ANNUAL REPORT

OF

COTTON

FOR

THE YEAR 2019-20

COTTON RESEARCH INSTITUTE

MULTAN

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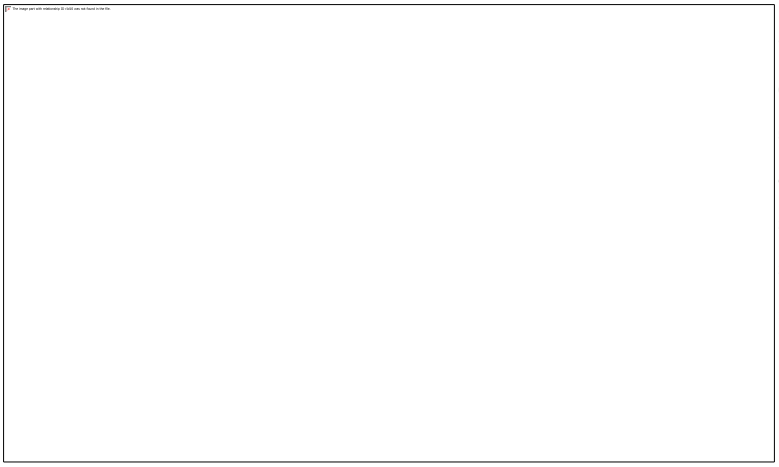
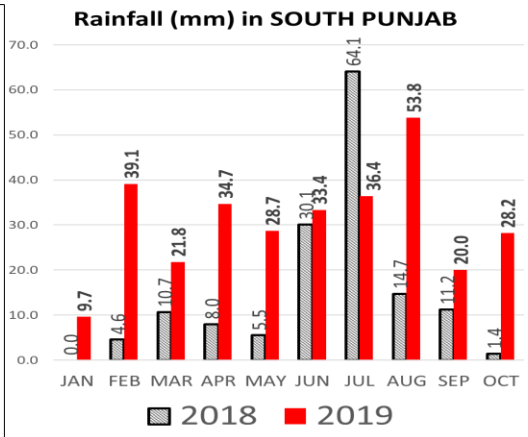
WEATHER





1. BREEDING PHASE

The first step in breeding phase is to create genetic variability subsequently reducing or identifying the environmental effects on the phenotype differences among plants and families can be determined or estimated. The differ se that were covered at CRI Multan during 2019-20 are mentioned as under:

1.1 Maintenance and enrichment of germplasm

Cotton germplasm at CRI, Multan comprised 170 genotypes, (Exotic Lines) =30 and Local Lines=140). Data on morphological and fiber quality parameters were recorded. Salient features of the germplasm are given below:

Table 1.1.1 SALIENT FEATURES OF GERMPLASM AT CRS, MULTAN

Characteristics	CRI Multan
CLCuD Incidence (%)	1-100
Boll Weight (g)	2.4-5.7
No. of Bolls/Plant	08 – 150
Plant Height (cm)	66-215
G.O.T. (%)	38-48
Staple Length(mm)	25.2-34.9
Fibre Fineness	3.7-5.9

(µg/inch)	
Fiber Strength (g/tex)	28.4- 46.2

1.2 STUDY OF FILIAL GENERATIONS

Single plant selections were made from the promising breeding material in different segregating generations (F_1 to F_5) for further testing for seed cotton yield, fiber traits and cotton leaf curl virus disease. The detail of breeding material planted and number of plants selected during 2019-20 is anchored in Table 1.2.1.

Table1.2.1 FILIAL GENERATIONS STUDIED DURING THE YEAR 2019-20

Sr. No.	Generation	Crosses	Plants/Progenies	Design
1	F_1	94	-	Non replicated
2	F_2	26	211	Non replicated
3	F_3	13	41	Non replicated
4	F_4	16	43	Non replicated
5	F_5	7	26	Non replicated
6	F_6	7	19	Non replicated
Total		163	340	

Cotton leaf curl virus incidence, seed cotton yield and fiber quality in filial generations (F_1 to F_5) during the year 2019-2020 is given as under:

Table1.2.2 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_1 GENERATION DURING THE YEAR 2019-2020

SALIENT FEATURES OF F_1 GENERATION DURING THE YEAR 2019-20 at CRI Multan										
Strain No.	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	GOT (%)	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
191007	29.2	108.3	30	3.1	190	59	38.3	28.2	4.7	40
191019	8.2	144.8	32	3.2	170	58	40.3	29.7	4.5	40.6
191021	7.5	69.1	23	3	168	58	40.8	31.4	4.6	33.8
191023	40	80	28	3	165	58	38.2	31.3	3.8	40.9

191032	35.3	107.1	26	3.2	172	59	39.6	29.6	4.8	37.2
191033	37.8	115.1	29	3.3	180	62	39.2	28.2	4.7	35.5
191937	40.1	111.5	31	3.1	175	64	41.2	30.1	4.5	40
191039	32.2	79.5	26	3.1	182	60	40.6	28.2	4.8	40.4
191041	35.7	95.2	31	3.1	190	62	39	28	4.8	37.3
191052	30.2	98.1	32	3.2	180	58	40	28.2	4.7	45
191061	8.9	160.5	46	3.5	195	64	40.8	28.5	4.7	37.3
191063	9.2	83	28	3	170	60	38.7	30.5	4.8	37.2

In F1 CLCuV ranged from 7.5 to 69.6 % and the lowest virus percentage (7.5 %) was recorded for the strain 191021. Number of bolls/plant and boll weight ranged from 15.0 to 46.0, and 2.1 to 3.5g , respectivelly. G.O.T. ranged from 31.6 to 43.0 % . The staple length ranged from 24.2to 31.3 mm. The highest staple length was found in the strain 191023 . The mike (fineness) ranged from 3.8 to 5.4 ug/in. The lowest mike was found in the strain 191023. The staple strength ranged from 33.8 to 43.9 g/tex. The highest staple strength was found in the strain 191045.

Table 1.2.3 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_2 GENERATION DURING THE YEAR 2019-2020

Strain No.	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	GOT (%)	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
192034	13	136	36	3.6	152	31	42.3	32.5	3.5	36.1
192045	10	181	31	3.4	160	30	41.9	32.4	4.2	36.7
192046	12	113	29	3.2	155	30	42.7	32	3.8	38
192047	12	143	32	3.4	147	31	42.1	32.2	4.4	36.7
192021	12	149	35	3.4	148	28	41.2	32.1	4.5	40
192022	10	126	34	3.4	164	29	39.2	32.1	4.2	38.1

192026	11	137	30	3.4	162	30	40.5	32.1	4.2	39.2
192034	16	129	33	3.6	158	31	41.7	32.1	4.5	40.9
192039	18	136	34	3.7	159	33	41.7	32.1	4.4	38.6
192046	11	139	29	3.2	159	31	42.7	32.1	4.5	39.7
192022	9	153	31	3.6	160	29	40.3	32	4.4	40.1
192022	10	171	36	3.5	159	29	38.5	32	4.5	36.2
192023	9	147	34	3.5	148	29	41.2	32	3.7	37.1
192033	14	137	33	3.7	154	32	42.3	32	4.3	38.5
192038	18	139	33	3.7	159	32	41.7	32	4.4	38.6
192045	18	179	33	3.5	163	33	41.7	32	4.2	37.2
192050	11	165	34	3.5	154	31	39.6	32	3.9	36.1
192022	9	150	35	3.6	160	31	41.5	31.9	4.3	40
192041	12	147	33	3.3	150	31	38.9	31.9	4.8	36.1
192063	14	136	30	3.3	153	32	39.7	31.9	4.6	36.5
192085	12	126	32	3.6	143	31	40.2	31.9	3.9	43.5
192202	23	141	37	3.3	154	29	42.7	31.9	4.5	43
192022	10	148	37	3.6	148	31	40.1	31.8	3.9	39.4
192023	10	148	33	3.4	136	30	40.1	31.8	4.6	38.7
192028	14	170	31	3.7	151	29	41.9	31.8	4.7	37.4
192032	14	137	33	3.7	154	32	42.3	31.8	3.7	36.2
192033	13	136	36	3.60	152	31	42.3	31.8	3.7	39.4
192038	16	176	29	3.5	160	30	41.4	31.8	4.7	36
192022	11	124	31	3.4	146	30	39.6	31.7	4	36.3
192157	9	139	34	3.4	150	28	38.9	31.7	4.8	41.7
192189	18	152	38	3.3	161	30	39.6	31.7	4.7	36.1

In F_2 trial CLCuV ranged from 09 to 23 % and the lowest virus percentage (09 %) was recorded for the strain 192018, 192029,192023 and 192172. Number of bolls/plant and boll weight ranged from 29-38, and 3.2 to 4.7g, respectivelly. G.O.T. ranged from 38.5. to 42.7 % .The highest G.O.T. (42.7 %) was found in the strain 192046. The staple length ranged from 31.7 to 32.5 mm. The highest staple length was found in the strain 192034. The mike (fineness) ranged from 3.5 to 4.8 ug/in. The lowest mike was found in the strain 192034. The staple strength ranged from 36.0

-43.5g/tex. The highest staple strength was found in the strain 192085.

Table 1.2.4 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_3GENERATION DURING THE YEAR 2019-2020

strains	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	GOT (%)	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
193003	47.5	91.3	19	4	152	35	40.4	31.4	4.4	32.7
193004	32.5	124.3	23	3.6	126	37	40.1	32.7	4.5	36.2
193006	50	109.2	39	3.9	123	34	38.9	32.2	4.2	33.1
193008	67.5	155.8	18	3.6	114	34	41	32.4	4.7	38.6
193013	42.5	113.3	23	3.8	138	36	41.9	31.2	4.7	30
193015	45	111.7	17	3.3	111	32	41.2	33.4	4.7	41.3
193016	60	84.2	26	4.3	84	28	42.7	32.5	4.7	43.7
193017	10	81.1	21	4.3	81	30	38.1	33.8	4.4	38.3
193022	47.5	119.7	33	3.2	119	33	40.7	32.9	4.6	32.7
193023	40	98.1	48	3.7	98	34	38.2	33.6	4.6	35.5
193029	67.5	116.6	27	3.4	116	32	3.6	30.6	4.5	39
193030	25	106	37	3.8	106	30	41	33.1	4.3	28.5
193032	50	109	16	3	109	28	42.9	29.5	4.5	39.7
193035	50	99.8	21	3.6	99	29	42.5	31.6	4.6	26.5

193037	50	127.3	29	4	127	31	41.7	30.3	3.8	34.3
193038	15	139.3	30	4.3	139	31	38.7	30.6	4	33.8
193040	25	88.5	23	4.2	88	34	38.4	31.4	4.7	29.7

In F_3 trial CLCuV ranged from 10 to 67.5 % and the lowest virus percentage (10 %) was recorded for the strain 193017 followed by 193038(15%). Number of bolls/plant and boll weight ranged from 16-48, and 3.2 0to 4.3g respectively. G.O.T. ranged from 38.1. to 42.9 % .The highest G.O.T. (42.9%) was found in the strain 193032. The staple length ranged from 29.5 to 33.8 mm. The highest staple length was found in the strain 193017. The mike (fineness) ranged from 3.8 to 4.7 ug/in. The lowest mike was found in the strain 193037. The staple strength ranged from 26.5-43.7g/tex. The highest staple strength was found in the strain 193016.

Table 1.2.5(a) SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_4 GENERATION

Strains	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	GOT (%)	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
194001	32.5	108.3	16	2.7	85	39	37	27.1	5.3	34.9
194002	32.5	144.8	14	2.5	93	41	34.1	27.3	4.7	36.5
194003	25	69.1	15	2.9	66	33	35.4	27.9	4.8	35.4
194004	27.5	80	14	3.1	130	44	34.6	28.5	4.7	37.5
194005	35	107.1	15	3	134	45	35.5	27	4.8	31
194006	40	115.1	13	2.9	106	41	34.1	29.2	4.6	35.7
194007	42.5	111.5	15	3.1	115	44	34.6	27.2	4.8	36.4
194008	27.5	79.5	16	2.9	128	47	35.6	27.8	4.7	40.9
194009	25	95.2	20	3	115	41	38.1	28.4	4.7	37.8
194010	32.5	98.1	18	3.2	101	40	33.9	28.5	4.5	42
194011	22.5	160.5	19	3.1	68	36	39.3	27.3	4.9	39
194012	25	83.5	17	3	103	46	35.9	27.9	4.8	33.3
194013	30	108.9	19	3.2	109	45	37	28.3	5.4	33.8
194014	30	189.2	18	3.3	110	44	36	27.7	4.8	39.8
194015	32.5	152.4	12	3.2	100	42	35.5	29.3	5.3	39.6
194016	37.5	149.2	17	3.2	106	42	36.3	30.1	5	39.4
194017	42.5	171.1	18	3.1	101	42	35.5	27.7	5.1	34
194018	52.5	158.9	13	3.3	113	40	34.7	28.4	4.7	33.7
194019	37.5	160.9	17	3.2	96	37	36.2	28.7	4.9	41

Table 1.2.6 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_5 GENERATION

Strain No.	CLCuV DI (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Monp /pl	GOT (%)	Fibre		
									Length (mm)	Fineness (µg/in)	Strength (g/tex)
195012/4	18.9	117	42	4.4	180	165	44	34.4	28.1	4.4	28.4
195008/2	15.3	159.4	52	4.3	175	170	42	35.7	29.7	4.7	28.2
195008/3	11.3	150.8	38	4.5	166	160	52	36.5	28.7	4.9	32.1
195008/5	15.3	123.1	46	4.2	165	185	48	34.9	28.3	4.8	33.3
195008/6	18.5	128.3	30	4.4	175	170	47	37.2	28.4	5.1	36
195008/8	14.2	93	45	4.2	167	177	46	35.3	28.2	4.5	36.8
195008/9	15.6	140.5	48	4.4	184	174	50	34.7	27.7	4.5	30.6
195008/10	30.9	143	38	4.5	188	178	48	37.1	30	4.7	39.8
195008/11	13.6	205.9	55	4.2	184	184	55	36.9	28.6	4.9	31.2
195008/13	15.9	125.8	35	4.4	186	186	56	34.1	31.7	4.2	38.6
195008/14	19.5	187.7	42	4.3	190	190	48	34.3	29.5	4.6	31.4
195008/15A	14.2	163.1	39	4	178	178	47	35.6	29.9	4.3	30.5
195008/15	13.2	213.4	46	4.5	171	171	51	35.9	28.1	4.7	31.7
195008/16	12.3	135.6	42	4.2	188	178	42	34.2	27.6	4.8	34.6
195008/18	14.3	131.3	37	4.2	180	189	48	34.8	28.1	4.7	34.7
195008/19	20.6	170.5	53	4.3	190	190	49	36.7	28.5	4.8	26.1
195008/20	23.2	167.3	48	4.1	164	174	52	36	28.8	4.4	35.6
195008/21	14.1	185.3	50	4.4	155	175	48	36.4	29.3	4.7	35
195008/22	9.5	161.9	41	4.2	170	176	47	36.3	29.5	4.9	34.8
195008/23	13.2	153.6	47	4.2	175	178	46	35.9	29.6	5	30.8
195008/24	21.2	131.2	39	3.7	187	185	47	34.9	28.3	4.9	39.5
195008/25	15.9	181.5	48	4.2	155	180	48	36.6	29.4	4.4	40.8

195008/26	18.2	186.8	51	4.4	171	176	46	35.7	29.5	4.6	36.1

In F_5 CLCuD ranged from 09.5 to 23.2 % and the lowest virus percentage (09.5 %) was recorded for the strain 195008/22. Number of bolls/plant and boll weight ranged from30.0 to 55.0, and 3.7-4.5g, respectively. GOT ranged from 34.2 to37.2 %. The highest GOT. (37.2%) was found in the strain 195008/6. The staple length ranged from 27.6 to29.9 mm. The highest staple length (29.9mm) was found in the strain 195008/15A. The mike (fineness) ranged from4.2 to5.0 ug/inch. The lowest mike (4.2 ug/in) was found in three strains 195008/13. The staple strength ranged from 26.1to 40.8/tex. The highest staple strength (40.8/tex) was found in the strain 195008/25. The best harmonious combination was 195008/02, 195008/08, 195008/13, 195008/25 respectively.

