 3

Methodology:

- Bt 10 rows with non-Bt 1 row
- Bt 1 row with non-Bt 1 row
- Bt
- Non-Bt

Observations:

- Collection of susceptible green bolls from Bt & non-Bt cotton varieties.
- Dissection of collected bolls to record PBW infestation.

4.2 Monitoring of population dynamics of different lepidopterous pests

Objective:

To record fluctuations in the population of different lepidopterous pests of cotton by using sex pheromone and light traps.

Methodology:

- Installation of sex pheromone baited traps for lepidopterous pests at CCRI, Multan and farmer's field at Khanewal for:
  - *Earias* species
  - *Helicoverpa armigera*
  - *Pectinophora gossypiella*
- Installation of light traps for lepidopterous pests at CCRI, Multan for:
  - *Earias* species
  - *Helicoverpa armigera*

- *Spodoptera litura*
- *Spodoptera exigua*

Year of Expt. : Continuous
Observations:

- Recording male moth catches of different lepidopterous pests through sex pheromone baited traps daily at Multan and weekly at farmer's field throughout the year.
- Recording the moth catches through light traps daily throughout the year.

Previous Year's Results

A) Sex pheromone traps

- Overall, increasing population trend was detected in all lepidopterous pests at both locations as compared to last year. Male moth catches of *P. gossypiella, E. vittella, E. insulana, S. litura, S. exigua and H. armigera* were 29.7%, 37.0%, 38.2%, 80.0% 21.0% and 75.5% higher as compared to last year at farmer's field. Comparatively, male moth catches of all the species except *E. insulana* were higher at farmer's field than at CCRI, Multan.

B) Light traps

- Number of moth catches of *E. vittella, E. insulana, S. litura, S. exigua and H. armigera* were 46.7%, 64.2%, 66.7%, 68.9% and 79.7% higher as compared to last year.

4.3 National Coordinated Varietal Trials

Cultivars : Variable
Layout : RCBD
Replications : 3
Year of Expt. : Continuous
Observations:

- Population of sucking pests
- Bollworms infestation and live larval population

Previous Year's Results

A. Non *Bt* strains (Set-A):
Jassid population remained below ETL during growing season on all the tested strains while its intensity was highest on PC-1908. Whitefly population was above ETL during July except on PC-1915, 24, 17, 19, 22, 16 and 10, respectively. During the month of August Whitefly population was below ETL during August on all the testing strains except on PC-1917, 24, 23, 13 and 2, respectively. However, in September whitefly was above ETL level on all the strains except on PC-1906. Overall, its intensity was highest on PC-1901 while lowest on PC-1906. Thrips remained below ETL throughout the season on all the strains while its population was highest on PC-1904 and lowest on PC-1922. Bollworms population remained zero on all the tested strains.

B. *Bt* strains (Set-B): Jassid population was below ETL on all the tested strains during study period. Overall, its intensity was highest on PC-1940 while lowest on PC-1950. Thrip population remained below ETL throughout the season on all the strains except on PC-1941 and 44. Bollworms population remained zero on all the tested strains.

C. *Bt* strains (Set-C): Overall, Jassid population was highest on PC-1956 and 1961. Overall whitefly population was recorded on PC-1957 and lowest on PC-1953. Thrips population remained below ETL during study period on all the tested strains and its intensity was higher on PC-1973 and 63, respectively and lowerest on PC-1951. Bollworms population remained zero on all the tested strains.

D. *Bt* strains (Set-D):
Overall, Jassid population was highest on PC-2002. . Population of whitefly was above ETL during July and September mostly on all the tested strains while population of whitefly was fluctuating on all the tested strains in August. Overall, its intensity was highest on PC-1964 and 1990, respectively. Thrips population observed below ETL during July and August and September on all the tested strains except on 20 02. Overall, its intensity was higher on PC-2002. Bollworms population remained zero on all the tested strains.

4.4 Impact of sowing period on the Dusky cotton bug infestation

Objective:
Quantitative and qualitative intensities of infestation at different sowing period.

Treatment :
Main Plots : Sowing period
1. March
2. April
3. May

Sub plots : 3 Bt & 2 non Bt varieties

Design : Split plot
Replication : 3
Year of Expt.: Continuous

Observation:

- Pest count on all fruiting parts at weekly interval

- Record yield
- Seed Germination
- Fiber parameters
- Oil contents

4.5 Impact of pesticides on the crop physiology/shape/canopy

Objective:

To evaluate non-phytotoxic potential insecticides for management of PBW and whitefly.

Insecticides : Variable
Lay out : RCBD
Replicates : 3
Year of Expt. : First

Observations:

- Plant structure
- Leaf physiology and morphology

4.6 Monitoring of insecticide resistance

Objectives:

- To monitor the levels of resistance in field strains of cotton pests
- To develop management strategies

Year of Expt. : Continuous
Methodology :

- Collection of sucking pests from different locations
- Collection of bollworms from different locations and establishing their culture in the laboratory
- Determining resistance in F1 generation

Previous Year's Results

Amrasca devastans

LC_{50} values were very high for acephate as compared to other tested insecticides in populations of all the locations

Phenacoccus solenopsis

LC_{50} value of pyriproxyfen was comparatively higher as compared to other tested insecticides.