1.3 STUDY OF FILIAL GENERATIONS OF INTERSPECIFIC MATERIAL UNDER COMMISSIONED RESEARCH

Table1.1.3.1 SALIENT FEATURES OF COMMISSIONED RESEARCH F_2 GENERATION DURING THE YEAR 2019-2020

Strain No.	CLCuV DI (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Mon /pl	GOT (%)	Fibre		
									Length (mm)	Fineness (µg/in)	Strength (g/tex)
192001	14.3	135.5	45	4.3	142	50	3	40.2	30.5	4.1	32.5
//	13.5	124.2	46	4.2	131	48	2	40.0	29.6	4.0	35.3
//	16.2	142.2	42	4.3	145	44	3	41.1	29.9	4.6	36.6
//	15.6	96.2	39	4.1	132	45	2	41.1	30.0	4.2	40.4
//	15.8	112.2	43	4.4	135	39	3	41.7	30.2	4.0	35.4
//	14.6	102.2	50	4.2	155	42	2	44.7	29.3	4.2	35.1
192005	37.9	88.3	42	4.1	145	52	2	43.1	28.2	4.7	41.7
//	45.2	81.3	38	4.1	134	48	3	42.6	29.4	4.2	48.6
//	40.9	96.2	30	3.9	138	49	2	40.2	29.6	4.4	32.1
//	14.5	121.2	41	3.8	135	44	3	40.2	28.0	4.5	38.1
//	15.2	90.2	50	4.2	129	41	3	40.2	29.2	4.6	36.3
192013	28.5	130.5	39	4.1	164	46	4	40.3	29.4	4.1	43.4
//	39.2	142.2	38	4.3	152	47	3	40.2	29.7	4.7	42.1
192017	28.5	99.2	43	3.8	144	42	3	40.2	29.5	4.6	33.1
//	15.1	98.3	36	3.9	136	40	2	40.2	30.1	4.2	39.1
//	15.3	132.2	56	3.8	140	39	2	42.8	30.8	3.8	34.2
//	18.2	96.3	38	4.2	134	38	2	40.1	28.8	4.3	35.7
192036	13.2	86.3	45	4.6	149	46	3	40.1	28.1	4.8	32.8

//	27.9	80.2	41	4.5	140	45	3	40.2	28.6	4.7	32.2
//	38.9	88.2	42	4.2	141	47	2	41.8	28.9	4.4	35.2
//	18.2	80.2	35	3.5	126	42	2	41.9	29.5	4.6	40.3
//	15.2	85.6	33	4.2	138	45	3	41.5	28.5	4.7	34.4
192038	19.8	120.0	39	4.5	135	38	3	40.2	28.8	4.5	37.5
192044	15.9	142.2	41	4.4	141	39	3	40.1	28.3	4.7	32.8
192056	18.2	98.2	39	4.2	135	38	2	40.1	28.5	4.6	35.7
//	20.5	89.2	38	4.1	130	41	3	40.2	29.6	4.3	35.4
192057	16.3	98.2	32	3.9	141	40	2	41.2	28.8	4.1	32.5
//	55.5	86.3	38	4.2	136	41	2	40.2	28.7	4.6	42.1
192068	19.6	88.2	34	3.8	145	40	2	40.1	28.1	3.9	37.7
//	18.6	87.3	40	4.2	140	42	3	40.2	28.9	4.2	32.7
MNH-886	**45.4**	**92.3**	**35**	**4.2**	**156**	**44**	**3**	**40.3**	**28.2**	**4.8**	**32.1**

In F_2 CLCuD ranged from 13.2 to 55.5 % and the lowest virus percentage (13.2 %) was recorded for the strain 192036. Number of bolls/plant and boll weight ranged from 30.0 to 56.0, and 3.5-4.6g, respectively. GOT. ranged from 40.0 to 44.7 %. The highest GOT. (44.7 %) was found in the strain 192001. The staple length ranged from 28.0 to 30.8 mm. The highest staple length was found in the strain 192017. The mike (fineness) ranged from 3.8 to 4.8 ug/inch. The lowest mike (3.8ug/in) was found in the strain 192017. The staple strength ranged from 32.1 to 48.6 g/tex. The highest staple strength (48.6 g/tex) was found in the strain-192005. The best harmonious combination were observed in192001,192013,192017 respectively.

Table1.1.3.2 SALIENT FEATURES OF COMMISSIONED RESEARCH F_3 GENERATION DURING THE YEAR 2019-2020

Strain No.	**CLCVDI (%)**	**Yield/Pl (g)**	**Bolls/pl**	**Av. Boll weight (g)**	**Plant Height (cm)**	**Node/pl**	**Monp /pl**	**GOT (%)**	**Fibre**		
									Length (mm)	**Finenes (µg/in)**	**Strength (g/tex)**

193001	18.9	98.2	46	4.2	165	38	3	41.2	28.9	4.6	35.6
//	15.2	135.4	37	4.3	156	42	2	40.1	28.6	4.4	41.2
//	18.3	112.6	42	4.4	156	44	2	41.1	28.1	4.7	34.7
//	15.2	85.2	40	4.1	153	38	2	41.8	28.0	4.2	38.9
//	15.2	89.3	45	4.2	150	41	2	40.2	28.2	4.8	32.2
//	19.5	121.2	57	4.5	142	39	2	40.2	28.7	4.1	36.1
//	18.5	98.3	38	4.5	165	38	3	41.5	28.9	3.8	34.1
193004	22.2	125.3	44	4.4	160	36	2	40.2	28.2	4.4	32.1
//	18.3	98.3	43	4.2	155	34	3	44.1	28.2	4.0	37.3
193011	16.2	85.6	42	4.4	205	46	2	40.2	30.9	4.5	32.6
//	19.2	88.6	38	4.2	189	46	3	42.3	30.5	4.6	32.3
//	12.0	96.3	46	4.2	190	42	2	41.2	30.1	4.2	34.4
//	18.2	98.2	47	4.1	185	46	3	40.0	31.1	3.9	34.4
//	16.3	124.6	39	4.1	178	46	4	42.5	29.6	3.6	33.4
//	14.2	85.6	40	4.2	186	42	3	40.2	31.5	4.4	38.9
//	12.3	136.2	41	4.2	200	47	3	44.2	29.1	4.7	32.6
//	13.2	120.2	39	4.4	186	46	3	40.1	30.0	4.7	32.9
//	15.6	90.2	38	3.9	185	50	2	40.1	30.0	4.7	37.8
//	12.8	125.3	39	4.1	178	46	2	40.3	29.9	4.4	36.1
193017	14.2	132.1	37	4.2	165	38	2	41.2	29.1	4.3	32.9
//	15.2	89.6	39	4.2	164	41	3	41.6	28.2	3.5	32.3
//	13.5	96.2	36	4.4	156	42	2	40.1	28.7	4.0	42.2
//	14.2	85.3	37	4.3	176	39	2	44.8	28.7	3.6	32.8
//	18.3	80.3	42	4.4	160	38	3	41.2	28.2	4.4	33.5
//	15.0	120.3	41	4.3	175	45	3	42.7	28.3	4.6	33.8
//	20.6	95.2	44	4.5	178	44	2	42.2	28.1	4.4	34.3
193018	45.2	90..2	35	4.2	142	34.	3	41.1	28.9	4.9	37.1

//	25.2	115.2	38	4.2	156	32	2	42.3	28.1	4.8	32.6
//	24.2	89.6	42	3.6	140	35	3	40.2	28.6	4.7	32.1
193034	19.3	86.3	39	4.1	146	34	3	43.1	29.4	3.8	37.1
//	25.3	85.2	44	4.2	145	36	2	41.2	29.4	3.9	35.2
MNH-886	**48.3**	**102.3**	**46**	**4.1**	**140**	**37**	**2**	**43.3**	**30.1**	**4.1**	**33.2**

In F_3 CLCuD ranged from 12.0 to 45.2 % and the lowest virus percentage (12.0 %) was recorded for the strain 193011.Number of bolls/plant and boll weight ranged from 35.0 to 57.0, and 3.6-4.5g, respectively. GOT. ranged from 40.0 to 44.8 %. The highest GOT. (44.8%) was found in the strain 193017. The staple length ranged from 28.0 to 31.5mm. The highest staple length (31.5mm) was found in the strain 193011. The mike (fineness) ranged from 3.5 to 4.9 ug/in. The lowest mike (3.5ug/inch) was found in the strain 193017. The staple strength ranged from 32.1 to 42.2 g/tex. The highest staple strength (42.2 g/tex) was found in the strain 193017. The best harmonious combination were observed in 193001,193011,193017,193034, respectively.

Table1.1.3.3 SALIENT FEATURES OF COMMISSIONED RESEARCH F_4 GENERATION DURING THE YEAR 2019-2020

Strain No.	**CLCuV DI (%)**	**Yield/Pl (g)**	**Bolls/pl**	**Av. Boll weight (g)**	**Plant Height (cm)**	**Node/pl**	**Monp /pl**	**GOT (%)**	**Fibre**		
									Length (mm)	**Fineness (µg/in)**	**Strength (g/tex)**
194001	19.2	145.2	38	4.5	170	42	2	45.3	29.8	4.3	32.7
//	18.5	96.2	40	4.3	165	44	2	40.1	30.1	4.2	34.6
//	16.9	120.1	34	4.3	156	52	3	42.3	30.8	4.1	35.5
194002	12.6	115.3	41	4.2	185	48	2	40.1	28.5	4.2	32.4
//	14.2	96.3	52	4.4	175	47	3	44.8	28.4	4.5	35.1
//	16.2	86.3	43	4.2	177	46	4	40.1	29.2	4.6	33.9
//	16.2	123.0	46	4.2	174	50	3	41.3	29.3	4.2	40.6

//	15.2	130.6	38	4.5	178	48	3	40.9	28.4	4.2	43.1
//	38.5	142.3	49	4.4	184	55	2	40.1	28.6	4.2	38.8
//	8.6	95.2	42	4.1	186	56	2	40.1	28.7	4.1	32.1
//	20.9	86.3	33	4.1	190	48	3	40.2	29.4	4.6	32.7
194003	19.5	85.6	46	4.5	178	47	2	40.1	29.5	3.6	40.9
//	12.6	112.3	42	4.4	171	51	2	41.7	29.8	3.8	35.1
//	15.2	124.3	35	4.4	178	42	3	42.2	28.4	4.2	36.6
//	12.0	160.2	31	4.2	189	48	3	40.5	29.7	3.9	40.6
//	12.3	145.2	33	4.3	190	49	2	40.1	28.1	4.1	32.8
//	10.5	132.2	30	4.4	174	52	2	40.0	28.2	4.2	42.5
//	14.5	124.2	34	4.1	175	48	3	40.2	29.4	3.9	44.1
//	15.2	120.2	31	4.2	176	47	3	41.6	29.0	3.9	36.2
//	28.5	110.0	38	3.7	178	46	2	40.2	28.6	4.1	45.6
//	15.6	92.3	39	4.4	185	47	3	43.2	28.5	4.2	43.1
//	18.3	95.2	47	4.2	180	48	2	43.1	28.4	4.0	36.2
//	20.2	90.1	42	4.2	182	52	2	43.1	29.5	3.8	43.2
//	14.3	96.2	47	4.4	186	53	2	41.2	28.4	3.8	45.2
//	18.9	88.6	44	4.5	190	56	3	42.1	28.5	3.9	35.9
MNH-886	22.3	85.2	42	4.4	98	45	2	40.2	28.9	4.8	32.9

In F_4 CLCuD ranged from 8.6 to 38.5 % and the lowest virus percentage (8.6 %) was recorded for the strain 194002. Number of bolls/plant and boll weight ranged from 31.0 to 52.0, and 3.7-4.5g, respectively. GOT. ranged from 40.0 to 45.3 %. The highest GOT. (45.3%) was found in the strain 194001. The staple length ranged from 28.1 to 30.8mm. The highest staple length (30.8mm) was found in the strain 194001. The mike (fineness) ranged from 3.6 to 4.6 ug/in. The lowest mike (3.6ug/inch) was found in three strains 194003.The staple strength ranged from 32.1 to 45.6 g/tex. The highest staple strength (45.6 g/tex) was found in the strain 194003. The best harmonious

combination were observed 194001,194002,193003, respectively.

Table1.1.3.4 SALIENT FEATURES OF COMMISSIONED RESEARCH F_5 GENERATION DURING THE YEAR 2019-2020

Strain No.	CLCuV DI (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Monp /pl	GOT (%)	Fibre		
									Length (mm)	Fineness (µg/in)	Strength (g/tex)
195001	18.9	130.3	45	5.0	195	52	2	43.5	30.1	4.1	33.6
//	15.3	142.3	35	4.8	140	54	3	40.2	30.1	4.2	40.4
//	11.3	130.2	42	4.9	150	45	2	44.5	31.0	4.2	35.2
195004	15.3	112.3	44	4.5	160	42	3	42.2	29.1	4.6	32.5
//	18.5	125.3	47	4.4	170	52	2	42.4	29.2	4.1	33.4
//	14.2	96.3	38	4.4	130	48	2	42.2	29.0	4.1	36.2
195007	15.6	120.2	48	4.3	130	53	1	40.2	28.4	4.2	36.2
//	30.9	98.2	41	4.4	132	46	2	42.2	29.0	4.4	35.2
195011	13.6	102.3	42	4.2	180	42	3	40.2	30.4	4.3	34.3
//	15.9	96.3	45	4.3	137	44	3	42.2	30.1	4.3	35.2
//	19.5	88.3	38	4.1	190	52	2	42.2	30.5	4.1	33.4
195018	14.2	90.2	38	4.2	136	42	2	41.8	30.4	4.8	33.0
//	13.2	112.1	47	4.1	180	46	3	43.1	29.2	4.5	35.2
195029	12.3	100.0	44	4.1	130	40	3	40.1	29.1	4.2	34.1
//	14.3	95.2	42	4.1	140	39	2	42.2	29.5	4.2	32.1
195030	20.6	96.3	52	4.2	140	38	2	40.2	29.3	4.1	34.3
//	23.2	125.3	56	4.1	185	46	2	40.1	29.5	3.8	34.6
195031	14.1	110.2	60	4.1	139	42	2	41.2	29.4	4.1	35.1
//	9.5	16032	58	4.2	190	52	3	43.5	29.6	4.0	34.2

//	13.2	178.3	55	4.3	185	56	2	42.2	29.8	4.0	35.1
MNH-886	21.2	115.2	46	4.2	192	52	3	40.2	28.2	4.8	32.0

In F_5 CLCuD ranged from 9.5 to 30.9 % and the lowest virus percentage (9.5 %) was recorded for the strain 195031. Number of bolls/plant and boll weight ranged from 35.0 to 60.0, and 4.1-5.0g, respectively. GOT. ranged from 40.1 to 44.5 %. The highest GOT. (44.5%) was found in the strain 195001. The staple length ranged from 28.4 to 31.0mm. The highest staple length (31.0mm) was found in the strain 195001. The mike (fineness) ranged from 3.8 to 4.8 ug/inch. The lowest mike (3.8ug/in) was found in three strains 195030. The staple strength ranged from 32.1 to 40.4 g/tex. The highest staple strength (40.4 g/tex) was found in the strain 195001. The best harmonious combination was 195001,195029,195030,195031 respectively.

The out-standing harmonious combination of Fillials under Commissioned Research at CRI, Multan during 2019-20

F_2						
Family No	**CLCuV %**	**G.O.T. (%)**	**S.L. (mm)**	**Mic (µg/inch)**	**Fiber Str. (g/ tex)**	**Boll weight (g)**
192001	15.6	41.1	30.0	4.2	40.4	4.3
//	15.8	41.7	30.2	4.0	35.4	4.4
192013	18.5	40.3	29.4	4.1	43.4	4.1
//	24.2	40.2	29.7	4.4	42.1	4.3
192017	28.5	40.2	29.5	4.6	38.1	4.2
//	15.1	40.2	30.1	4.2	39.1	4.1
//	15.3	42.8	30.8	3.8	34.2	4.0
MNH-886	**45.2**	**40.3**	**28.2**	**4.8**	**33.2**	**4.1**
F_3						
Family No	**CLCuV**	**G.O.T.**	**S.L.**	**Mic**	**Fiber Str.**	**Boll weight**

	%	(%)	(mm)	(µg/inch)	(g/ tex)	(g)
193001	15.2	41.8	29.5	4.2	38.9	4.1
//	19.5	40.2	29.7	4.1	36.1	4.5
193011	18.2	40.0	31.1	3.9	38.4	4.1
//	14.2	40.2	31.5	4.4	38.9	4.2
193017	14.3	41.2	29.8	4.3	36.9	4.2
//	15.2	41.6	29.6	3.5	32.3	4.2
13034	19.3	43.1	29.4	3.8	37.1	4.1
//	25.3	41.2	29.4	3.9	35.2	4.2
MNH-886	**35.2**	**41.2**	**28.5**	**4.8**	**32.4**	**4.1**
F_4						
Family No	**CLCuV %**	**G.O.T. (%)**	**S.L. (mm)**	**Mic (µg/inch)**	**Fiber Str. (g/ tex)**	**Boll weight (g)**
194001	19.2	45.3	29.8	4.3	38.7	4.5
//	18.5	40.1	30.1	4.2	34.6	4.3
//	16.9	42.3	30.8	4.1	35.5	4.3
194002	16.2	40.1	29.2	4.6	36.9	4.2
//	18.3	41.3	29.3	4.2	40.6	4.2
194003	19.5	40.1	29.5	3.6	40.9	4.5
//	12.6	41.7	29.8	3.8	35.1	4.3
MNH-886	**38.2**	**40.2**	**28.3**	**4.9**	**35.4**	**4.2**
F_5						
195001	18.9	43.5	30.1	4.1	36.6	5.0
//	15.3	40.2	30.1	4.2	40.4	4.8
//	11.3	44.5	31.0	4.2	35.2	4.9
195011	13.6	42.2	30.1	4.3	35.2	4.2
//	15.9	42.2	30.5	4.1	36.8	4.3
//	19.5	41.8	30.4	4.8	33.0	4.1
195029	12.3	40.1	29.6	4.2	34.1	4.1
//	14.3	42.2	29.5	4.2	34.5	4.2

195030	12.3	42.2	29.5	4.2	34.5	4.1
//	14.3	40.2	29.3	4.1	34.3	4.2
195031	14.1	43.5	29.6	4.0	34.2	4.1
//	9.5	42.2	29.8	4.0	35.1	4.2
//	13.2	40.2	28.2	4.8	32.0	4.3
MNH-886	**56.2**	**39.8**	**28.6**	**4.8**	**36.4**	**4.3**

3. EVALUATION PHASE

3.1 PRELIMINARY YIELD TRIALS

The objective of Preliminary Yield Trial (PYT) is to evaluate 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 virus disease. Cultivars at this stage were subjected to a reduced selection pressure and the selected lines were progressed to the Advanced Yield Trials. During year 2019-2020, 32 lines/strains were planted in 4 PYTs with different genotypes per trial along with one standard variety (MNH-886, IUB-13). Detailed results of each PYT are given below:

Table 2.1.1PERFORMANCE OF PROMISING STRAINS IN PYT-1DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		Fibre			
						Flower	Open boll	GOT (%)	Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-121	14.1	2512	41.2	4.2	181.5	45	86	41.2	31.5	4.3	39.8
CRI-122	10.2	1689	39.4	4.4	184.2	48	90	44.3	30.6	4.6	34.2
CRI-126	20.3	1875	38.4	4.5	190.4	50	85	41.2	29.7	4.3	35.7
CRI-127	12.1	1536	45.6	4.3	194.5	47	91	42.1	29.2	4.1	36.7
CRI-129	26.2	2021	35.3	4.4	190.6	56	89	40.1	30.3	4.2	36.1
CRI-131	16.1	1815	34.2	4.6	189.3	49	88	39.8	29.4	4.5	34.1
CRI-134	34.1	1426	41.2	4.5	200.3	56	84	40.1	29	4.8	32.1
CRI-136	21.2	1720	42.3	4.3	195.4	53	86	41.1	30.1	4.2	39.2
MNH-886	**45.6**	**1578**	**42.5**	**4.1**	**198.8**	**45**	**90**	**40.2**	**28.5**	**4.2**	**32.1**
The result of statistical analysis of yield is significant at (P< 0.05). Eight strains viz., CRI-121, CRI-122, CRI-											

126, CRI-127, CRI-129, CRI-131, CRI-134, CRI-136 along with one standard MNH-886 were tested for yield and fiber characteristics. CRI-121 produced highest yield (2512 kg/ha) followed as compared with standard MNH-886 (1578 kg/ha). As per GOT is concerned, the strain CRI-122 has maximum GOT i.e., 44.3% followed by CRI-127 having 42.1% GOT as compared with standard MNH-886 (40.2%). In case of staple length, the strain CRI-121 have maximum staple length (31.5 mm) followed by the strain CRI-122 with 30.6 mm staple length as compared with standard having 28.5 mm staple length. The lowest virus disease intensity (10.2%) was found in strain CRI-122 followed by CRI-127 having 12.1% CLCuD as compared with standard having 45.6 % CLCuD.

Table 2.1.2PERFORMANCE OF PROMISING STRAINS IN PYT-2 DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		Fibre			
						Flower	Open boll	GOT (%)	Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-121	14.1	2512	41.2	4.2	181.5	45	86	41.2	31.5	4.3	39.8
CRI-122	10.2	1689	39.4	4.4	184.2	48	90	44.3	30.6	4.6	34.2
CRI-126	20.3	1875	38.4	4.5	190.4	50	85	41.2	29.7	4.3	35.7
CRI-127	12.1	1536	45.6	4.3	194.5	47	91	42.1	29.2	4.1	36.7
CRI-129	26.2	2021	35.3	4.4	190.6	56	89	40.1	30.3	4.2	36.1
CRI-131	16.1	1815	34.2	4.6	189.3	49	88	39.8	29.4	4.5	34.1
CRI-134	34.1	1426	41.2	4.5	200.3	56	84	40.1	29	4.8	32.1
CRI-136	21.2	1720	42.3	4.3	195.4	53	86	41.1	30.1	4.2	39.2
MNH-886	**45.6**	**1578**	**42.5**	**4.1**	**198.8**	**45**	**90**	**40.2**	**28.5**	**4.2**	**32.1**

The result of statistical analysis of yield is (non significant). Eight strains viz., CRI-206, CRi-207, CRI-208,CRI-209, CRI-210, CRI-211, CRI-212 and CRI-213.CRI-212 produced highest yield (1459 kg/ha) as compared with standard MNH-886 (801 kg/ha). As per G.O.T. is concerned, the strain CRI-208 has maximum G.O.T. i.e.,38.2 % followed by CRI-210 having 37.7% G.O.T as compared with standard MNH-886 (36.3%). In case of staple length, the strain CRI- 212 has maximum staple length (29.9 mm) followed by the strain CRI-210 with 29.1 mm staple length as compared with standard having 26.6 mm staple length.The lowest virus disease intensity (4.0%) was found in strain CRI-208 followed by CRI-206 having 6.0 % CLCuD as compared with standard having 17.0 % CLCuD.

Table 2.1.3PERFORMANCE OF PROMISING STRAINS IN PYT-3 DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st		GOT (%)	Fibre		
							Flower	Open boll		Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-214	27.5	1327	38	3	113	37.6	56	97	40.3	28.2	4.6	36.1
CRI-215	20	1363	35	3.1	98	36.2	55	98	40	32.2	4.7	45.4
CRI-216	30	1193	30	3	77	31.8	57	99	40.1	29.5	5	40.5
CRI-217	32.5	1399	41	3.3	110	39.6	56	100	40.5	30.1	5.1	30.3
CRI-218	30	1580	39	3.4	157	41.1	58	101	38.8	29.4	4.1	37.6
CRI-197	25	1516	37	3.4	106	36.8	56	97	37.1	32.4	4.8	41.3
CRI-190	37.5	1130	28	3.3	90	37.7	59	102	42.8	28.2	5.5	36.7
CRI-191	27.5	1309	36	3.6	82	33.8	60	104	40.1	34.4	5.6	45.6
MNH-886	40	1489	28	3.6	82	34.4	54	95	36.2	28.2	5.7	36.8

The result of statistical analysis of yield is (non-significant). Eight Strains viz., CRI-214, CRI-215, CRI-216, CRI-217, CRI-218, CRI-197, CRI-190, CRI-191 along with one standard (MNH-886) were tested for yield and fiber characteristics. CRI- 197 produced highest yield 1616kg/ha) followed by CRI-218 1580kg/ha) as compared with standard MNH-886 (1489kg/ha). As per G.O.T is concerned, the strain CRI -190 has maximum G.O.T. i.e., 42.8% followed by CRI-217 having 40.5% G.O.T as compared with standard MNH-886 (36.2%). In case of staple length, the strain CRI-191 has maximum staple length (34.4mm) followed by strain CRI-197 with 32.4 mm as compared with standard having 28.2 mm staple length. The lowest virus disease intensity (20.0%) was found in strain CRI-215 followed by CRI-197 having 25.0%CLCUD as compared with standard having 40.0% CLCUD.

Table 2.1.4PERFORMANCE OF PROMISING STRAINS IN PYT-4 DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st		GOT (%)	Fibre		
							Flower	Open boll		Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-219	20	1365	32	3	131	48	43	79	39.9	31	4.1	40.6
CRI-220	30	1030	27	3.1	72	35	42	78	42.1	30.7	4.4	39.2

CRI-221	35	731	20	3.2	77	39	43	79	38.4	33.5	3.7	29.6
CRI-222	40	1078	25	3.3	113	43	45	83	46.7	30	4.8	36
CRI-223	22.5	1437	35	3.5	97	43	47	84	41.6	30.6	4.7	34.9
CRI-224	27.5	1353	31	3.5	129	48	49	84	41.6	30.4	4.1	35.9
CRI-225	25	1616	38	3.3	108	42	50	84	42	28.6	5	35
CRI-226	30	1867	41	3.6	123	38	51	85	42.2	29.8	5.1	32.8
IUB-2013	45.5	1365	35	3.2	82	40	53	85	41.2	26.2	5.4	33.9

The result of statistical analysis of yield is (highly significant). Eight strains viz., CRI-219,CRI-220,CRI-221, CRI-222 , CRI-223,CRI-224,CRI-225,CRI-226 along with one standard (IUB-2013) were tested for yield and fiber characteristics. CRI-226 produced highest yield (1867 kg/ha) as compared with standard IUB-2013 (1365 kg/ha). As per G.O.T. is concerned, the strain CRI-222 has maximum G.O.T. i.e.,46.7% followed by CRI-226 having 42.2% G.O.T as compared with standard IUB-2013 (41.2%). In case of staple length, the strain CRI- 221 have maximum staple length (33.5 mm) followed by the strain CRI-219 with 31.0 mm staple length as compared with standard having 26.2 mm staple length.The lowest virus disease intensity (20.0%) was found in strain CRI-219 followed by CRI-223 having 22.5 % CLCuD as compared with standard having 45.5 % CLCuD

3.2 ADVANCE YIELD TRIALS (AYTS)

The objective ofAdvanced Yield Trial (AYT) entails the evaluation of newly advanced cotton lines selected from the PYT for yield and other important quantitative traits. During year 2019-2020 about 32 lines/strains alongwith one check FH-LALAZAR or MNH-886 in each trial were planted to assess their yield potential and their fiber quality. Detailed results of AYTs are presented below:

Table 2.2.1PERFORMANCE OF PROMISING STRAINS IN AYT-1 DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Avg Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st		GOT (%)	Fibre		
							Flower	Open boll		Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-123	20.5	2601	35	5	90.2	42.2	40	83	42.3	31.7	4.5	35.5
CRI-124	29.2	1995	41	4.5	103	47.6	44	91	39.2	29.5	4.2	34.2
CRI-125	18.2	1658	45	4.4	123.1	45.2	49	88	41	30.2	4.4	38.7

CRI-128	22.3	2375	29	4.5	110.2	42.3	52	94	39.5	30.1	4.3	40.1
CRI-130	14.2	2024	57	4.6	118.1	47.5	49	87	43.5	29.4	4.6	43.2
CRI-132	22.5	1998	34	4.2	175.2	56.2	50	85	37.4	30.4	4.7	33.8
CRI-133	16.8	2420	61	4.7	166.2	60.2	52	90	41.2	30.8	4.6	34.1
CRI-135	28.2	1912	44	4.4	100.1	42.3	55	89	42.1	30.5	4.5	34.2
MNH-886	**42.9**	**1952**	**30**	**4.2**	**135**	**48..2**	**57**	**94**	**40.1**	**28.3**	**4.9**	**32.5**

The result of statistical analysis of yield is non-significant (P< 0.05). Eight strains viz., CRI-123, CRI-124, CRI-125, CRI-128, CRI-130, CRI-132, CRI-133, CRI-135, along with one standard MNH-886 were tested for yield and fiber characteristics.CRI-123 produced highest yield (2601 kg/ha) as compared with standard MNH-886 (1952 kg/ha). As per GOT is concerned, the strain CRI-130 has maximum GOT i.e., 43.5 % followed by CRI-123 having 42.3% GOT as compared with standard MNH-886 (40.1%). In case of staple length, the strain CRI-123 have maximum staple length (31.7 mm) followed by the strain CRI-133 with 30.8 mm staple length as compared with standard having 28.3 mm staple length. The lowest virus disease intensity (14.2%) was found in strain CRI-130 followed by CRI-133 having 16.8% CLCuD as compared with standard having 42.9 %.

Table 2.2.2 PERFORMANCE OF ELITE STRAINS IN AYT-2 DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st		GOT (%)	Fibre		
							Flower	Open boll		Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-227	78.9	658	25	3.1	105	66	48	60	39.8	28.8	4.5	40
MNH-875/2	6.7	1591	40	3.6	170	63	44	58	41.2	30.4	4.4	37
MNH-875/3	18.5	1313	36	3.2	196	67	43	58	41	28	4	35
MNH-875/4	8.7	1451	41	4.1	200	66	44	58	41	28.3	4.2	33
MNH-875/5	5.9	1504	35	3.6	210	65	41	54	40.2	28	3.5	37
MNH-875/6	15.6	1399	25	3.8	190	63	43	56	40.1	30.2	4	40
MNH-875/7	16.8	957	27	4.2	190	65	44	57	40.2	28.9	4.5	35
MNH-875/8	4.7	2436	46	4.1	212	64	44	58	41.5	28.1	4.6	39
MNH-886	**69.3**	**1112**	**37**	**4**	**165**	**68**	**41**	**53**	**40.1**	**28.3**	**4.2**	**34**

The result of statistical analysis of yield is significant (P< 0.05). Eight strains viz., CRI-227, MNH-875/2, MNH-875/3, MNH-875/4, MNH-875/5, MNH-875/6, MNH-875/7, MNH-875/8, along with one standard MNH-886 were tested for yield and fiber characteristics. MNH-875/8 produced highest yield (2436 kg/ha) followed by MNH-875/2 (1591 kg/ha) as compared with standard MNH-886 (1112 kg/ha). As per GOT is concerned, the strain MNH-875/8 has maximum GOT i.e., 41.5 % followed by MNH-875/2 having 41.2% GOT as compared with standard MNH-886 (40.1%). In case of staple length, the strain MNH-875/2 have maximum staple length (30.4 mm) followed by the strain MNH-875/6 with 30.2 mm staple length as compared with standard having 28.3 mm staple length. The lowest virus disease intensity (4.7%) was found in strain MNH-875/8 followed by MNH-875/5having 5.9% CLCuD as compared with standard having 69.3 %.

Table 2.2.3 PERFORMANCE PROMISING STRAINS IN AYT-3 DURING 2019-2020 AT CRS MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st		GOT (%)	Fibre		
							Flower	Open boll		Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-228	34.1	1207	13.0	4.0	94	38	59	90	38.1	28.6	4.1	28.0

CRI-229	35.7	848	24	4.1	122.0	49	50	93	35.8	29.6	3.9	25.3
CRI-230	31.8	873	24	4.3	79.0	45	55	88	37.9	26.5	5.5	29.8
CRI-231	33.2	1410	19.0	4	173.0	49.0	55	89	37.5	29.1	4.6	35.3
CRI-232	30.1	1028	20.0	3.9	130.0	48	59	90	37.4	28.4	4.5	35.3
CRI-233	26.0	1351	31	3.4	93.0	44	52	93	37.4	29.2	4.5	35.2
CRI-234	20.0	2032	32.0	3.5	152	53.0	58	88	37.1	27.7	4.0	34.0
MNH-871	20.1	1339	21.0	3.1	150	47	56	89	40.3	28.8	4.5	35.5
FH-Lalazar	45.0	1375	23.0	4	133.0	48.0	55	87	40.1	27.5	4.6	34.5

The result of statistical analysis of yield is (significant). Eight strains viz., CRI-228, ,CRI-229,CRI-230, CRI-231, CRI-232, CRI-233, CRI-234, MNH-871 along with one standard (FH-Lalazar) were tested for yield and fiber characteristics. CRI-234 produced highest yield (2032 kg/ha) as compared with standard FH-Lalazar (1375 kg/ha). As per G.O.T. is concerned, the strain MNH-871 has maximum G.O.T. i.e., 40.3% followed by CRI-228 having 38.1% G.O.T as compared with standard FH-Lalazar (40.1%). In case of staple length, the strain CRI-229 have maximum staple length (29.6 mm) followed by the strain CRI-233 with 29.2 mm staple length as compared with standard having 27.5 mm staple length.The lowest virus disease intensity (20%) was found in strain CRI-234 followed by MNH-871 having 20.1 % CLCuD as compared with standard having 45.0 % CLCuD.

Table 2.2.3 PERFORMANCE PROMISING STRAINS IN AYT-4 DURING 2019-2020 AT CRS MULTAN

PERFORMANCE OF PROMISING STRAINS IN (AYT-4) DURING 2019-20 AT CRI MULTAN

Variety	CLCuD (%)	Yield (kg/ha)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st		GOT (%)	Fibre		
							Flower	Open boll		Length (mm)	Fineness (µg/in)	Strength (g/tex)
CRI-236	40.4	1730	32.0	2.7	103.3	22.3	57	88	38.2	24.2	5.5	31.0
CRI-237	31.0	1450	52.7	2.4	104.0	22.3	52	83	39.5	23.5	5.7	36.0
CRI-238	25.0	2000	39.3	3.2	90.0	25.8	54	85	41.6	27.5	4.8	35.2
CRI-239	46.3	1169	30.0	2.4	85.0	25.0	55	86	37.8	29.7	4.7	37.5
CRI-240	41.3	1964	35.0	2.7	101.0	26.3	55	86	43.7	26.0	5.2	29.7

CRI-241	30.8	1078	20.3	2.4	98.0	28.3	58	90	40.3	26.4	5.6	36.5
CRI-242	19.0	2036	42.0	3.0	108.3	24.0	56	87	42.0	28.1	4.7	34.0
CRI-243	17.3	2298	38.0	2.7	119.3	28.3	57	92	39.9	27.6	5.4	40.7
FH-Lalazar	36.0	1375	20.0	3.5	133.0	24.0	55	95	40.1	28.5	4.8	30.0

The result of statistical analysis of yield is (highly significant). Eight strains viz., CRI-236, CRI-237,CRI-238,CRI-239,CRI-240, CRI-241, CRI-242 and CRI-243 along with one standard (FH-Lalazar) were tested for yield and fiber haracteristics. CRI-243 produced highest yield (2298 kg/ha) as compared with standard FH-Lalazar (1375 kg/ha). As per G.O.T. is concerned, the strain CRI-240 has maximum G.O.T. i.e., 43.7% followed by CRI-242 having 42.0% G.O.T as compared with standard FH-Lalazar (40.1%). In case of staple length, the strain CRI-239 has maximum staple length (29.7 mm) followed by the strain CRI-242 with 28.1 mm staple length as compared with standard having 28.5 mm staple length.The lowest virus disease intensity (17.3%) was found in strain CRI-243followed by CRI-242having 19.0 % CLCuD as compared with standard having 36.0 % CLCuD.

4. NATIONAL COORDINATED VARIETAL TRIAL (NCVT)

The objective of this trial is to test the performance of new Varieties of different cotton research centers on national basis under different ecological zones. During year 2019-2020 the trial was conducted at CRS Multan, The results with respect to CLCuV incidence and yield were presented in Table 3.3.1 to 3.3.2.