Oxycarenus hyalinipennis

LC_{50} values for actamiprid followed by profenophos found to be very high as compared to other insecticides.

Bemisia tabaci

Results showed moderate to very high LC_{50} values for all the tested insecticides. These LC_{50} values indicate resistance development to the tested insecticides in various locations. Hence, there is a dire need to develop and imply insecticide resistance management (IRM) strategies.

4.7 Screening of new and commercially available insecticides

Objective:

To determine comparative efficacy of new and commercially available insecticides against major insect pests

Insecticides : Variable
Lay out : RCBD
Replicates : 3
Location : CCRI, Multan / Farmer's field
Year of Expt. : Continuous

4.8 Projects (Punjab Agriculture Research Board (PARB))

4.8.1 Studies on Pink bollworm

Activities:

1. Rearing technology
2. Diapausing and cyclic behavior of PBW
3. Efficacy of different insecticides against PBW in field and lab conditions
4. Identification /import and rearing of PBW predators and parasites
5. Impact of pesticides on the crop physiology/shape/canopy
6. Optimum BT toxin required for PBW control in existing cotton varieties.
7. Optimum timing and stage of spray against PBW
8. Topping fifty days before last picking and its impact on PBW infestation
9. Bt Resistance Monitoring

10. Study behavior on BT and non BT paired plots
11. Modelling of PBW epidemiology dynamics
12. Onset of PBW attack
13. Weather variables and relationship of PBW

4.8.2 Studies on Whitefly

1. Rearing Technology
2. Surveys of alternate host plants
3. Planting time evaluation
4. Efficacy of different insecticides against WF in field and lab conditions
5. Varietal screening for Plant resistance against WF
6. Micro-nutrient effects on plant physiology and association with WF incidence
7. Resistance monitoring
8. Identification and evaluation of high quality adjuvants

4.9 Project (ALP)

4.9.1 Studies on dusky cotton bug

1. Monitoring of dusky cotton bug population in relation to crop position and farmers practices in core and noncore cotton zones of the Punjab during cotton period
2. Qualitative and quantitative impact of pest infestation on early and normal sown crop in sprayed and control condition
3. Assessment of losses caused by dusky cotton bug in field controlled cage condition
4. Host plant resistance studies
5. Spray regime with suitable insecticides
6. Insecticide resistance monitoring against dusky cotton bug
7. Screening of insecticides from different groups of commercially available insecticides

5. PLANT PATHOLOGY SECTION

5.1 Survey on Prevalence of Diseases and Collection of Diseased Plant samples

Objective:

i) To estimate the incidence and severity of cotton leaf curl Disease (CLCuD) and other diseases in cotton growing areas.

ii) To collect the diseased cotton plants and other alternate hosts of CLCuV for virologicalstudies.

Detail:

i) Documentation of CLCuD incidence and severity on cotton varieties.

ii) Collection of samples of cotton and other possible alternate hosts of whitefly infected with CLCuV

5.2 Evaluation of NCVT against CLCuD.

Objective

Evaluation of cotton varieties /strains for their reaction to CLCuD and other diseases .

Detail

i) The material developed by the breeding, Cyto-genetics and other stations to be screened against CLCuD.

ii) Confirmation of resistant material for their resistance to CLCuD through petiole-graft-transmission technique.

Year of Experiment: Continuous

Previous Year's Results

i) 213 lines included in NCVT, National Coordinated Hybrid Trial, Bt Trial, PCCT and Standard Varietal Trials, except one line in NCVT all others showed susceptibility to CLCuD under field conditions.

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iii) Out of 48 US germplasm only one line shows highly tolerance to CLCuD under field condition.

5.3 Epidemiological Studies of CLCuD.

Objective:

To findout the factors for incidence and severity progression of Cotton Leaf Curl Disease

A: None Bt Genotypes

Treatments

(a) Sowing Date = 6
[March 01, March 15, April 01,April 15, May 01, May 15]

(b) Genotype = 3
[Cyto-226,Cyto-164 and CIM-610]

Layout : Split plot (main: sowing date)

Repeats : 3

Detail:

i) Data on incidence of disease at fortnightly interval after sowing.

ii) Main stem height

iii) Data on weather parameters

Year of Experiment : Second
(In Collaboration with Agronomy Section)

Previous Year's Results

i) The progression of disease was gradually low on crop planted earlier, whereas the progression was sharply high on crop planted in June.

ii) Average across cultivars, mininmum disease index was recorded on crop planted on 15th April

iii) Averged across sowing time, minimum disease incidence was observed in cv Cyto -164 and Cyto-226 ascompare to CIM-610

iv) Fortnightly increase of disease when compare with weather parameter, it indicates that disease incidence was maximum in 15th May and june 1st planting

v) Maximum temperature 33.6~36.1°C and minimum temperature 23.4 ~ 26.0 with relative humidity 86.8 %~89.1 % favoured the increase of fortnightly increase of CLCD.