Table 3.1 1PERFORMANCE OF NEW VARIETIES IN NCVT SET-E DURING 2019-2020 AT CRS MULTAN

Strain#	Denomination	Yield (kg/ha)	CLCuD%
1901	1901	3444	32.5
1902	1902	2153	32.5
1903	1903	3875	32.5
1904	1904	3875	4.0
1905	1905	2153	42.5
1906	1906	1722	17.5
1907	1907	2583	47.5
1908	1908	2153	50.0
1909	1909	3875	55.0
1910	Tassco-115	2583	57.5
1911	Tassco-112	4305	32.5
1912	Tahafuz-15	3875	42.5
1913	Diamond-2	3014	57.5
1914	Suncrop-3	3014	32.5
1915	CIM-602 (Bt-Standard)	3875	47.5
1916	Tahafuz-12(C-II)	3444	60.0
1917	Suncrop(C-II)	5597	45.0
1918	Sayban-209	861	47.5

1919	Saim-102	3875	50.0
1920	Rohi-2	1722	60.0
1921	Rohi-1	1722	52.5
1922	TJ-King(C-II)	2153	55.0
1923	1923	4736	42.5
1924	NS-211	2153	7.5
1925	Eye-22	2583	37.5
1926	Eye-111	2153	52.5
1927	Eye-20	2153	57.5
1928	Rustam-Beej-111(CKC)	1292	42.5
1929	Rustam-Beej-11(C-II)	2799	45.0
1930	Rustam-11	3229	72.5
1931	ICI-2424	1722	62.5
1932	YBG-2323(CKC)	4305	40.0
1933	YBG-2222(C-II)	3229	45.0
1934	1934	4305	47.5
1935	CIM-602 (Bt-Standard)	1292	42.5
1936	1936	2583	47.5
1937	1937	3014	45.0
1938	1938	3014	45.0
1939	1939	1937	52.5
1940	1940	2799	50.0
1941	BF-1	3875	50.0
1942	1942	3875	50.0
1943	1943	3875	47.5
1944	Bahar-136	2799	52.5
1945	ASPL-710	4305	47.5
1946	ASPL-709	4305	50.0
1947	IR-NIBGE-15	3875	50.0

1948	IR-NIBGE-14	3875	45.0
1949	IR-NIBGE-13	4305	50.0
1950	NIAB-SANAB-M	2583	50.0
1951	NIAB-512	3014	42.5
1952	NIAB-973	1300	52.5
1953	NIAB-819	1722	45.0
1954	NIAB-135	4305	40.0
1955	NIAB-1011	1507	57.5
1956	NIA-89	6028	55.0
1957	IUB-73	2368	57.5
1958	VH-383	3014	57.5
1959	VH-189	2153	57.5
1960	CIM-602 (Bt-Standard)	3014	60.0
1961	VH-402	1722	62.5
1962	SLH-33	5597	60.0
1963	RH-Kashish	1292	57.5
1964	RH-Afnan-2	3444	45.0
1965	RH-670	2153	45.0
1966	GH-Hamaliya	3875	50.0
1967	GH-Sultan	2583	47.5
1968	GH-Uhad	2583	40.0
1969	FH-Anmol	3014	42.5
1970	FH-492	2368	40.0
1971	FH-155	3229	60.0
1972	FH-Super-Cotton-2017	3875	60.0
1973	FH-AM-Cotton-2017	2153	52.5
1974	BH-224	2583	60.0
1975	BH-223	2799	50.0
1976	MNH-1050	1722	52.5

1977	MNH-1035	2799	50.0
1978	CEMB-Klean-Cotton-6	3660	52.5
1979	CEMB-Klean-Cotton-5	3444	62.5
1980	CEMB-Klean-Cotton-4	4305	50.0
1981	CEMB-Klean-Cotton-3	3229	47.5
1982	CRIS-638	1722	67.5
1983	CRIS-673	2712	62.5
1984	CRIS-671	861	52.5
1985	Bt-Cyto-535	861	57.5
1986	Bt-Cyto-533	1507	62.5
1987	Bt-CIM-785	1507	55.0
1988	Bt-CIM-775	6028	15.0
1989	Bt-Cyto-511	3014	57.5
1990	Bt-CIM-789	2153	57.5
1991	Bt-CIM-678	2153	52.5
1992	Bt-CIM-303	2368	52.5
1993	CIM-602 (Bt-Standard)	2153	50.0
1994	**Cyto-124 (Non-Bt Standard)**	1937	37.5
1995	NIAB-929	2153	50.0
1996	NIA-88	2799	40.0
1997	1997	2583	52.5
1998	CRIS-644	1722	52.5
1999	Cyto-226	1722	17.5

The result of statistical analysis of yield was non-significant.Nity nine strains were tested for yield and CLCuD response. Strains NIA-89 (6028 kg/ha) produced the highest yield whereas the highest CLCuD (72.5%) infestation was observed in Rustam-11. Similarly, strains Sayban-209 (861 kg/ha) produced the minimum yield whereas the minimum CLCuD (4.0%) infestation was observed in strain 1904.

5. AGRONOMIC PHASE

Agronomic research program aims at developing agronomic practices that can be easily adopted by the cotton growers and managing the cotton crop with judicious use of inputs to obtain the maximum yield with minimum inputs. In order to achieve this objective, Agronomists of Cotton Research Institute Multan conducted the following experiments during 2019-20.

5.1 Effect of different sowing dates on growth and yield of new genotypes of cotton

The objective of this trial was to evaluate yield performance of various promising strains at different sowing dates. Experiment was laid out according to split plot arrangement with three replications. The crop was sown as per treatment on eight different sowing dates. The plant spacing was kept 30 cm and all the other agronomic practices were kept uniform and normal. The results are described below.

The results revealed that seed cotton yield decreased with delay in sowing time. MNH-1050 produced maximum seed cotton yield of 3528.1, 3516.4 kg per hectare when sown on 16-04-2019 and 1-4-2019 respectively followed by MNH-1027 (3396.6 Kg/ha) . Minimum seed cotton yield was produced by all strains when sown on 16thJune 2019. It is concluded that sowing of cotton after 16thMay decreased seed cotton yield significantly . The best sowing time is 1st week of April to 2nd week of May in order to get maximum seed cotton yield.

Table 3.1 EFFECT OF DIFFERENT SOWING DATES ON YIELD OF NEW GENOTYPES OF COTTON

Sowing dates	IUB-13 Yield Kg/ha	MNH-1027 Yield Kg/ha	MNH-1050 Yield Kg/ha	MNH-875 Yield Kg/ha	Average
01-03-2019	2990	3001.9	3103.5	2941.9	3009.3
15-03-2019	3037.5	3265.0	3336.7	2966.0	3151.3
1-04-2019	3073.5	3384.6	3516.4	3037.8	3253.1
16-04-2019	3001.6	3396.6	3528.1	3276.9	3300.8
02-05-2019	1650.5	1913.6	2021.1	1578.6	1791.0
16-05-2019	825.2	1100.3	1160.1	861.2	986.7
01-06-2019	502.3	789.5	837.2	538.2	666.8
16-06-2019	251.2	334.9	418.5	119.6	281.0

	1916.5	2148.3	2240.2	1915.0	
LSD (0.05)	179.58				

5.2 Performance of different genotypes under different planting densities

The main objective of this trial was to evaluate response of new strains of cotton at different plant spacing levels. For this purpose, three cotton varieties viz; IUB-13, MNH-1027 and MNH-1050 were planted at three different plant spacing levels. MNH-1050 produced maximum yield of 2081.0 kg/ha by S-3 (in which 30 cm plant to plant distance was maintained) . Whereas IUB-13 produced minimum seed cotton yield of 1530.7 kg/ha by S-3 (in which 30 cm plant to plant distance was maintained. It is concluded that new strain MNH-1050 can be sown at plant spacing level of 30 cm for getting maximum seed cotton yield .

Table 3.2 YIELD RECORD OF PLANT POPULATION EXPERIMENT

Spacing	Yield (kg/ha)			
	IUB-13	**MNH-1027**	**MNH-1050**	**Average**
S-1 (15.0 cm)	1686.3	2069.0	1841.7	1865.7
S-2 (22.5 cm)	1626.3	1925.3	1937.7	1829.8
S-3 (30.0 cm)	1530.7	1674.3	2081.0	1762.0
Average	1614.4	1889.5	1953.5	
LSD (0.05)		524.92		

5.3 Impact of NPK on yield of cotton

The major objective of this experiment was to evaluate the response of seed cotton yield of new strains of cotton at different levels of NPK. In this experiment five fertilizer doses were evaluated. The maximum yield potential of 1698.3 kg/ha was produced by T-5 when 306 - 57 - 94 NPK kg/ha was applied which is significantly higher as compared to control. The response of all fertilizer treatments was found significant.

Table 3.3 YIELD RECORD OF FERTILIZER EXPERIMENT

Treatment (N – P - K) kg/ha	Yield (kg/ha)				
	IUB-13	**MNH-1027**	**MNH-1050**	**MNH-875**	**Average**
T-1 (114 - 0 - 0)	992.7	1151.3	1232.0	1076.7	**1113.2**
T-2 (114 - 57 - 0)	1088.3	1243.7	1375.3	1148.3	**1213.9**
T-3 (198 - 57 - 94)	1148.0	1339.3	1459.0	1184.3	**1282.7**
T-4 (250 - 57 - 94)	1195.7	1361.3	1566.7	1243.7	**1341.9**
T-5 (306 - 57 - 94)	1291.7	1437.3	1698.3	1375.3	**1450.7**
Average	**1143.3**	**1306.6**	**1466.3**	**1205.7**	

LSD (0.05) = 139.58

5.4 Role of different management practices on yield of cotton

The objective of this experiment was to determine the share of different management practices on seed cotton yield of cotton. The crop was sown on 12th May 2019. Recommended dose of P_2O_5 and K_2O was applied to all treatments except T_2 and T_6 at the time of sowing. Nitrogen was applied in four split doses to all treatments except T_2 and T_6. Irrigation was stopped to T_3 after 30 days of sowing. Weeds were not controlled in T_4 and insects were not controlled in T_5. Furthermore above four management practices and inputs were not applied to T_6 except irrigation which was applied for 1st 30 days.

The data revealed that the maximum seed cotton yield of 2782.7 kg per ha was obtained in T_1 (with the recommended dose of fertilizer and irrigation applied, weeds and insects were controlled). In T_2 and T_3 yield was decreased by 19 % and 54 % respectively over control. Weeds decreased yield 44% and insect infestation by 15 % over control whereas in T_6 decrease in yield over control was 88 %.

Table 3.5 ROLE OF DIFFERENT MANAGEMENT PRACTICES ON YIELD OF COTTON

Treatment	Fertilizer	Irrigation	Weed Mgt.	Pest Mgt.	Yield (kg/ha)	% Decrease over T_1
T_1	+	+	+	+	2782.7	-
T_2	-	+	+	+	2268.7	19
T_3	+	-	+	+	1281.3	54
T_4	+	+	-	+	1547.0	44
T_5	+	+	+	-	2362.0	15
T_6	-	-	-	-	347.3	88

LSD (0.05) =323.34

5.5 Role of incorporation of cotton sticks and wheat straw on yield of cotton in Cotton-Wheat Cropping system

The objective of this experiment was to determine the impact of incorporation of wheat straw and cotton sticks on seed cotton yield of cotton. First of all, physiochemical analysis of the soil was done then wheat straw was removed from $T_1$and wheat straw was rotavated and burnt in T_2 and T3 respectively then field was irrigated. At *Watter* condition soil was prepared and crop was sown on beds on 18th May 2019.Recommended dose of N, P and K was applied to all the treatments. At the maturity of crop, data of seed cotton yield was recorded and physiochemical analysis of the soil was made again. However, cotton sticks were incorporated in that part of the field in which wheat straw was rotavated (T_2) and from the remaining portion (T_1) cotton sticks were removed.

Data revealed that maximum seed cotton yield of 1184.2 Kg /ha was obtained in T_2 which is statistically at par withT_3,however in T_1 Produced minimum seed cotton yield (1090.1 Kg/ha).

Table 3.6.1 Effect of Rotavation of wheat straw and cotton sticks on yield of cotton

Treatments	Yield (Kg/ha)	%age increase over T_1
T1 Cotton sticks and wheat straw removed	1090.1	-
T2 Cotton sticks and wheat straw incorporated	1184.2	9.0
T3 Cotton sticks incorporated and wheat straw burnt	1116.0	3.0
LSD (0.05)	99.72	

5.6 Effect of different weedicides on yield of cotton

The objective of this experiment was to determine the efficacy of different pre-emergence and post-emergence herbicides on yield of cotton.Four different types of herbicides were used alone and in combination with one another while in Treatment T_7 weeds were controlled only by manual and mechanical hoeing and in T_8 by manual hoeing.

Data showed that maximum seed cotton yield of 2492.6 Kg/ha was produced by T_4 (Dual Gold 960EC@2.0 L/ha + Glyphosate 490 G /L@ 4.7 L/ha) statistically at par with T_3 (Stomp (Pendimethaline) @ 2.5 L/ha + Glyphosate 490 G /L@ 4.7 L/ha). Minimum seed cotton yield (1139.4 Kg/ha) was produced by T_8 while T_7 produced seed cotton yield of 1545.5 Kg/ha

Table 3.7 Efficacy of Weedicides on yield of cotton

Treatments	Yield (Kg/ha)
T1 Stomp (Pendimethaline) @ 2.5 L/ha	2260.1
T2 Dual Gold 960 EC@2.0 L/ha	2264.4
T3 Stomp (Pendimethaline) @ 2.5 L/ha + Glyphosate 490 G /L@ 4.7 L/ha	2468.2
T4 Dal Gold 960 EC@2.0 L/ha + Glyphosate 490 G /L@ 4.7 L/ha	2492.6
T5 Acetochlor @ 0.875 L + Pendimethaline @ 2.0 L/ha	1950.2
T6 Glyphosate 490 G /L@ 4.7 L/ha	2267.3
T7 Manual+ Mechanical hoeing	1545.5
T8 Manual one hoeing	1139.4
LSD (0.05)	208.15

6. ENTOMOLOGICAL PHASE:-

Objective: -

Cotton is an important cash crop of Pakistan and insect pest are one of the most threatening to cotton crop. They damage crops in two ways; they both affect the quality and quantity of the seed cotton. Long term use of insecticides for their management induced insecticide resistance problem in feeding insect pests. Integrated pest management is an important tool to mitigate these problems, therefore, entomological experiments were focused on special reference to IPM.

In order to achieve this objective, the cotton Research Institute, Multanworked out the following activities during 2019-20.

1. SCREENING OF DIFFERENT INSECTICIDES WITH DIFFERENT BRANDS (GENERIC AND MULTINATIONAL) AGAINST PINK BOLLWORM.

The objective of this trial was to find out the most selective pesticides against pink bollworm. The trial was conducted in the field area of Cotton Research Institute, Multan following randomized complete block design with three repeats.The data regarding pink bollworm population was taken from 25 randomly selected plants per plot before and after 3 days, 5 days and 7 days of spray. Finally, the data was analyzed statistically and percent mortality was calculated.

Table 4.1: EFFICACY OF DIFFERENT INSECTICIDES WITH DIFFERENT BRANDS (GENERIC AND MULTINATIONAL) AGAINST PINK BOLLWORM

SCREENING OF DIFFERENT INSECTICIDES AGAINST PINK BOLLWORM

Sr. No.	Insecticides	Dose/Acre (ml)	% Mortality after 24 hours	48 hours	72 hours
1	Curator (Triazophos+Bifenthrin)	600	33.30 a	41.65 a	47.74 a
2	Coragen (Chlorantraniliprole)	50	24.06 b	26.77 c	30.50 b
3	Trizone (Triazophos)	800	30.66 a	34.59 b	40.33 a
4	Raddiant (Spintoram)	100	19.85 b	34.53 b	33.30 b

5	Belt (Flubendamide)	50	24.14 b	30.43 b	34.47 b
6	Proaxis (Gamacyhalothrin)	120	25.58 b	23.08 c	33.15 b
7	Talstar (Bifenthrin)	400	21.46 b	28.71 c	28.96 b
8	Cedox (Triazophos+Deltamethrin)	600	33.58 a	44.05 a	48.20 a
9	Bolton (Chlorpyriphos+Betacyfluthrin)	600	33.77 a	42.37 a	47.03 a
10	Capital Plus (Triazophos+Betacyfluthrin)	600	27.02 a	36.0 8b	40.71 a
11	Control	-	0.00c	0.00 d	0.00 c
	LSD @ 5%		7.24	6.47	8.59

Among tested insecticides for the control of pink bollworm, none of the available insecticide provided mortality higher than 50% at 24, 48 and 72 hours after spray. Mortality ranged from 19.85 to 33.77% after 24 hours of spray being minimum of Talstar and maximum for combination of Triazophos and Deltamethrin respectively. At 48 hours after spray mortality percentage ranked from 26.77 to 44.05 for Coragen (Chlorantraniliprole) and Cedox (triazophos+deltamethrin) respectively. After 72hours, Cedox (Triazophos+Deltamethrin) gave maximum control (48.2) followed by Curator (Triazophos+Bifenthrin) which gave (47.74) and Bolton (47.03%) against Pink bollworm (Table 4.1).

2. SCREENING OF DIFFERENT INSECTICIDES WITH DIFFERENT BRANDS (GENERIC AND MULTINATIONAL) AGAINST WHITEFLY

The data regarding whitefly population was taken from 20 randomly selected leaves per plot.The data regarding whitefly population was taken before and after 24 hours, 48 hours and 72 hours of the Pesticide application. Finally, the data was statistically analyzed and percent mortality was calculated.

Table 4.2: EFFICACY OF DIFFERENT INSECTICIDES WITH DIFFERENT BRANDS (GENERIC AND MULTINATIONAL) AGAINST WHITEFLY

Sr.#	Name of Insecticides	Dose/acre	Pre-treatment Pop. /leaf	% Mortality after		
				24 hours	48 hours	72 hours
1	Movento (Spirotetramate, Bayer)	150 ml	13.8	21.4 c	27.1 b	37.3 b
2	Acetapmiprid (Generic)	150 gm	16.5	17.4 c	19.2 c	22.1 c
3	Acetapmiprid (Arysta life sciences)	150 gm	12.9	24.7 b	31.7 b	33.9 b
4	Ulala (Flonicamid), ICI	80 gm	12.6	19.8 c	24.7 c	29.4 b

5	Buprofezin (Generic)	600 gm	9.7	26.3 b	32.5 b	30.1b
6	Buffer (Buprofezin, Jaffer Brothers)	600g	13.4	29.5 b	34.1 b	37.2 b
7	Priority (Pyriproxifen, Kanzo Ag)	500 ml	12.8	22.4 c	29.4 b	34.6 b
8	Admiral (Pyriproxifen, FMC)	200ml	15.7	32.5 a	36.4 a	43.8 a
9	Legend (Matrine, kanzo Ag)	500 ml	13.1	21.4 c	28.3 b	36.6 b
10	Mavrik (Matrine, Suncrop)	500ml	14.8	11.7 d	23.4 c	29.4 b
11	Diafenthiuron (Generic)	200 ml	12.9	35.5 a	39.3 a	41.3 a
12	Polo (Diafenthiuron, Syngenta)	200ml	15.4	39.2 a	43.5 a	46.8 a
13	Control		13.8	0.0 e	0.0 d	0.0 d
	LSD @ 5%			6.72	8.36	9.14

Thirteen insecticides including check were screened out for their effectiveness against Cotton whitefly. All the insecticides that were screened out failed to give mortality above 80% however, Polo (Diafenthuron) gave maximum mortality (46.8%) against Whitefly after 72 hours of application followed by Admiral (Pyriproxifen) which gave 43.8% mortality.

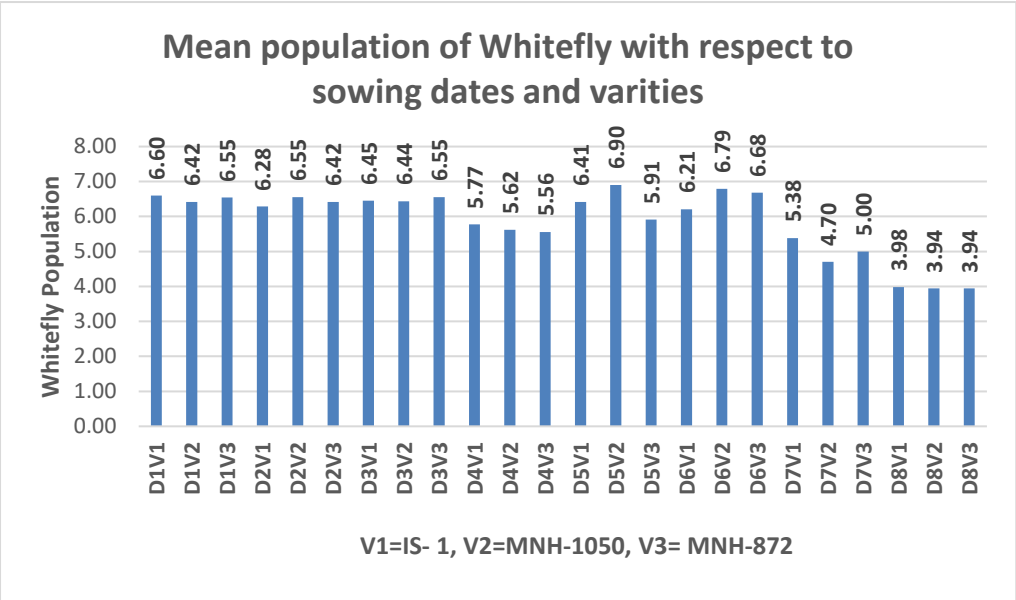
3. Varietal Screening of Different Advanced Lines of Cotton Against Cotton Whitefly and Pink Bollworm

Sr. #	**Entry**	**Mean Whitefly**	**% Pink BW infestation**	**Leaf lamina thickness (mm)**	**Leaf area (cm2)**	**Trichome density / sq. cm**	**Nectaries/ leaf**	**No. of Gossypol glands**
1	MNH-1020	4.98	25.50	0.292	101.54	188.83	2.00	127.17
2	Cyto-124	4.86	29.38	0.273	78.86	109.33	4.66	96.33
3	MNH-1035	6.66	22.67	0.326	115.9	153.17	2.00	101.5

4	MNH-1016	7.89	22.95	0.334	126.29	184.67	3.00	110.6
5	FH-490	7.94	16.87	0.329	104.99	130.67	1.33	85.0
6	MNH-1026	7.96	25.50	0.277	133.57	91.16	2.00	83.5
7	MNH-1050	8.31	32.03	0.280	125.08	102.67	2.66	49.5
8	MNH-886	7.38	27.45	0.296	149.52	159.00	1.66	83.6
9	MNH-872	6.28	19.97	0.288	127.33	92.16	1.00	59.16
10	VH-327	4.63	16.59	0.287	158.36	106.83	1.66	76.6

There were 10 promising lines/varieties of cotton were screened out against Cotton whitefly and Pink Bollworm to check their respective resistance and tolerance level. Mean maximum seasonal whitefly population (7.94/leaf) was observed on FH-490 while mean minimum population (4.63/leaf) was observed on VH-327. In case of Pink bollworm, mean maximum seasonal percent infestation (29.38%) was recorded on MNH-886.

4. **Effect of Different Agronomic Practices (Planting Time) on Population Dynamics of Cotton Whitefly**



Three different varieties viz; V1=IS-1, V2= MNH-1050, V3= MNH-872 were sown at 8 different sowing times viz; D_1 = 1st March 2019, D_2 = 16th March 2019, D_3 = 1st April 2019, D_4 = 16th April 2019, D_5 = 1st May 2019, D_6 = 16th May 2019, D_7 = 1st June 2019, D_8 = 16th June 2019. Whitefly infestation on sowing date (D1, D2, D3) was at par with each other ranging from 6.28 to 6.60, on D4 population ranked from 5.56 to 5.77, similar trend of population was recorded on D5 and D6 ranging from 5.91 to 6.90 per leaf. On D7 and D8 decline in population of whitefly was recorded from 5.38 to 3.94 per leaf respectively. It indicated whitefly escape on these sowing dates.

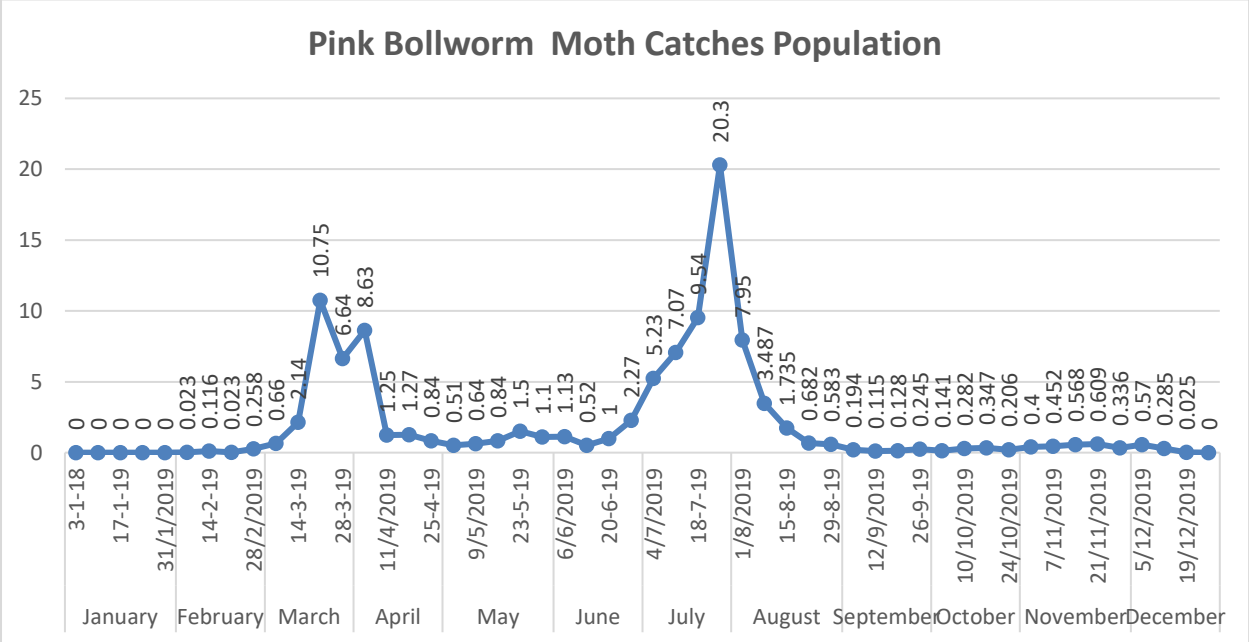
5. **Efficacy of different seed dressing insecticides/fungicides against sucking insect pest and disease incidence on cotton**

Sr.#	**Name of Insecticides**	**Mean population/leaf**			**% Disease incidence**
		Whitefly	Jassid	Thrips	
1	Confidor 70%WS + Dynasty cst 125 FS	0.98 a	0.56 a	0.72 b	Nil
2	Asset 70 ws (imidacloprid 70% w/w)+ Dynasty cst	0.89 a	0.77 a	1.14 a	Nil
3	Argyl Super 62.5 % ws (chlothianadin + azoxystrobin)	1.42 a	0.90 a	1.40 a	Nil
4	Actara ST 70% WS (Thiamethoxam) + Dynasty	1.76 a	0.97 a	1.44 a	Nil

	cst 125 FS				
5	Imidacloprid 70% WS + Dynasty cst 125 FS	0.84 a	0.76 a	1.21 a	Nil
6	Hombre Exel 37.25 FS (imidacloprid (30.76%) + tebuconazole(1.07%)	0.89 a	0.57 a	0.93 a	Nil
7	Control	2.01 a	1.13 a	2.52 a	Nil
LSD @ 0.5%		1.98	1.10	1.56	

7 mixture of different insecticides and fungicides including check were tested against sucking insect pests of cotton and Root rot/ wilt disease. Results showed that in sucking insect pests only population of jassid was observed above threshold level only in control. Disease incidence like root rot or wilt did not observed on any treatment. Therefore, it is recommended to treat the seed with any above insecticide before sowing.

6. **Monitoring of Lepidopterous Moths (Pink bollworm, American bollworm, Spotted Bollworm & Army Worm) with Sex Pheromone Traps**



Four (04) pheromone traps for monitoring of Pink bollworm were installed in the direct area of CRI, Multan. Moth catches data were recorded throughout the year. The graph showed that there were two population peaks were observed in a year. First peak with maximum (20.3) average weekly moth catches

per night per trap of Pink bollworm were recorded on the 4th week of July while 2nd peak (10.73) moth catches was observed on 3rd week of March.

7. Bio-Assay study of different insecticides against pink bollworm (*Pectinophora gossypiella* S.)

Sr. #	Insecticides	LC50[a]	95 % FL [b]	Slope (± SE [c])	$\chi 2^{d}$	df[e]	N[f]
1	Coragen (Chlorantraniliprole)	108.59	51.4-265.1	2.18±0.24	11.209	3	108.59
2	Deltamax (Triazophos + deltamethrin)	308.79	275.6-555.7	3.01±0.31	4.80	3	308.79
3	Proaxis (Gamma cyhalothrin)	728.34	335.1-1832.3	1.95±0.23	9.8	3	728.34
4	Bolton (Chlorpyriphos+betacyfluthrin)	323.5	217.4-502.0	2.19±0.26	4.53	3	323.5
5	Triazophos	505.51	276-1410	1.69±0.22	7.35	3	505.51
6	Raddient (spintoram)	451.96	238.3-1260.1	1.54±0.25	5.35	3	451.96
7	Bifenthrin	590.10	150.1-744.9	1.92±0.23	9.02	3	590.10
8	Emmamectin	1550.66	336.4-2712.5	2.99±0.31	4.62	3	1550.66
9	Deltamethrin	470.27	138.1-704.9	1.69±0.22	7.35	3	470.27

Among the tested insecticides regarding toxicological studies under laboratory bioassay Coragen, Deltamax, Bolton and Radiant gave better results against Pink bollworm. Minimum LC-50 value of 108.593 of Coragen demonstrated maximum toxicity against pink bollworm moth followed by Deltamex and Bolton with LC-50 308.7 and 323.5 as compared with emamectin and belt showing least effectiveness with LC50 values of 1550.6 and 3439.1 respectively.

8. **Bio-Assay study of different insecticides against cotton whitefly (*Bemisia tabaci*)**

Sr. #	Insecticides	LC50[a]	95 % FL [b]	Slope (± SE [c])	$\chi 2$[d]	df[e]	P[f]	N[g]
1	Movento (Spirotetramate)	120.85	90.8-151.9	2.18 ± 0.35	1.78	2	0.409	40
2	Ulala (flunicamid)	129.5	80.06-269.04	1.64 ± 0.24	3.56	3	0.31	40
3	Forum (Diafenthiuron)	191.4	164.7-221.12	4.37 ± 0.6	0.43	2	0.806	40
4	Pyriproxifen	416.7	333.9-499.8	3.03 ± 0.04	1.89	2	0.390	40
5	Legend (Metrin)	1612.8	1081.4-3289.8	1.29 ± 0.25	2.79	3	0.42	40
6	Acetamaprid	669.9	446.27-1506.4	1.78 ± 0.36	1.17	3	0.58	40
7	Buprofezin	1306.9	900.5-2356.7	1.19 ± 0.23	0.56	3	0.90	40
8	Bifenthrin	912.17	740.2-1265.6	3.12 ± 0.56	0.272	3	0.69	40
9	Movento (Spirotetramate)	120.85	90.8-151.9	2.18 ± 0.35	1.78	2	0.409	40

Among the tested insecticides regarding toxicological studies under laboratory bioassay Movento, Ulala and Forum gave better results against whitefly. LC50 value of these insecticides ranged from 120.85 to 191.4 as compared with LC50 value of Legend (1612.8), Buprofezin (1306.9), Bifenthrin (912.17), Acetamaprid (669.9) and Priority (416.7) respectively.

7. PROJECTS

1. 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, Director Entomological Research Institute, Faisalabad, Cotton Research Institute, Multan, MNSUA, NIBGE and CCRI Multan. The objectives of project are the management of 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. The results are already discussed in entomology studies.

2. 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, Director 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 timing, stage of spray and plant-based insecticides will also be observed for the proper management of whitefly. The results are already discussed in entomology studies.

3. Commissioned Research for Development of Cotton Seed

An ADP project "Commissioned Research for Development of Cotton Seed" was approved 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. During2019-20, totally 95 crosses comprises 308 progenies of F_1, F_2, F_3, F_4, and F_5 were sown at Cotton Research Institute Mulan. Individual progenies of F_1, F_2, F_3, F_4, and F_5 were 153, 81, 54, and 20, respectively. Morphological traits like CLCuV, yield and fiber trait data were recorded. Some entries/genetic material from F_2-F_5 has shown promising results in terms of CLCuV resistance, heat tolerance and harmonious combination of fibre traits i.e. the range of CLCuD (%) was 9.5-28.5. Similarly, bolls weight was 4-4.5g. Whereas, among fibre traits, GOT, and staple length was 40-45.3 %, and 28.2-31.5 5mm, respectively. Likewise, fibre fineness was 3.5-4.6µg/inch.

4. 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. The activities of this project were

started from 01-01-2018 and will continue up to 31-12-2022. The output of the project activities so far as about 500 different exotic and indigenous cotton accessions including BT and Non Bt genotypes have been collected from local and foreign sources i.e. India, Turkey, Brazil, China, USA etc. After delinting of each cotton genotype, samples were analyzed in the NIR Spectrometer for oil content measurement at USPCAS UAF Faisalabad. Analysis of 200 accessions was completed. Twenty high oil contents parents were selected and sown in the field for hybridization in order to attain high oil contents plants having better economic traits. A total of three Accessions have 7 to 10% oil contents and 47 accessions showed 10 to 15% oil contents. Whereas, 50 accessions possess 15 to 20% oil contents

5. 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. This variety will have short stature, early and uniform maturity with compact plant shape. The activities of this project were started from 01-01-2018 and will be continue up to 31-12-2022. Eight advances lines were identified suitable for mechanical picking and MNH-1027 is one the upcoming promising strain suitable for mechanical picking with harmonious combination of fibre traits.

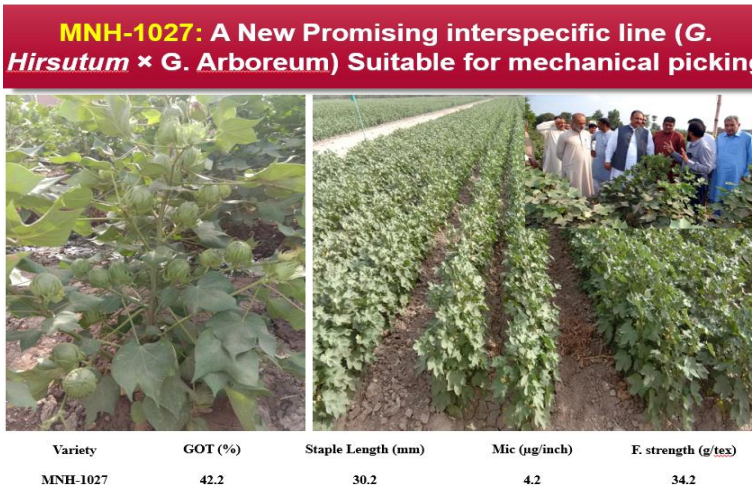


Fig. 8. Pictorial view of MNH-1027, The variety for mechanical picking

8. SALIENT ACHIEVEMENTS DURING THE YEAR

International Cotton Conferences

- Three scientists i.e. Dr. Abid Mahmood (DG Research), Dr. Saghir Ahmad (Director Cotton), and Dr. Zia-Ullah-Zia (Assistant Research Officer) presented research papers in 3rd "Sino-Pak International Conferences on Innovations in Cotton Breeding and Biotechnology" September 04-06, 2019

- Changji, China

- Participation in seven mega cotton seminars in Punjab and also deliver lectures on cotton.
- Participated in exhibitions (BZU, MNSUAM, and Expo Centre-Lhr)

9. Area Covered by CRI Varieties

The varieties of CRI Multan and its allied research station occupied 32% area in Punjab during 2019 as depicted in Fig 9.