B: Bt Genotypes

Treatments

(a) Sowing Date = 6
[March 01, March 15, April 01, April 15, May 01, May 15}

(b) Genotype = 6
Cyto-535,Cyto-533,CIM-785,CIM 775,CIM875,Cyto-179,

Layout : Split plot (main: sowing date)

Repeats : 3

Detail:

i) Data on incidence of disease at fortnightly interval after sowing.
ii) Main stem height
iii) Data on weather parameters

Year of Experiment : Second
(In Collaboration with Agronomy Section)

Previous Year's Results

i) The progression of disease was gradually low on crop planted earlier, whereas the progression was sharply high on crop planted in 15th May.
ii) Average across cultivars, mininmum disease index was recorded on crop planted on 15th March.
iii) Averged across sowing time, all cultivars showed susceptibility against CLCuD Fortnightly increase of disease when compare with weather parameter, it indicates that disease incidence was maximum in 1st May and 15th May planting
iv) Maximum temperature 33.6~36.1°C and minimum temperature 23.4 ~ 26.0 with relative humidity 86.8 %~89.1 % favoured the increase of fortnightly increase of CLCD.

5.4 Evaluation of Advanced Strains in National Co-ordinated Varietal Trial (NCVT) in tolerance to Cotton Diseases.

Objective:

To determine comparative resistance/tolerance of NCVT strains to different diseases of cotton.

Details:

Data on following diseases:

- Stunting
- Cotton Leaf Curl .
- Bacterial Blight
- Wilt
- Boll rot

Year of Experiment Continuous

Previous Year's Results

i) All strains showed susceptibility against CLCuD.except one strain.
ii) In Set A Minimum disease severity was recorded in 1906 and minimum disease index was recorded in 1918.
iii) In Set B All the NCVT strains found highly susceptible to cotton leaf curl disease. Minimum disease incidence and index was recorded in 1942 and. disease severity was recorded in1941
iv) In Set C All the NCVT strains observed highly susceptibility to cotton leaf curl disease. Minimum disease severity and disease index was recorded in 1962 Maximum, disease boll rot incidence(1.8 %) was observed in 1961.
v) In Set D All the NCVT strains found highly susceptible to cotton leaf curl disease except 1987 was highly tolerant. Minimum disease incidence and disease index was recorded in 1987. Maximum CLCuD severity and disease index was observed in 2001
vi) Strains were little affected by stunting and boll rot.

5.5 Studies on cotton seed germination and seedling diseases of cotton.

Objective:

i) Effect of Plasma treatment on seed germination and Seedling diseases of cotton.

Details:

Treat the seeds of cotton with different gasses at different time duration to estimate its effect on seed germination and Seedling mortality.

Year of Experiment: First

5.6 Cotton Leaf curl virus management using Ellelopathic plants extract

Objective:

i) To enhance yield by managing the CLCuD Vector through allelopathic Plants

Details:

i) T1 Neem (Azadirachta indica) seed kernel extracts (20g)
ii) T2 Pyrethrin (Chrysanthemum cinerariifolium) flower extracts (20g)
iii) T3 citronella(lemongrass)extract (20)
iv) T4 Chilli (Ipomoea carnea) extracts (10g)
v) T5 Garlic (Allium sativum L.) extracts (10g)
vi) T6 Tobacco (Nicotiana tabacum) leaf extracts (10g)
vii) T7 Mustard (Brassica nigra) seed extract (20g)
viii) T8 Untreated control
ix) Data of disease incidence and yield

Year of experiment First

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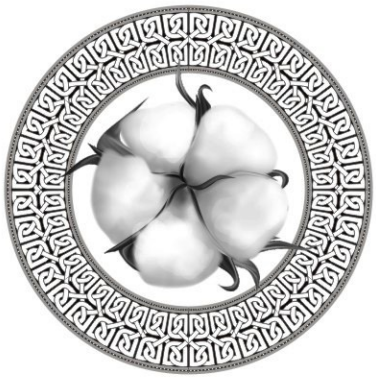

6. PLANT PHYSIOLOGY / CHEMISTRY SECTION

6.1 Studies on genotype - Environment Interactions

6.1.1 Adaptability of genotypes to high temperature stress

Objectives

(i) Comparative performance of promising genotypes under high temperature stress

(ii) To quantify physiological traits contributing to heat tolerance

Treatments

Genotypes : Promising
Planting date : mid-April
Design : RCB
Replications : 3
Year of experiment: Continuous
Observations:

- Physiological traits contributing to heat tolerance
- Seed cotton yield and its parameters.