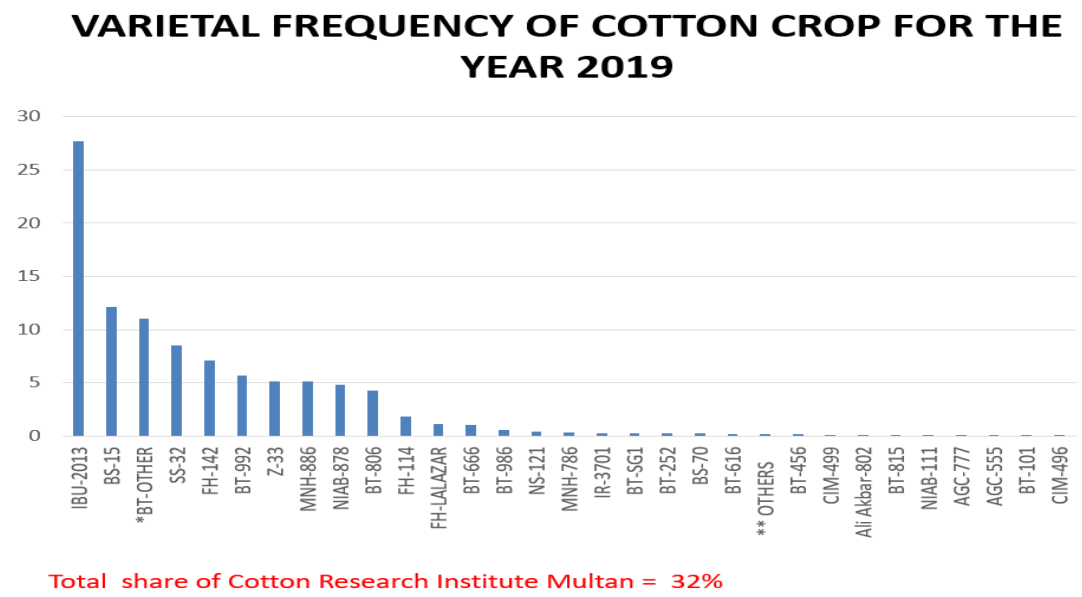


Fig. 9. Varietal frequency of different cotton varieties

MISCELLANEOUS ACTIVITIES

- Scientific Publications: 9
- Urdu Articles: 4
- Radio/TV Talks: 6
- MoUs & International Trainings: 1
- Seminars/exhibitions: 2
- Meetings of Cotton Research

- and Development Board: 12

10. Other Activities

- Cotton Research and Board meetings
- Cotton Production Plan for the year 2019
- Weekly crop situational report
- Member/Secretary of Technical advisory committee meetings on fortnightly basis

11. SENIOR SCIENTISTS

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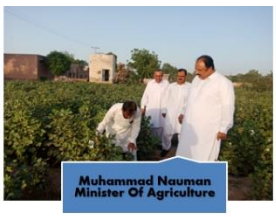
12. DELEGATES VISIT CRI MULTAN

3rd “Sino-Pak International Conferences on Innovations in Cotton Breeding and Biotechnology” September 04-06, 2019 Changji, China

VISIT OF MR. JAHANGIR TAREEN KHAN,
MR. MUHAMMAD NAUMAN (MINISTER OF AGRICULTURE), Mr. WASIF KHURSHID (SECRETARY AGRICULTURE)



Foreign Minister Shah Mehmood Qureshi Visiting CRI Multan

Alamdar Hussain Qureshi, Chairman Task force Visiting CRI Multan

ANNUAL REPORT 2019-20

COTTON RESEARCH STATION, BAHAWALPUR

1. WEATHER (2019)

MONTH	TEMPERTAURE (°C) 2019		MEAN RELATIVE HUMIDITY (%)	RAIN FALL(mm)
	MEAN MAXIMUM	MEAN MINIMUM	2019	2019
JANUARY	19.4	7.5	90.8	9.0
FEBRUARY	20.2	7.6	88.9	38.0
MARCH	26.5	12.7	78.9	10.0
APRIL	36.8	21.5	66.5	18.0
MAY	39.0	23.7	57.8	22.0
JUNE	40.0	26.0	60.0	26.0
JULY	39.5	29.5	68.0	-
AUGUST	37.5	28.4	75.2	30.0
SEPTEMBER	36.3	27.2	76.2	24.0
OCTOBER	32.3	19.5	77.0	66.0
NOVEMBER	26.5	14.0	86.3	20.0
DECEMBER	18.5	8.6	90.6	17.0
Total				**288.0**

2. BREEDING PHASE

The first step in breeding phase is to create genetic diversity and afterward reducing or identifying the environmental effects on the phenotype so that true genetic differences among plants and families can be determined or estimated. The different ladders of breeding phase that were covered at CRS Bahawalpur during 2019-20 are mentioned as under:

1.1 MAINTENANCE AND ENRICHMENT OF GERMPLASM

Cotton germplasm at CRS, Bahawalpur comprised 74 genotypes. Salient features of the germplasm are given below:

Table 1.1.1 SALIENT FEATURES OF GERMPLASM AT CRS, BAHAWALPUR

Character	**Range**
Plant Yield (g)	25-300
Plant Height (cm)	80-175
No. of Bolls/Plant	10-120
Boll weight (g)	1.75-4.5
CLCuV infestation (%)	3-100
No. of Monopodial Branches	0-5
No. of Sympodial Branches	6-40
Nodes to first fruiting branch	5-14
Leaf Shape	Okra - Broad
Leaf size	Small - Medium
GOT %	33-42.5
Staple Length (mm)	25-31
Fiber Fineness (µg/inch)	3.4-6.0
Fiber Strength (g/tex)	26-40

1.2 Hybridization Programme

The following crosses were attempted during the year 2019-20. Set bolls of each cross will be sown as a single boll to row in F1 during the year 2020-21.

Table 1.2.1 List of successful bolls crossed at Cotton Research Station, Bahawalpur (2019-20)

Cross No.	**Cross**	**No. of Bolls Set**	**Cross No.**	**Cross**	**No. of Bolls Set**
1	BH-224X FH-142	15	26.	BH-318(N.Bt) X BH-305(N.Bt)	05
2	BH-224X MNH-1026	11	27.	BH-318(N.Bt) X BH-167(N.Bt)	07
3	BH-224 X MNH-1045	11	28.	BH-315(N.Bt) X BH-318(N.Bt)	07
4	BH-224 X MNH-886	11	29.	BH-315(N.Bt)X BH-305(N.Bt)	04

5	BH-223 X MNH-1026	7	30.	BH-315(N.Bt) X BH-160(N.Bt)	07
6	BH-223 X FH-142	7	31.	BH-247 X VH-402	05
7	BH-535 X MNH-1045	11	32.	BH-247 X RH-KASHISH	10
8	BH-287 X MNH-1045	5	33.	BH-244 X MNH-1045	08
9	BH-535 X MNH-1026	9	34.	BH-244 X ICI-2424	12
10	BH-287 X MNH-1026	6	35.	BH- 224 X BH-247	14
11.	MNH-1045X BH-597	05	36.	BH-224 X BH-313	09
12.	MNH-1045 X BH-188	06	37.	BH-243 X PCCT –I. 19	08
13.	MNH-1026X BH-597	13	38.	BH-243 X NCVT-D(1985)	02
14.	MNH-1026XBH-188	05	39.	BH-313 X NCVT-D(1986)	02
15.	BH-184 X MNH-1045	04	40.	BH-313 X BH-11	02
16.	BH-184 X MNH-1026	09	41.	BH-227 X MNH-1045	03
17.	BH-184 X MNH-886	09	42.	BH-227 X MNH-1026	05
18.	BH-299 X MNH-1026	15	43.	BH-11 X MNH-1045	03
19.	BH-299 X MNH-1045	13	44.	BH-11 x NCVT-C(1963)	02
20.	BH-299 X MNH-886	10	45.	BH-225.OKRA X BH-224	04
21.	BH-247X MNH1045	09	46.	BH-225 OKRA X BH-247	02
22.	BH-247 X FH-142	11	47	BH-184 X BH-313	02
23.	BH-247 X MNH-1026	10	48	BH184 X BH-243	02
24.	BH-310 X BH-305 (N.Bt)	10	49	BH-310 X BH-315 (N.Bt)	02
25.	BH-310 (N.Bt) X BH-305	05	50	BH-310 X BH-160 (N.Bt)	03
Total No. of successful bolls					**358**

3. STUDY OF FILIAL GENERATIONS

Single plant selections were made from the promising breeding material in different segregating generations (F_1 to F_6) for further testing for seed cotton yield, fiber traits and cotton leaf curl virus disease. The detail of breeding material planted and number of plants selected during 2019-20 is anchored in Table 1.3.1.

Table1.3.1 FILIAL GENERATIONS STUDIED DURING THE YEAR 2019-20

Sr. No.	Generation	Studied	Selected
		Crosses/Progenies	Crosses/Plants/Progenies
1	F_1	46	46 Crosses
2	F_2	45	734
3	F_3	1000	522
4	F_4	411	59
5	F_5	126	14
6	F_6	89	06 (Bulk within family)

Cotton leaf curl virus (CLCuV) incidence and fiber quality traits in filial generations (F_1 to F_6) during the year 2019-20 is given as under:

F_1 – GENERATION

Table1.3.2 SALIENT FEATURES OF SOME OUTSTANDING FAMILIES OF F_1 DURING 2019-20

Family No.	CLCuV %	GOT%	Staple Length (mm)
191008	7.0	41.2	29.5
191019	9.0	40.8	29.0
191031	8.0	40.3	29.5

F_0 seed from 46 crosses made during 2018-19 was sown in single boll to row. The above families have shown better performance in field regarding earliness in maturity, tolerance against CLCuV and drought as well as the fiber characteristics as shown in table 1.3.2.

F_2 – GENERATION

Table 1.3.3 SALIENT FEATURES OF SOME OUTSTANDING FAMILIES OF F_2 DURING 2019-20

Family No.	CLCuV %	Plant yield (g)	Boll wt. (g)	GOT%	Staple Length (mm)
192058	8.0	107.8	4.1	43.3	29.0
192063	6.4	101.3	4.0	41.4	29.5
192070	7.2	106.5	4.2	40.5	29.0

45 crosses were studied during the year. The above families have shown better tolerance against CLCuV, heat and drought along with better fiber traits as shown in table 1.3.3.

F_3 – GENERATION

Table 1.3.4 SALIENT FEATURES OF SOME OUTSTANDING FAMILIES OF F_3 DURING 2019-20

Family No.	CLCuV %	Plant yield (g)	Boll wt. (g)	GOT%	Staple Length (mm)
193441	12.2	72.3	3.9	39.8	30.0
193448	9.5	100.2	4.1	41.9	29.0
192070	7.9	103.7	4.0	42.0	29.5

1000 progeny lines were tested in F_3 for better yield potential, CLCuV, heat & drought tolerance as well as better fiber quality traits. The above families have shown better performance as shown in table 1.3.4.

F_4 – GENERATION

Table 1.3.5 SALIENT FEATURES OF SOME OUTSTANDING FAMILIES OF F_4 DURING 2019-20

Family No.	CLCuV %	Plant yield (g)	Boll wt. (g)	GOT%	Staple Length (mm)
194677	13.8	87.3	3.8	40.2	30.0
194682	10.6	105.1	4.0	41.4	29.6
194689	9.8	112.7	4.2	41.1	29.3

411 progeny lines were tested in F_4 for better yield potential, CLCuV, heat & drought tolerance as well as better fiber quality traits. The above families have shown better performance as shown in table 1.3.5.

F_5 – GENERATION

Table 1.3.6 SALIENT FEATURES OF SOME OUTSTANDING FAMILIES OF F_5 DURING 2019-20

Family No.	CLCuV %	Plant yield (g)	Boll wt. (g)	GOT%	Staple Length (mm)
195791	14.6	88.7	3.8	41.2	29.0
195802	11.3	101.2	4.0	42.3	28.6
195815	8.7	107.7	4.1	41.8	28.8

126 progeny lines/families were tested in F_5 for better yield potential, CLCuV, heat & drought tolerance as well as better fiber quality traits. The above families have shown better performance as shown in table 1.3.6.

F_6 – GENERATION

Table 1.3.7 SALIENT FEATURES OF SOME OUTSTANDING FAMILIES OF F_6 DURING 2019-20

Family No.	CLCuV %	Plant yield (g)	Boll wt. (g)	GOT%	Staple Length (mm)
196870	13.4	94.5	4.0	40.6	28.5
195802	14.2	99.2	3.8	41.7	29.0
195815	15.7	103.4	4.1	42.5	28.7

89 progeny lines/families were tested in F_6 for better yield potential, CLCuV, heat & drought tolerance as well as better fiber quality traits. The above families have shown better performance as shown in table 1.3.7.

4. EVALUATION PHASE

2.1 PRELIMINARY YIELD TRIALS (PYTs)

The objective of Preliminary Yield Trial (PYT) is to evaluate 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 virus disease, heat and drought. Cultivars at this stage were subjected to a reduced selection pressure and the selected lines were progressed to the Advanced Yield Trials (AYTs). During year 2019-20, 46 lines/strains were planted in 6 PYTs with different genotypes per trial along with two standard varieties (BH-184 & FH-142 (Bt)/ BH-160 & BH-167 (N.Bt)). Detailed results of each PYT are given below:

Table 2.1.1 PERFORMANCE OF PROMISING STRAINS IN PYT-1 DURING 2019-20 AT CRS, BWP.

Genotypes	Yield (kg/ha)	GOT %	SL (mm)
BH 224	1253	42.0	28.0
BH 254	1169	42.0	28.5
BH 345	1098	36.4	28.0
BH 368	943	35.4	29.0
BH 184	943	40.6	28.4
FH 142	943	41.8	28.0
BH 341	919	43.0	28.0
BH 613	788	35.4	28.5
BH 315	776	42.5	27.5
BH 223	728	42.0	28.0

BH-224 produced 1253 kg/ha seed cotton, better than all other strains. GOT %age of BH-341was better and gave 43.0 % followed by BH-315 which produced 42.5%. Strains BH-368 and BH-254 gave better staple length which was 29.0 mm & 28.5 mm respectively than all other varieties in the trial.

Table 2.1.2 PERFORMANCE OF PROMISING STRAINS IN PYT-2 DURING 2019-20 AT CRS, BWP.

Genotypes	Yield (kg/ha)	GOT %	SL (mm)
BH-291	1256	42.0	29.0
BH-341	1214	38.0	26.0
BH-345	1201	37.2	28.5
FH-142	1118	41.0	28.5
BH-373	1118	40.0	29.5
BH-617	1118	40.8	28.5
BH-606	1007	37.4	27.5

BH-221	1007	36.6	27.5
BH-184	994	37.8	28.5
BH-535	966	42.8	29.0

Strain BH-291out yielded than all other varieties/strains tested in the trial and produced seed cotton 1256 Kg/ha followed by BH-341which produced 1214 kg/ha of seed cotton. BH-535 and BH-291gave higher GOT of 42.8% & 42.0% respectively as compared to all other varieties in the trial. Strains BH-373 and standard BH-291 measured longer fiber length of 29.5 mm & 29.0 mm respectively than all other contesting varieties in the trial.

Table 2.1.3 PERFORMANCE OF PROMISING STRAINS IN PYT-3 DURING 2019-20 AT CRS, BWP.

Genotypes	Yield (kg/ha)	GOT %	SL (mm)
BH-585	869	37.0	28.5
FH-142	773	42.6	28.5
BH-373	745	40.4	27.0
BH-184	718	41.4	28.5
BH-405	704	43.0	28.0
BH-283	676	33.4	28.0
BH-375	662	40.2	29.5
BH-267	566	42.8	28.0
BH-563	552	43.4	28.0
BH-318	538	42.4	29.0

Strain BH-585 produced 869 Kg/ha seed cotton which is more than all other strains in the trial followed by FH-142 with the yield 773 kg/ha. In GOT% age, BH-563 gave higher value of 43.4% as compared to all others in the trial. BH-375 measured longer fiber length of 29.5mm than all other strains in this trial.

Table 2.1.4 PERFORMANCE OF PROMISING STRAINS IN PYT-4 DURING 2019-20 AT CRS, BWP.

Genotypes	Yield (kg/ha)	GOT %	SL (mm)
FH-142	842	42.8	28.0
BH-184	828	40.0	28.5
BH-189	787	41.4	27.0
BH-272	759	40.2	28.0
BH-377	718	43.0	29.5
BH-299	704	42.0	28.0

BH-376	676	42.0	28.0
BH-284	635	42.0	28.5
BH-287	607	43.2	28.0
BH-223	524	40.0	28.5

BH-227 produced 842 Kg of seed cotton per hectare which is highest than all other strains in this trial. In GOT% age strain BH-287 gave highest value of 43.2% as compared to all others in the trial. Strain BH-377 measured best fiber length of 29.5 mm.

Table 2.1.5 PERFORMANCE OF PROMISING STRAINS IN PYT-5 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH-597	1256	41.4	29.0
BH-224	1214	38.0	26.0
BH-378	1132	36.0	28.0
BH-226	1118	34.0	28.0
BH-381	1090	34.2	26.5
BH-184	1076	41.2	28.0
BH-320	1049	38.8	28.5
FH-142	1035	41.6	28.5
BH-380	1035	43.4	28.0
BH-232	1035	43.0	28.0

BH-597 produced 1256 kg seed cotton yield per hectare followed by BH-224 which gave 1214 kg/ha of seed cotton. In GOT% age BH-597 gave highest value of 43.4 % as compared to others in the trial. Strain BH-597 was also measured with better fiber length of 29.0 mm than all contesting strains of this trial.

Table 2.1.6 PERFORMANCE OF PROMISING STRAINS IN PYT-6 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH-312	1088	42.0	28.5
BH-311	881	38.6	29.0
BH-315	867	38.2	28.0
BH-167	854	37.2	28.0
BH-175	757	40.0	27.5
BH-318	757	40.8	28.0

BH-160	688	42.0	28.5
BH-306	661	42.5	27.5

Strain BH-312 yielded 1088 Kg seed cotton per hectare and out yielded than all the strains. In GOT% age strains BH-306 and BH-312 gave higher value of 42.5% & 42.0% respectively as compared to all others in the trial. Strain BH-311 measured longest staple length of 29.0 mm than all the contestants.

2.2 ADVANCE YIELD TRIALS (AYTs)

The objective of Advanced Yield Trial (AYT) entails the evaluation of newly advanced cotton lines selected from the PYT for yield and other important quantitative traits. During year 2019-20 about 44 lines/strains along with two checks (BH-184 & FH-142 (Bt)/ BH-160 & BH-167 (N.Bt)) in each trial were planted to assess their yield potential and their fiber quality. Detailed results of AYTs are presented below:

Table 2.2.1 PERFORMANCE OF PROMISING STRAINS IN AYT-1 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH 188	1446	38.0	29.0
BH 223	1418	33.8	28.5
BH 404	1377	41.2	27.5
BH 184	1322	38.8	27.0
BH 175	1115	34.0	28.0
BH 224	1088	42.0	29.0
BH 309	1060	38.8	28.5
BH 200	991	41.6	28.5
BH 186	964	37.2	28.0
FH 142	854	42.0	28.5

Advanced strain BH-188 perform best in all the varieties/strains and gave 1446 Kg of seed cotton yield whereas BH-223 gave 1418 Kg/ha. GOT %age of FH-142 was recorded 42.0% which is best than all the contesting varieties/strains in the trial. The staple length of BH-188 exceeded from all the varieties/strains and measured 29.0mm.

Table 2.2.2 PERFORMANCE OF PROMISING STRAINS IN AYT-2 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH-224	1118	40.4	28.5
BH-223	994	35.8	28.5
BH-313	966	38.6	29.0
BH-225	966	42.0	28.5
BH-184	966	42.0	29.5
BH-S-1	952	38.2	28.0
BH-311	925	42.0	28.5
BH-315	911	40.6	28.5
BH-317	842	42.4	28.5
FH-142	828	42.0	29.0

Advance strain BH-224 out yielded among all the varieties/strains and produced 1118 Kg/ha followed by BH-223 **(**994 Kg/ha). In GOT %age BH-317 gave 42.4 % which is the best among all other varieties/strains in the trial. The staple length of BH-184(29.5mm) was found best than all the contesting varieties/strains

Table 2.2.3 PERFORMANCE OF PROMISING STRAINS IN AYT-3 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH-224	1076	42.2	28.5
BH-200	1064	38.6	28.5
BH-408	993	36.6	28.5
BH-188	969	40.6	28.0
FH-142	945	42.0	28.5
BH-207	933	43.6	28.0

BH-184	861	42.2	29.0
BH341	837	40.0	28.5
BH-309	825	39.6	29.0
BH-311	801	42.0	27.5

Advance strain BH-224 out yielded among all the varieties/strains and produced 1076 Kg seed cotton which is better than standard BH-184(861Kg/ha). In GOT % age BH-224 gave 42.2% which is best than all other varieties in the trial. The staple length of BH-309 (29.0mm) was found best than all the contesting varieties/strains.

Table 2.2.4 PERFORMANCE OF PROMISING STRAINS IN AYT-4 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH-243	1232	37.8	27.5
BH-220	1208	42.0	28.0
BH-244	1160	38.6	27.5
BH-11	1124	42.0	28.0
BH-313	1064	43.8	28.5
FH-142	1041	40.8	29.0
BH-217	945	38.6	28.5
BH-232	897	43.4	28.5
BH-225	873	38.0	28.0
BH-184	873	40.8	28.0

Advance strain BH-243 out yielded among all the varieties/strains and produced 1232 Kg/ ha. In GOT % age BH-313 gave 43.8 % which is highest than all the contesting varieties/strains. The staple length of FH-142 (29.0 mm) was more than all the contesting varieties/strains.

Table 2.2.5 PERFORMANCE OF PROMISING STRAINS IN AYT-5 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**

BH-227	1088	39.8	28.0
BH-249	1052	41.8	29.0
BH-617	1017	41.0	28.5
BH-224	1017	40.8	28.5
FH-142	1005	36.0	28.5
BH-606	969	42.5	28.5
BH-247	921	42.0	29.0
BH-248	909	38.4	28.5
BH-613	873	39.0	28.5
BH-184	861	36.4	28.4

Strain FH-227 out yielded among all the varieties/strains by producing 1088 Kg/ha seed cotton followed by BH-249 which produced 1052 Kg/ha. In GOT % age BH-606 & BH-249 excelled all the varieties and produced 42.5% & 41.8% respectively. The staple length of BH-249 & BH-247 (29.0 mm) was more than all the contesting strains/varieties in the trial.

Table 2.2.6 PERFORMANCE OF PROMISING STRAINS IN AYT-6 DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
BH-301	1046	42.2	27.5
BH-305	1005	39.8	28.5
BH-309	867	42.0	29.5
BH-160	867	40.6	28.5
BH-167	785	37.8	29.0
BH-310	675	40.6	28.0

Strain BH-301out yielded among all the varieties/strains by producing 1046 Kg/ha seed cotton followed by BH-305which produced 1005 Kg/ha. In GOT %age BH-301 & BH 309 excelled all the varieties and produced 42.2 & 42.0 % respectively. The staple length of BH-309 (29.5 mm) was the best among all the contestants.

5. COORDINATED PHASE

3.1 PROVINCIAL COORDINATED COTTON TRIAL (PCCT)

The objective of this trial is to test the performance of new promising strains of different cotton research centers of Punjab under different ecological zones. During year 2019-20 the trial was conducted at CRS Bahawalpur, Set-1 comprised of 27 Bt. Strains and Set-2 comprised of 08 non-Bt. Strains. The results with respect to CLCuV incidence and yield were presented in Table 3.1.1 to 3.1.2.

Table 3.1.1 PERFORMANCE OF NEW STRAINS IN PCCT-1 (*Bt.*) DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
PC-9	1995	39.0	28.0
PC-8	1980	41.8	28.0
PC-7	2196	46.0	29.5
PC-6	1693	36.4	29.0
PC-5	1808	42.0	28.0
PC-4	1335	38.4	28.5
PC-3	1636	44.0	28.5
PC-27	1234	44.0	28.5
PC-26	1622	37.0	27.5
PC-25	1335	42.8	27.0
PC-24	1421	42.8	29.5
PC-23	1593	40.8	28.5
PC-22	1650	41.0	29.0
PC-21	1693	42.0	29.0
PC-20	1464	44.0	28.0
PC-2	1507	38.0	29.5

PC-19	1593	44.0	28.5
PC-18	1521	42.0	28.0
PC-17	1507	43.2	28.5
PC-16	1492	40.0	28.5
PC-15	1292	40.8	29.0
PC-14	1435	42.6	28.5
PC-13	1478	41.0	28.0
PC-12	1392	35.2	28.0
PC-11	1306	40.6	27.5
PC-10	1823	44.0	28.5
PC-1	1627	43.4	29.5

Variety PC-7 out yielded among all the varieties and produced 2196 Kg/ha seed cotton followed by PC-9 which produced 1995 Kg/ha seed cotton yield. In GOT % age PC-7 excelled all the varieties and produced 46.0 % which is highest among all others in the trial. The staple length of PC-1, PC-2 & PC-7 (29.5 mm) were found maximum.

Table 3.1.2 PERFORMANCE OF NEW STRAINS IN PCCT-2 (Non-*Bt.*) DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
PC-5	1808	38.4	29.0
PC-2	1521	40.0	27.0
PC-8	1507	34.4	28.5
PC-3	1378	42.0	27.5
PC-6	1349	44.0	28.0
PC-4	1335	38.6	28.0
PC-7	1306	40.8	27.5

PC-1	1205	38.0	28.5

PC-5 out yielded among all the contesting varieties and produced1808 Kg/ha seed cotton followed by PC-2 which produced 1521 Kg/ha seed cotton. In GOT % age PC-6 excelled all the varieties and produced 44.0 % which is highest among all others in the trial. The staple length of PC-5 (29.0mm) was found maximum than all the contesting strains/varieties in the trial.

3.2 NATIONAL COORDINATED VARIETAL TRIAL (NCVT)

The objective of this trial is to test the performance of new Varieties of different cotton research centers/private sectors at national level under different ecological zones. During year 2019-20 the trial was conducted at CRS Bahawalpur with different 4 sets (A to D). The results with respect to CLCuV incidence and yield were presented in Table 3.2.1 to 3.2.4.

Table 3.2.1 PERFORMANCE OF NEW STRAINS IN NCVT (SET-A) DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
NS-211	1498	42.4	28.5
Suncrop (C-II)	1434	41.6	28.0
Tahafuz-12 (C-II)	1422	40.2	28.0
Rohi-1	1408	41.0	28.0
1906	1306	34.6	28.5
TJ-King(C-II)	1281	39.6	28.5
Tahafuz-15	1178	40.0	28.0
1901	1140	42.0	28.0
Sayban-209	1127	41.2	29.5
1902	1114	38.0	28.0
1904	1114	40.4	27.5
Suncrop-3	1114	40.8	28.5

1923	1114	40.0	27.0
CIM-602(Bt-Std.)	1088	43.2	28.0
1905	1037	42.4	28.5
Rohi-2	1037	42.2	27.0
1903	1012	34.6	28.5
Tassco-112	1012	40.4	28.5
Diamond-2	1011	41.2	29.0
1908	986	34.4	28.0
Saim-102	986	39.0	28.5
1907	870	38.6	27.0
1909	794	38.0	27.0
Tassco-115	666	39.4	26.5

Among all the strains NS-211 showed maximum yield potential of 1498 Kg/ha followed by Rohi-1which produced 1408 Kg/ha of seed cotton. In GOT % age CIM-602 excelled all the varieties and produced 43.2 % which is highest among all others in the trial. The staple length of Sayban-209 (29.5 mm) were found maximum than all the contesting strains/varieties in the trial.

Table 3.2.2 PERFORMANCE OF NEW STRAINS IN NCVT (SET-B) DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
NIAB-SANAB-M	1599	38.8	28.5
Rustam-11	1467	41.4	28
1938	1467	40.4	28.5
Eye-22	1432	35	28.5
Eye-20	1431	42.2	28
ICI-2424	1408	42.6	27
BF-1	1348	40.6	28.5
1937	1300	42.4	29
1942	1276	39.2	29.5
Eye-111	1265	40	29
IR-NIBGE-13	1265	37	28.5
ASPL-709	1241	34	27
IR-NIBGE-14	1241	41.2	27.5
Bahar-136	1205	40.6	27.5
ASPL-710	1205	39.6	28.5
1943	1193	37	28
1939	1169	40	27.5
1934	1157	41.6	28
CIM-602 (Bt-Std.)	1074	38	28
Rustam-Beej-11(C-II)	1062	39.8	27
YBG-2222(C-II)	1062	38	28

IR-NIBGE-15	1062	40.4	28
YBG-2323(CKC)	1026	42	27.5
1936	1014	41	27.5
1940	1002	39.6	29.5
Rustam-Beej-111(CKC)	990	35	26.5

Among all the contesting varieties NIAB-SANAB-M showed maximum yield potential of 1599 Kg/ha followed by1938 which produced 1467 Kg/ha of seed cotton. In GOT % age ICI-2424 excelled all the varieties and produced 42.6 % which is highest among all others in the trial. The staple length of 1940 (29.5 mm) were found maximum than all the contesting strains/varieties in the trial.

Table 3.2.3 PERFORMANCE OF NEW STRAINS IN NCVT (SET-C) DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
FH-Super-Cotton-2017	1635	42	29
RH-Kashish	1563	42.6	27.5
VH-402	1456	40.4	28
NIAB-512	1408	41	28.5
NIAB-135	1408	38.4	28
FH-155	1372	42.4	28.5
NIAB-1011	1360	37.6	28.5
VH-189	1360	42.2	29
GH-Hamaliya	1360	41	28
GH-Sultan	1360	38	28.5
GH-Uhad	1336	40.2	28.5
BH-223	1324	40.6	28
VH-383	1312	41	27.5
BH-224	1312	42	28
RH-Afnan-2	1289	36.6	27
RH-670	1288	40.2	28
FH-Anmol	1229	40	28
FH-492	1193	42.2	27
NIAB-819	1145	40	29.5
FH-AM-Cotton-2017	1121	41.6	27.5

Among all the contesting varieties FH-Super-Cotton-2017 showed maximum yield potential of 1635 Kg/ha followed by RH-Kashish which produced 1563 Kg/ha of seed cotton. In GOT % age RH-Kashish excelled all the varieties and

produced 42.6 % which is highest among all others in the trial. The staple length of NIAB-819 (29.5 mm) were found maximum than all the contesting strains/varieties in the trial.

Table 3.2.4 PERFORMANCE OF NEW STRAINS IN NCVT (SET-D) DURING 2019-20 AT CRS, BWP.

Genotypes	**Yield (kg/ha)**	**GOT %**	**SL (mm)**
2000	1980	41.8	27.5
Cyto-226	1750	41	28
2001	1693	41.2	28.5
Bt-Cyto-533	1621	37.8	28.5
Bt-CIM-775	1621	41.4	30
Bt-Cyto-535	1478	42.6	28
Bt-Cyto-511	1421	36.8	28.5
MZM-7	1421	39	27
MNH-1050	1277	42.2	27.5
CRIS-671	1248	41.2	28.5
CRIS-638	1234	35.4	29
CEMB-Klean-Cotton-3	1205	40	29.5
CRIS-673	1205	41	27.5
MNH-1035	1190	41	29
CEMB-Klean-Cotton-5	1176	38.5	29.5
CIM-602 (Bt-Standard)	1162	39	28.5
1997	1162	43	29.5
CEMB-Klean-Cotton-6	1147	42.4	29
NIA-88	1147	41.2	27.5
CEMB-Klean-Cotton-4	1119	42.4	28

Bt-CIM-303	1076	42.6	28.5
NIAB-929	1033	43.4	28
CRIS-644	1004	35.8	29
Cyto-124 (Non-Bt Std.)	990	43.6	28
Bt-CIM-785	975	39.6	28.5
Bt-CIM-678	975	38.4	28
Bt-CIM-789	961	40.6	29

Among all the contesting varieties 2000 showed maximum yield potential of 1980 Kg/ha followed by Cyto-226 which produced 1750 Kg/ha of seed cotton. In GOT % age Bt-CIM-303 excelled all the varieties and produced 42.6 % which is highest among all others in the trial. The staple length of Bt-CIM-775 (30.0 mm) was found maximum than all the contesting strains/varieties in the trial.

6. AGRONOMIC PHASE

Agronomic research program aims for developing agronomic practices that can be easily adopted by the cotton growers and managing the cotton crop with judicious use of inputs to obtain the maximum yield with minimum inputs. In order to achieve this objective, the following agronomic experiments were conducted during 2019.

4.1 IMPACT OF NPK ON YIELD OF COTTON

The major objective of this experiment was to evaluate the response of new strains of cotton for seed cotton yield at different levels of NPK (table 4.1.1). In this experiment five fertilizer doses were evaluated. The maximum yield potential of 1285 kg/ha was produced by T-3 when 114 - 114 - 57 NPK (kg/ha) was applied table 4.1.2.

Table 4.1.1 DIFFERENT LEVELS OF NPK

TREATMENTS						
Fertilizer	**T0**	**T1**	**T2**	**T3**	**T4**	T5
N (kg/ha)	-	57	114	114	171	171
P (kg/ha)	-	57	57	114	57	114
K (kg/ha)	-	57	57	57	57	57

Table 4.1.2 PERFORMANCE OF TWO STRAINS AT DIFFERENT NPK LEVELS DURING 2019-20

TREATMENTS	Yield Kg/ha	
	BH-223	**BH-224**
T0	756	789
T1	1076	1088
T2	1138	1202
T3	**1248**	**1285**
T4	1108	1120
T5	940	972

4.2 IMPACT OF DIFFERENT PLANT SPACING ON YIELD OF COTTON

The major objective of this experiment was to evaluate the response of new strains of cotton for seed cotton yield at different distance of planting. In this experiment four planting distances were evaluated (table 4.2.1). The maximum yield potential of 1219 kg/ha was produced at S2 i.e. 12'' as shown in table 4.2.2.

Table 4.2.1 DIFFERENT PLANT SPACING

S1	**S2**	**S3**	**S4**
9''	12''	15''	18''

Table 4.2.2 PERFORMANCE OF TWO STRAINS AT DIFFERENT PLANT SPACING DURING 2019-20

Plant Spacing	Yield Kg/ha	
	BH-223	**BH-224**
9''	885	1052
12''	**1196**	**1219**

15''	1124	1004
18''	1100	1172

ANNUAL REPORT 2019-20

COTTON RESEARCH STATION, FAISALABAD

1 WEATHER

MONTH	TEMPERTAURE (°C)		MEAN RELATIVE HUMIDITY (%)	RAIN FALL(mm) 2018	RAIN FALL(mm) 2019
	MEAN MAXIMUM	MEAN MINIMUM			
JANUARY	21.5	4.0	89.2	-	1.2
FEBRUARY	25.1	9.0	82.2	7.2	9.2
MARCH	30.9	15.4	68.2	12.4	14.6
APRIL	36.3	21.2	57.7	11.4	22.5
MAY	39.4	24.5	45.8	12.0	23.2
JUNE	41.4	26.3	43.6	293.0	122.8
JULY	37.0	26.7	73.7	144.6	175.3
AUGUST	37.2	26.9	76.0	84.0	152.0
SEPTEMBER	36.9	26.4	73.5	48.1	85.4
OCTOBER	32.9	18.4	73.7	0.6	0.4
NOVEMBER	26.3	12.8	82.2	-	3.0
DECEMBER	17.0	6.0	87.0	7.0	0.4
Total					**610.0**

2 BREEDING PHASE

1.1 MAINTENANCE AND ENRICHMENT OF GERMPLASM

A total of 500 local and exotic accessions were studied during the year 2019-20. The data on different morphological and fiber quality parameters were recorded. The ranges of some characters are given in Table 1.

Table 1: CHARACTERS STUDIED AND THEIR RANGE IN GERMPLASM

Trait	Range
CLCuD Incidence (% age)	1.0-90.9

Boll Weight (g)	1.8-5.7
No. of Bolls/plant	05 – 85
Plant Height (cm)	50-295
GOT (%)	37.0-46.5
Staple Length (mm)	22.5- 32.1
Fiber Fineness (µg/inch)	3.6-5.9
Fiber Strength (g/tex)	26.5 – 44.6

1.2 DEVELOPMENT OF BREEDING MATERIAL POSSESSING HIGHER YIELD AND BETTER FIBER QUALITY

A total of eighty six (50) crosses were harvested during this year. The following F_1 to F_6 filial generations were studied in breeding area of Cotton Research Station, Faisalabad during the year 2019-20.