Previous year's Results

1. A total of 24 genotypes were tested against thermal stress tolerance under field conditions.
2. The genotypes GH-Hamaliya, CRIS-682, CIM-775, NIAB-1011 and Cyto-535 performed better in terms of heat-tolerance by maintaining highest dehiscence of anthers, fruit setting on first and second positions along sympodia and seed cotton production.
3. There were positive relationships of fully dehiscent anthers, pollen viability, percent boll set on 1st and 2nd position along sympodia with seed cotton yield.
4. The parameters such as cell injury, cell membrane thermostability had negative correlations with seed cotton yield.

6.1.2 Evaluation of stress alleviating chemicals in cotton under heat stress conditions

Objectives

i) To improve heat tolerance in variable cotton genotypes by the use of stress alleviating chemicals

ii) To quantify physiological and biochemical traits contributing to heat tolerance

Tr.	Bio-chemicals	Dose
T1	Control	Water alone
T2	Indole-3-acetic acid (IAA)	80mg/L
T3	Hydrogen peroxide (H_2O_2)	30 mg/L
T4	Salicylic Acid (SA)	50 mg/L
T5	Moringa Leaf Extract (MLE)	30 ml/L
T6	Ascorbic Acid	150 mg/L

The experiment will be divided into two sets prior to sowing:
Set-I: Non-heat treated seed
Set-II: Heat treatment of seed
Bio-chemicals will be applied by foliar method

Genotypes : 2
Planting date : mid-April
Design : split-plot
Replications : 3
Year of experiment: 2nd
Observations:

- Physiological traits contributing to heat tolerance
- Seed cotton yield and its parameters

Previous year's Results

1. All six different bio-chemicals tested were found to improve heat tolerance in both CIM-678 and M1-18 cotton genotypes.
2. Maximum yield was obtained in plots where three sprays of Salicylic Acid (SA) @ 50 mg/L were done. Seed cotton yield increased, with SA applications, from 1291 to 1372 kg ha^{-1} in M1-18 and from 1372 to 1650 kg ha^{-1} in CIM-678, respectively.
3. Improvement in yield by SA application was 6.3% in M1-18 and 26.3% in CIM-678 over control.

6.1.3 Characterization of cotton germplasm for heat tolerance

Objective:

- To screen the cotton germplasm for heat tolerance characteristics

Sowing date : mid-April
Design : RCBD
Target entries : 200
Year of experiment: 2nd
Observations:

- Cell injury
- Anther dehiscence

(In collaboration with Breeding Section)

Previous year's Results

Relative cell injury (RCI%) were determined in199 accessions of the cotton genepool entries. On the basis of RCI%, 30 entries were characterized as tolerant, 86 as medium tolerant and 83 as heat sensitive entries.

6.2 Soil Health and Plant Nutrition

6.2.1 Long term effects of reduced tillage on soil health and cotton-wheat/ berseem productivity

Objectives:

i) To evaluate the effects of reduced tillage on soil health and crop productivity
ii) To lower cost of production

Treatments

Cotton - Wheat		Cotton - Berseem	
NT	RT	NT	RT

NT: normal tillage, RT: Reduced tillage

Duration : 5 years
Planting time: mi-April
Area: 1 Acre
Observations:

- Pre-sowing and post-harvest soil analyses
- Crop growth and productivity
- Cost analysis

6.2.2 Does phosphorus application time affect root development and cotton productivity?

Objectives

i) To determine the appropriate time of phosphorus application in cotton
ii) Phosphorus use efficiency in relation to application time

Tr.	Application time		
	Pre-Sowing	25 DAP	50 DAP
T1	0	0	0
T2	50	x	x
T3	x	50	x
T4	x	25	25

Phosphorus dose @ 50 kg P_2O_5/ha

Design : RCBD
Variety : Two
Year of experiment: 2nd
Location : CCRI, Multan
Planting time: mid-April

Observations

- Pre-sowing and post-harvest soil analyses
- Plant structure
- Root growth & development
- Fruit production
- Dry matter yield
- P concentration and uptake by cotton plant
- Seed cotton yield

Previous year's studies

1. P application time showed variable response in both genotypes. Seed cotton yield and its components were improved in plots where delayed and split doses of P were applied. The plot receiving P ½ at 25 DAP & ½ at 50 DAP produced 1997 and 1682 kg ha^{-1} seed cotton, 23 and 15 bolls per plant, 2.29 and 3.22 g boll weight in Cyto-511 and Cyto-535, respectively.
2. Improvement in seed cotton yield in plot that receiving P ½ at 25 DAP and ½ at 50 DAP was 17.6% and 12.5% in Cyto-511 and Cyto-535, respectively as compared to pre-planting P application. Between the genotypes, CYTO-511 produced the maximum seed cotton yield in all treatments.

6.2.3 Improving resource use efficiency and soil health by integrating seasonal crops in cotton

Objectives

i. To increase farm income per unit land area
ii. Efficient utilization of available resources with concurrent improvement in soil health

Treatments

T1	Cotton-sole
T2	Cotton-straw mulch
T3	Cotton-Rice
T4	Cotton-Soybean
T5	Cotton-Cluster bean

Design : RCBD
Variety : 1
Year of experiment: 1st
Location : CCRI, Multan
Sowing time : mid-April

Observations

- Pre-sowing & post-harvest soil analyses
- Plant structure and yield
- Soil temperature
- soil bulk density
- water holding capacity
- Harvest index
- Land equivalent ratio
- Area time equivalent ratio,
- Cotton equivalent yield

6.3 Plant-Water Relationships

6.3.1 Adaptability of genotypes to water stress conditions

Objectives

i) Evaluating the performance of transgenic genotypes under water stress conditions
ii) Quantifying physiological traits contributing to water stress tolerance

Treatments:
Irrigation levels : 2
No stress : [(-1.6 ± 0.2 MPa LWP (ψ_w)]
Water stress : (-2.4 ± 0.2 MPa LWP ψ_w)
Genotypes : Multiple
Design : Split plot (Main: Irrigation levels)
Replications : 4
Year of expt. : Continuous
Location : CCRI, Multan
Sowing time : mid-April
Observations

- Crop growth parameters
- Gas exchange characteristics
- Seed cotton yield and its parameters

- Relative water content
- Water use efficiency
- Fibre quality

Previous year's studies

1. Twelve cotton genotypes were tested under normal irrigation and water deficit stress conditions.
2. The genotypes showed variable response to applied irrigation water levels. Seed cotton yield varied from 1572 to 2417 kg ha^{-1} in normal irrigated crop while the yield ranged from 1007 to 1945 kg ha^{-1} under water deficit condition in different genotypes. Genotype CIM-785 produced the maximum seed cotton yield of 2417 kg ha^{-1} in no stress while the highest yield of 1945 kg ha^{-1} under water stress was produced by GH-Deebal.
3. Imposition of water stress caused an average decrease of 23.2% in seed cotton yield, 9.2% in boll weight and 18.4% in bolls per plant.

6.3.2 Exogenous application of bio-chemicals to improve drought tolerance in cotton

Objectives:

i) To evaluate the role of bio-chemicals in eliminating adverse effects of drought stress

ii) Quantification of drought related parameters influenced by applied bio-chemicals

Design : Split-split plot
Replications : 3
Varieties : 2
Year of expt : 1st
Sowing time : mid-April

Treatments

Tr.	Bio-chemicals	Dose
T1	Control	Water alone
T2	$AgNO_3$	40 µM
T3	ɤ-amino butyric acid	100 µM
T4	Acetic acid	50 mM
T5	Calotrope Leaf Ext.	50 ml/L
T6	Methyl Jasmonate	40 µM

Observations

- Physiological traits
- Water use efficiency
- Fiber traits
- Seed cotton yield

6.4 Seed Physiology

6.4.1 Effect of foliar applied bio-chemicals in improving the cottonseed health and quality

Objective

i) To evaluate the efficacy of applied bio-chemicals on seed health and transgenic cotton production

ii) To quantify physiological and biochemical traits of cotton seed health

Methodology

The experiment will be divided into two sets:
Set-I: Non-heat treatment
Set-II: Heat treatment prior to sowing
(Bio-chemicals will be applied by 3 foliar sprays)

Treatment

Tr.	Bio-chemicals	FS Dose
T1	Control	Water alone
T2	IAA	80 mg/L
T3	Hydrogen peroxide	30 mg/L
T4	Salicylic Acid	50 mg/L
T5	Moringa Leaf Ext.	30 ml/L
T6	Ascorbic Acid	150 mg/L

Design : Split-plot
Replications : 3
Variety : Promising
Date of sowing : Mid, April 2020
Year of Expt. : 1st

Observations

- Plant structure development
- Fruit production
- Seed cotton yield and components
- Seed health parameters

7. TRANSFER OF TECHNOLOGY

7.1 Integrated Multi-Media Publicity Campaign

Objectives : i) Development of multi-media publicity materials on seed technology & cotton production technology.

ii) Use of mass media campaign to disseminate the new technology/research findings to various target groups.

- ♦ Extension workers/staff
- ♦ Cotton growers
- ♦ Field staff of private pesticide / fertilizer / seed industry
- ♦ Students from Agriculture Colleges/ Universities
  - ➢ Staff & farmers working under Non-government organizations(NGO's)

7.1.1 Print Media

A Publications

i) Management of cotton cultivars
ii) Recommendations for better germination of cotton seed
iii) *Kapaas mein Potash ki Ahmiyat*
iv) Management of sucking pests
v) Management of bollworms
vi) Weed management in cotton
vii) Production technology for approved CCRI varieties.
viii) Balanced use of fertilizers
ix) Management of Mealy bug
x) Management of CLCuV
xi) Importance of nozzle for better spray coverage (insecticide & weedicides).
xii) Micronutrients
xiii) Production technology of Bt. cotton
xiv) Clean cotton picking and its storage.
xv) Articles on various aspects of cotton production for newspapers, magazines and journals
xvi) Preparation of technical reports

B Press Releases

Variable.

7.1.2 Electronic Media

A T.V. Programs

i) Participation of scientists/experts in agriculture programs of different channels
ii) TV Tellops
iii) TV Discussion
iv) Video stock-shots of different cultivation practices in cotton.

B Radio Programs

Dissemination of new cotton production technology for cotton growers and other stakeholders by the scientists of the institute through radio programs

C New Studio-Setup

To make a new studio-setup in a recording room

D. Farmers Advisory Committee (FAC)

Fortnightly farmers advisory committee will be continued

Previous Year's Activities

1. سنٹرل کاٹن ریسرچ انسٹیٹیوٹ، ملتان۔۔۔۔ایک تعارف	= 2000
2. *Bt.CIM-343*	= 2000
3.*Bt.CIM-343*	= 2000

Programs	Number
Radio Programs	
Radio Talks	04
Radio Interview	02
Group Discussion	02
Radio News/Press releases	56
TV Programs	
Interview/Programs	35
TV / Press Coverage	17
Meetings / Seminars	
Press releases	56
Articles in newspapers & magazines	09
Press Report	01

7.1 Training Programs

Objectives : Training Programs / Refresher Courses for

i) Cotton Production Technology
ii) Best agronomic practices for cotton production
iii) Soil Fertility & Health
iv) Organic Cotton Cultivation
v) Cotton Mealybug and its Management
vi) "Best Management Practices for Persistent Organic Pollutants"
vii) Weed Management
viii) Advanced breeding techniques for variety evolution
ix) Production Technology of new approved commercial cotton varieties
x) Seed Technologies
xi) Seed Health and nutrient management
xii) integrated pest management
xiii) Management of cotton diseases
xiv) Cotton crop management
xv) Causes of fibre traits deterioration in Pakistan
xvi) Management of PBW & sucking insect pests

7.2 **Target Groups** : i) Officers and staff of the Department of Agriculture Extension
ii) Cotton growers
iii) Technical / Field staff of pesticide, fertilizer & seed industry.
iv) Staff & cotton growers working under NGO's

Activities :

- ♦ Planning, development and execution of training / refresher courses
- ♦ Production for training materials

Previous Year's Activities

Organized/ Coordinated by	Participant	No. of Participants
Agri.(Ext.), Punjab & CCRI ,Multan	Master Trainees	12
Agri.(Ext.), Sindh & CCRI ,Multan	Master Trainees	20
CCRI & SANGTANI, (NGO)	Master Trainees	32
Ministry of Climate Change, UNDP and CCRI Multan	Master Trainees	34
PCSI ,Multan	Cotton Selectors	30
WWF & CCRI	i. Master Trainees ii. Farmers	151 864
WWF Pakistan ,	Master Trainee	50
CCRI & Agriculture Extension Department, Balochistan	i.Master Trainees ii. Farmers	182 90
ILO & CCRI, Multan	Master Trainee Farmers	23 118
CCRI & FFC	i.Master Trainees ii. Farmers	200 1300
Pedaver Foundation (NGO), Lahore & CCRI,Multan	i.Master Trainees ii. Farmers Farmers	10 55 35

7.3 E-mail & face book page CCRI, Multan

- Updating cotton research & development (RD) activities on link www.facebook.com/CCRIM.PK

Email	**: ccri.multan@yahoo.com**
Email sent	> 331
Email received	> 486

7.4 Seminars/Workshops

Participation in seminars, workshops and conferences organized by different institutions:

Previous Year's Activities	
Seminars/ Workshops/Conference	Numbers
Seminars	
i. National	06
iii. Travelling	-
Workshops	02
Conference	02

7.5 Other Activities

i) Making arrangements of meetings, seminars & workshops.
ii) Facilitate the visits of dignitaries and students of different institutions.
iii) Participation in Agricultural Exhibitions.
iv) Social media activities (face book, Whatsapp & YouTube)
v) Use of Infographic technology

Previous Year's Activities	
Meetings	**Presided over by**
Agriculture Research Sub-Committee (ARSC)	Vice President, PCCC
Cotton Crop Assessment Committee	Federal Secretary, Mintex
National Assembly Standing Committee on Textile Industry	Chairman, Standing Committee
Cotton Crop Management Group (04)	i.Minister Agri.Punjab ii.Sec.Agri.Punjab

Visits to Institute

Dignitaries/Delegation	Dated
Mr. Bilal Israel Khan and Mr. Ibrahim Khan progressive cotton farmers	01.03.2019
Haji Irfan Ahmad Khan Daha, former minister and Mr. Muhammad Khan Daha, MNA	08.04.2019
2-member agriculture researchers from Pakistan Agriculture Research Council (PARC)	03.05.2019
Prof Dr Idrees Ahmad Nasir, Head, Seed Biotechnology Research Group from Center of Excellence in Molecular Biology (CEMB), Lahore	20.06.2019
Mr. Arif H. Makhdum, Country Manager and Mr. Toheed Ghani Mahesar, Supply Chain Consultant, Cotton Connect Pakistan	26.08.2019
Mr. Bilal Israel Khan and Mr. Ibrahim Khan progressive cotton farmers	01.03.2019
Dr. Abdul Majeed, Country Manager ICARDA; Mr. Muhammad Arshad, Cotton Consultant and Ms Sameera Younas, Consultant, ICARDA	16.09.2019
The delegation from FAO comprising Ms Jessie Fagan, Decent Rural Employmenet Consultant; Ms Ariane Genthon, Child Labour Expert; Dr. Shakeel Ahmad Khan, Seed Sector Consultant and Mr Jam Muhammad Khalid, Participatory CSA Extension Specialist	25.09.2019
4-member delegation from ICI, Pakistan	05.11.2019
9-member Chinese delegation led by Mr. Wen Wanhe, Group Leader, CMEC International, China	06.11.2019
Dr. Muhammad Anjum Ali, Director General Agriculture (Ext.) Punjab	02.12.2019
Mr. Muhammad Yasin, Cotton Botanist CB from Cotton Research Institute, Khan Pur and its team ; Mr. Taj Muhammad, Assistant Agronomist, Dr. Abdul Khaliq, and Mr. Abdul Raoof, ARO.	10.12.2019
Mr. Manzoor Hussain Soomro, Agriculture Specialist SIAPEP, Hyderabad Sindh; Dr. Abdul Sattar Buriro, Coordinator Exposure	15.12.2019
Makhdum Ahmad Alam Anwar, former chairmanship National Assembly Standing Committee on Agriculture	20.01.2020

Mr. Bilal Israel, Progressive Grower & Dr. Muhammad Shakeel, Entomologist	23.01.2020
Mr. Mirpayoz Mirsaatov, Head, Foreign Economic Relations Department, Uzbekistan Agrotech Trading Company	26.01.2020
Dr. Khalid Abdullah, Vice President, PCCC	27.01.2020
Ms Rabia Sultan, progressive cotton farmer from Muzafargarh	02.02.2020

Institutions	No. of Participants
University of Agriculture, Faisalabad	384
University College of Agriculture, BZU, Multan	27
Agricultural Training Institute, Karor, Layyah	44
Pak German Polytechnic Institute for Agriculture Technology, Chak 5 Faiz, Multan	36
Govt.College of Technology ,Textile department ,DAE	49

Presentations	
Multimedia slides for presentations for Meetings / seminars/Workshops etc	>3407

7.6 Tele-Cotton Activities

Previous Year's Activities	
Tele-Cotton SMS	42
No.of Clients	>22000

7.7 Agriculture Show/ Mela

Previous Years Activity		
Date	**Organized by**	**Venue**
October 9-10,2019	MNSUA,Multan	MNSUA,Multan

8. FIBRE TECHNOLOGY SECTION

8.1 Testing of Lint Samples

Objective:

To provide technical support to various sections of the Institute and other Research Institutes/Stations of public sector and PCCC in testing of the fibre characteristics and spinning of their research material.

Year of Experiment : Continuous

Previous Year's Result	
Departments	**No. of Samples**
Breeding, CCRI, Multan	**42993**
Cytogenetics, CCRI Multan	**17004**
Agronomy, CCRI, Multan	**180**
Fibre Technology, CCRI, Multan	**1828**
Plant Physiology, CCRI, Multan	**285**
Director's research material, CCRI, Multan	**43476**
CCRI, Sakrand	**1914**
CRS, M.P. Khas	**438**
CRS, Ghotki	**558**
CRS, D.I.Khan	**2025**
CRS, Sibbi	**669**
CEMB, Lahore	**105**
Spot Examination, Faisalabad	**270**
Thatha Gurmani Farm	**297**
Quality Survey (Sindh)	**1404**
Quality Survey (Punjab)	**1560**
Director Research Material PCCC, Multan	**462**
Research Scholars (MNSUA)	**96**
Total	**115564**

8.2 Testing of Commercial Samples

Objective:

To extend fibre testing facilities to private sector in testing of lint samples.

576 samples received from private sector for fibre analysis.

Year of Experiment: Continuous

8.3 The effect of bio-chemicals' application on cotton fibre properties to improve drought tolerance

Objective:

To study the effect of bio-chemicals' on Cotton fibre properties in eliminating adverse effects of drought stress

	Bio-chemicals	Dose
1	Control	Water alone
2	$AgNO_3$	40 µM
3	ɤ-amino butyric acid	100 µM
4	Acetic acid	50 mM
5	Calotrope Leaf Ext.	50 ml/L
6	Methyl Jasmonate	40 µM

Water Levels **2 :** No stress (-1.6 ± 0.2 Mpa LWP)
Water stress (-2.4 ± 0.2 MPa WP)

Varieties **:** 2

Biochemical treatments : 6

Design **:** Split –Split plot

Year of expt. **: 1st**

Methodology:

i. Collections of opened bolls.
ii. Ginning of seed cotton samples for various fibre characteristics.
iii. Testing of fibre characteristics

OBSREVATIONS

- Lint (%age)
- Fibre Length
- Uniformity Index
- Micronaire
- Fibre Strength
- Color Grade

(Collaboration: Plant Physiology/Chemistry Section)

8.4 The role of stress alleviating chemicals on cotton fibre characteristics under heat stress conditions.

Objectives

The objective of this study is to evaluate the role of stress alleviating chemicals on cotton fibre characteristics under heat stress conditions.

Treat-ments	Bio-chemicals	Dose
T1	Control	Water alone
T2	Indole Acetic Acid (IAA)	80 mg/L
T3	Hydrogen peroxide (H_2O_2)	30 mg/L
T4	Salicylic Acid (SA)	50 mg/L
T5	Moringa Leaf Extract (MLE)	30 ml/L
T6	Ascorbic Acid	150 mg/L

Bio-chemicals will be applied by foliar method
Genotypes : 2 (M1-18 & CIM 678)
Design : RCB
Year of experiment: 2nd
Methodology:

iv. Collections of opened bolls.
v. Ginning of seed cotton samples for various fibre characteristics.
vi. Testing of fibre characteristics

Observations:

- Lint %
- Fibre Length
- Uniformity Index
- Micronaire Value
- Fibre Strength
- Colour Grade

(Collaboration: Plant Physiology/Chemistry Section)

8.5 Quality survey of lint collected from ginning factories

Objective:

A quality survey will be conducted to know the lint quality of the ginning factories during the cotton season.

Methodology:

- Collection of lint samples from the ginning factories of different districts in Punjab.

Observations:

- Fibre Length
- Uniformity Index
- Micronaire
- Fibre Strength
- Colour Grade

Year of Experiment: Continuous

8.6 ICA-Bremen Cotton Round Test Program, Faser Institute, Germany

Objective:

To keep the fibre testing equipment in calibrated form. Moreover, to examine analysis of fibre at par with other fibre testing facilities in the world.

Detail:

Three lint samples will be received from the Faser Institute, Bremen, Germany. The samples will be tested for different fibre characteristics. The results will be sent to Faser institute, Germany for comparative analysis.

Year of Experiment: Continuous

03 samples were received from Faser Institute, Germany for fibre analysis during the period under report.

8.7 Collaborative Study with Spinning Industry

A: To collect data regarding the consumption of cotton fibre with special reference of the cotton fibre traits and others fibres as well, in industry to focusing the Economics comparatives.

Methodology:

A comprehensive questionnaire will be shared to keeping in-view all the set objectives and industry will be visited to collect the required data.

B: *Development of Artificial neural network-based system for intelligent prediction of the potential of high yielding as well as high quality indigenous cotton varieties/genotypes.

*(Subject to the approval of project)

9. STATISTICS SECTION

9.1 Experimental Design Layout.

Objective:

To make lay out plan for field experiments which will be conducted by different sections of Central Cotton Research Institute Multan. The facility will also be provided to various Research Stations of Pakistan Central Cotton Committee.

Detail:

In collaboration with sections of the institutes lay out plan for different experimental design will be chalked out. Data tables of experiments will be analyzed statistically.

Previous Year's Work	
R.C.B.D.	165
Split-Split Plot.	13
F-Pool	9
Regression.	--
Corelation	--
Graphical Representation	--
Total:	**187**

9.2 Statistical Analysis

Objective:

To perform statistical analysis of experimental data provided by sections of the institute. The analysis facility will also be provided to Cotton Research Stations of PCCC. Guidance will be provided for the interpretation of the analysis.

9.3 Design and analysis of NCVT

Objective:

The Directorate of Research Pakistan Central Cotton Committee performs National Coordinated Varietal Trail at fourteen locations all over Pakistan. The layout of the experiment will be made and analysis will be performed by this section.

Previous Year's Work	
R.C.B.D. (NCVT)	118

9.4 Maintenance of Cotton Statistics

Objective:

To maintain the record of cotton statistics and rates of cotton commodities.

Detail:

The record of cotton statistics and daily rates of cotton commodities will be maintained.

Year: Continuous

Previous Year's Prices (Average Price Rs per 40 Kg at Multan)	
Seed cotton	3892
Cottonseed	1690
Cottonseed Cake	1850
Lint	9470

Source:
Market Committee Multan.
(October 2019 to January 2020)

9.5 Study of factors affecting the cotton lint rate in Pakistan

Objective:

The main objective of this experiment is to identifying different factors and study their relative influence on cotton lint rate.

Year: Second.

9.6 Cost of cultivation for Cotton and major substitutive crops.

Objective:

To study the comparison of per acre cost for production of cotton and its major substitute crops namely Sugarcane, Maize and Sunflower etc.

Year: First.

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