1.2.1 Regular Breeding Programme

Following breeding material was screened during the year under report to develop high yielding and tolerant to biotic and abiotic stresses lines along with desired fiber quality traits (Table-2).

Table 2: BREEDING MATERIAL STUDIED DURING THE YEAR 2019-20

Sr. No.	Generation	Studied Progenies	Selected Crosses/Plants/Progenies
1.	F_1	50	50 progenies seed were pooled separately
2.	F_2	49	29 Single plants finally selected
3.	F_3	180	39 Single plants finally selected
4.	F_4	51	54 Single plants finally selected
5.	F_5	60	49 Single plants finally selected
6.	F_6	68	10 lines were finally selected out of 68 progenies and bulked for PYT trial

SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_1 GENERATION DURING THE YEAR 2019-20 at CRS FSD

Entry No.	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node	Mop /pl	GOT (%)	Fibre		
									Length (mm)	Fineness (µg/in)	Strength (g/tex)
1025	0.0	151.2	48.2	3.2	176	4.0	2.8	36	29.96	3.98	31.4
1020	2.1	128.3	38.1	3.5	148	4.6	2.2	37	28.76	4.63	29.8
1043	8.3	128.8	40.4	2.8	139	4.6	3.0	44	28.30	4.34	29.2
1049	12.0	123.7	39.2	3.1	157	4.0	2.0	44	29.72	4.03	26.5
1061	1.5	122.0	37.1	3.2	172	4.0	3.4	44	29.47	4.23	28.9

In F_1 generation trial, total 62 entries were studied. In F_1, CLCuD ranged from 0% to 43% and the lowest virus parentage (0.0%) was recorded for the entries 1007, 1018 and 1019. Average number of bolls/plant and average boll weight ranged from 10 to 50 and 3.2 to 4.4gm, respectively. GOT. ranged from 35.0 to 45.2%. The staple length ranged from 23.9 to 29.96mm. The mic (fineness) ranged from 3.73 to 5.00 µg/inch. The fiber strength ranged from 22.2 to 31.7 g/tex.

SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_2 GENERATION DURING THE YEAR 2019-20 at CRS FSD

Strain No	CLCuD (%)	Yield/pl (g)	Bolls/pl.	Avg. Boll weight (g)	Plant Height(cm)	Node	GOT (%)	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
2001	1.21	157	59	3.0	165	4.5	44	28.47	4.53	32.8
2005	2.72	172	55	3.1	150	4.0	39	28.13	3.67	27.0
2007	0.00	138	52	2.7	160	3.7	41	29.00	4.14	29.2
2010	3.01	158	47	3.5	145	3.5	37	28.33	3.92	25.5
2040	2.59	182	50	3.2	175	4.0	37	28.04	4.52	27.6

In F_2 CLCuD ranged from 0.0 to 9.26 %. Number of bolls/plants and boll weight ranged from 13.0-59.0 and 2.0-4.3 g respectively, especially GOT. ranged from 25.0 to 48.0 %. The staple length ranged from 23.70 to 30.8 mm. The mic (fineness) ranged from 3.62 to 5.49µg/in.. The staple strength ranged from 21.2-31.7 g/tex.

SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_3 GENERATION DURING THE YEAR 2019-20 at CRS, FSD

Strains	CLCuD%	Yield/pl. (g)	Bolls/pl.	Avg. Boll Weight (g)	Plant Height (cm)	Node	GOT%	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
3007/P1	5.21%	85	32	2.8	122	5	40.5	30.37	4.65	33.1
3007/P3	5.21%	93	32	2.8	122	5	41.2	28.82	3.78	34.1
3002/P2	18%	115	44	3.3	160	6	40.0	29.29	4.26	28.7
3031/P3	31%	116	41	3.4	167	7	39.0	28.7	3.36	25.7
3048/P2	20.45%	79	27	2.9	173	5	40.0	28.59	4.11	31.5

In F_3 CLCuD ranged from 5.12 to 31.7% and the lowest virus percentage (5.12%) was recorded for the strain 3007. Number of bolls/plant and boll weight ranged from 18 to 46, and 1.4 to 3.5g respectively. GOT ranged from 34.5% to 48% .The highest GOT (48%) was found in the strain 3004. The staple length ranged from 23.7 to 30.4 mm. The highest staple length was found in the strain 3007. Fiber fineness ranged from 2.9 to 5.5 ug/in. The lowest mic was found in the strain 3031. The staple strength ranged from 19.2 to 34.1 g/tex. The highest staple strength was found in the strain 3007. The best harmonious combinations were 3002, 3007, 3031 and 3048.

SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_4 GENERATION DURING THE YEAR 2019-20 at CRS, FSD

Strain No.	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node	Monp /pl	GOT (%)	Fibre		
									Length (mm)	Fineness (µg/in)	Strength (g/tex)
4020/P1	10.71%	98	27	2.9	142	7	40.3	28.56	4.02	28.5	4020/P1
4037/P1	15.74%	129	35	3.3	193	7	40.0	29.09	3.34	25.9	4037/P1
4043/P1	20.65%	100	46	2.6	215	6	42.3	28.8	3.31	24.1	4043/P1
4044/P2	25.89%	86	38	2.7	200	7	37.5	28.58	3.53	21.6	4044/P2
4058/P4	15.74%	150	39	2.8	135	7	42.0	28.76	3.97	31.5	4058/P4
4059/P5	18.40%	102	42	2.6	153	8	45.5	28.38	4.24	25.4	4059/P5

In F_4 CLCuD ranged from 5.5 to 25.8% and the lowest virus percentage (5.5%) was recorded for the strain 4006. Number of bolls/plant and boll weight ranged from 14 to 50, and 2.4 to 3.3 g respectively. GOT ranged from 29.8 to 45.5% .The highest GOT (45.5%) was found in the strain 4059. The staple length ranged from 24.1 to 29.2 mm. The highest staple length was found in the strain 4059. The mic (fineness) ranged from 2.8 to 4.2 ug/in. The lowest mic was found in the strain 4042. The staple strength ranged from 18.6 to 31.5 g/tex. The highest staple strength was found in the strain 4058. The best harmonious combinations were 4020, 4037, 4043, 4044, 4058 and 4059.

SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_5 GENERATION DURING THE YEAR 2019-20 at CRS Faisalabad

Strain No.	CLCuD (%)	Yield/Pl (g)	Bolls/pl	Plant Height (cm)	Node	Monp /pl	GOT (%)	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
5003	2.68	104	64	194	5	2	38	29.46	4.19	27.0
5009	4.46	93	51	196	6	2	36	28.49	3.21	25.15
5011	4.17	115	61	172	5	2	39	27.94	3.54	25.1
5026	8.04	130	41	151	6	2	35	27.52	3.98	23.45
5049	6.25	73	62	187	7	2	36	28.66	3.70	29.8

The best harmonious combinations were 5003, 5009, 5011, 5026 and 5049. In F_5CLCuD ranged from 1.79 to 21.30 % and the lowest virus percentage (1.79 %) was recorded for the strain 5018. Number of bolls/plant ranged from 36 t 84. GOT ranged from 34 to 46 %. The highest GOT (46 %) was found in the strain 5004. The staple length ranged fror 24.77 to 29.49 mm. The highest staple length was found in the strain 5003. The mike (fineness) ranged from 2.91 t 4.43 ug/in. and the lowest mike was found in the strain 5018. The staple strength ranged from 21.3 to 30.3 g/tex. Th highest staple strength was found in the strain 5058.

SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_6 GENERATION DURING THE YEAR 2019-20 at CRS Faisalabad

Strains	CLCuD%	Yield/plot (g)	Bolls/pl.	Plant Height (cm)	Node	Mono/pl.	GOT%	Fibre		
								Length (mm)	Fineness (µg/in)	Strength (g/tex)
6042	8.54	1015	78	184	5	1	41	27.84	3.97	29.9

6050	2.33	2660	55	158	6	1	41	28.39	3.94	29.9
6062	3.06	1145	77	175	6	2	42	28.13	3.47	27.6
6066	3.65	820	62	165	6	2	42	28.99	3.49	25.8
6067	6.10	640	49	170	6	2	42	28.88	3.65	31.2

The best harmonious combinations were 6042, 6050, 6062, 6066 and 6067. In F_6CLCuD ranged from 2.08 to 12.90 % and the lowest virus percentage (2.08 %) was recorded for the strain 6057. Number of bolls/plant ranged from 48 to113 gm. GOT ranged from 40% to 46 % .The highest GOT (46%) was found in the strains 6041 and 6043. The staple length ranged from 24.39 to 28.99 mm. The highest staple length was found in the strain 6066. The mike (fineness) ranged from 3.23 to 4.88 ug/in. The lowest mike was found in the strain 6054. The staple strength ranged from 22.7 to 31.2 g/tex. The highest staple strength was found in the strain 6067.

3 EVALUATION PHASE

2.1 PRELIMINARY YIELD TRIALS

The objective of Preliminary Yield Trial (PYT) is to evaluate 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 virus disease. Cultivars at this stage were subjected to a reduced selection pressure and the selected lines were progressed to the Advanced Yield Trials. During year 2019-20, 38 lines/strains were planted in 3 PYTs with different genotypes per trial along with one standard variety (FH-142). Detailed results of each PYT are given below:

:

PERFORMANCE OF PROMISING STRAINS IN PYT-1 DURING 2019-20 AT CRS,FSD

Variety	CLCuD (%)	Yield (kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		Fibre			
							Square	Flower	GOT (%)	Length (mm)	Fineness (µg/in)	Strength (g/tex)
FH-513	6.3	2534	34430	22	2.8	113	36	53	39.3	26.6	4.18	30.8
FH-514	4.2	2152	34430	32	3	130	36	57	36.7	26.4	4.57	25.3
FH-515	26.4	2403	34430	29	3.7	132	36	56	37.8	27.1	4.69	26.9
FH-516	5.6	1698	34215	18	3	103	35	55	36.7	27.6	4.73	25.4
FH-517	8.3	3013	34430	32	2.8	124	33	55	41.2	28.4	4.48	27.7

FH-518	6.3	2649	34430	28	3.2	122	35	56	40.6	28.0	4.61	29.9
FH-519	4.9	980	34430	36	3.7	126	36	54	43.2	26.5	4.84	26.2
FH-520	18.1	2384	34430	29	3.7	113	36	56	43.2	27.6	4.68	23.9
FH-521	11.1	1700	34430	33	3.5	126	35	54	40.0	27.6	4.36	27.3
FH-522	5.6	1985	34430	26	3.5	120	37	58	42.9	26.8	4.96	26.3
FH-523	6.9	2078	34430	22	3.5	107	34	55	40.0	26.7	4.86	25.1
FH-524	9.0	1444	34430	25	2.8	112	36	55	42.9	26.5	3.93	24.6
FH-142	9.0	1506	34430	29	3.2	125	37	58	40.6	27.8	4.38	24.7
LSD (0.05)	**278.14**											

The result of statistical analysis of yield is significant. Twelve strains along with one standard FH-142 were tested for yield and fiber characteristics. FH-517 produced highest yield (3013 kg/ha) followed by FH-518 (2649 kg/ha) as compared with standard FH-142 (1506 kg/ha). As per GOT is concerned, the strains FH-519 and FH-520 has maximum GOT i.e., 43.2% followed by FH-522 having 42.9 % GOT as compared with standard FH-142 (40.6 %). In case of staple length, the strain FH-517 have maximum staple length (28.4 mm) followed by the strain FH-518 with 28.0 mm staple length as compared with standard having 27.8 mm staple length. The lowest virus disease intensity (4.2 %) was found in strain FH-514 followed by FH-519 having 4.9 % CLCuD as compared with standard having 9.0 % CLCuD.

PERFORMANCE OF PROMISING STRAINS IN PYT-2 DURING 2019-20 AT CRS,FSD

Variety	**CLCuD (%)**	**Yield (kg/ha)**	**Plant pop/ha**	**Bolls/pl**	**Av. Boll weight (g)**	**Plant Height (cm)**	**Days to 1st**		**Fibre**			
							Square	**Flower**	**GOT (%)**	**Length (mm)**	**Fineness (µg/in)**	**Strength (g/tex)**
FH-494	3.5	2678	34430	22	3.8	113	34	54	39.5	28.6	4.79	27.2
FH-495	13.3	2295	34229	32	3.6	130	37	57	41.7	27.3	4.42	28.6
FH-455	15.3	2511	34430	29	3.1	132	36	55	41.9	27.1	4.31	29.4
FH-505	15.3	1985	34430	18	2.3	103	35	55	43.5	25.3	4.09	29.5
FH-456	5.6	2582	34251	32	3.3	124	36	55	45.5	28.9	4.53	29.0
6035/17	7.6	2750	34430	28	3.9	122	34	54	43.6	28.0	4.48	29.1
FH-452	3.5	1745	34430	36	3.2	126	36	56	40.6	28.1	4.18	30.5
FH-458	2.1	1961	34430	29	3.4	113	37	54	38.2	27.0	4.31	30.0
FH-SUPER COTTON	3.5	2487	34251	33	3.5	126	36	53	40.0	28.6	4.82	29.0

FH-AM-COTTON	21.3	2032	25822	26	3.3	120	37	56	42.4	28.4	4.62	29.3
FH-ANMOL COTTON	6.5	1745	25822	22	3.7	107	37	56	40.5	28.0	4.80	29.6
FH-SANDAL COTTON	5.9	1650	32278	25	4	112	36	53	40.0	27.9	4.79	29.3
FH-142*	6.2	1865	30843	29	2.6	125	37	56	38.5	27.8	4.13	29.5
LSD (0.05) **318.97**												

The result of statistical analysis of yield is significant. Twelve strains along with one standard FH-142 were tested for yield and fiber characteristics. 6035/17 produced highest yield (2750 kg/ha) followed by FH-494 (2678 kg/ha) as compared with standard FH-142 (1506 kg/ha). As per GOT is concerned, the strain FH-456 has maximum GOT i.e., 45.5% followed by 6035/17 having 43.6 % GOT as compared with standard FH-142 (38.5 %). In case of staple length, the strain FH-456 have maximum staple length (28.9 mm) followed by the strain FH-494 with 28.4 mm staple length as compared with standard having 27.8 mm staple length. The lowest virus disease intensity (2.1 %) was found in strain FH-458 followed by FH-494 having 3.5 % CLCuD as compared with standard having 6.2 % CLCuD.

PERFORMANCE OF PROMISING STRAINS IN PYT-3 DURING 2019-20 AT CRS,FSD

Variety	CLCuD (%)	Yield (kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		Fibre			
							Square	Flower	GOT (%)	Length (mm)	Fineness (µg/in)	Strength (g/tex)
6028/17	25.0	2224	34430	22	2.9	113	36	52	36.4	27.9	3.51	27.1
6038/17	4.2	2044	34430	32	2.8	130	34	51	38.1	27.4	3.47	27.7
6061/17	12.5	2511	34430	29	2.6	132	35	55	42.3	27.4	4.21	29.8
6007/18	6.3	2439	28692	18	3	103	36	53	40.0	27.1	3.99	29.7
6008/18	6.3	2869	34430	32	3.3	124	35	55	36.4	28.4	4.66	29.7
6009/18	4.2	2295	34430	28	2.8	122	35	54	39.3	28.0	4.03	28.1
6011/18	26.0	2439	34430	36	3.2	126	35	55	37.5	27.5	4.55	32
6019/18	5.2	2618	34430	29	4	113	34	54	40.0	27.0	4.21	29.4
6021/18	32.3	2869	34430	33	2.8	126	35	53	35.7	28.3	4.24	30.6
6023/18	7.3	1937	34430	26	2.8	120	36	55	39.3	27.5	4.10	28.80
6030/18	8.3	2152	34430	22	2.9	107	35	54	31.0	28.6	3.42	27.9

6034/18	10.4	1721	34430	25	2.4	112	36	54	41.7	28.04	4.03	28.1
6037/18	10.4	2797	34430	29	3.5	125	34	55	40.0	27.4	5.2	28.7
6039/18	10.4	2467	34430	34	2.4	114	36	57	41.7	28.9	4.67	28.8
FH-142*	10.4	1721	34430	24	3.4	111	36	54	38.2	27.7	4.6	28.1
LSD (0.05)	**295.01**											

The result of statistical analysis of yield is significant. Fifteen strains along with one standard FH-142 were tested for yield and fiber characteristics. 6021/18 and 6008/18produced highest yield (2869 kg/ha) followed by 6037/18 (2797 kg/ha) as compared with standard FH-142 (1721 kg/ha). As per GOT is concerned, the strains 6061/17 has maximum GOT i.e., 42.3 % followed by 6039/17 having 41.7 % GOT as compared with standard FH-142 (38.2 %). In case of staple length, the strain 6030/18 have maximum staple length (28.6 mm) followed by the strain 6008/18 with 28.4 mm staple length as compared with standard having 27.7 mm staple length. The lowest virus disease intensity (4.2 %) was found in strain 6038/17 followed by 6007/18 having 6.3 % CLCuD as compared with standard having 10.4 % CLCuD.

2.2 ADVANCE YIELD TRIALS

The objective ofAdvanced Yield Trial (AYT) entails the evaluation of newly advanced cotton lines selected from the PYT for yield and other important quantitative traits. During year 2019-20 about 20 lines/strains along with one check FH-142 in each trial were planted to assess their yield potential and their fiber quality. Detailed results of AYTs are presented below:

PERFORMANCE OF PROMISING STRAINS IN AYT-1 DURING 2019-20 AT CRS,FSD

Variety	**CLCuD (%)**	**Yield (kg/ha)**	**Plant pop/ha**	**Bolls/pl**	**Av. Boll weight (g)**	**Plant Height (cm)**	**Days to 1st**		**Fibre**			
							Square	**Flower**	**GOT (%)**	**Length (mm)**	**Fineness (µg/in)**	**Strength (g/tex)**
FH-496	18.8	2343	34430	27	2.80	188	35	54	39.3	28.1	4.24	29.6
FH-497	11.1	2893	34430	30	3.20	158	36	54	37.5	28.7	4.47	30.5
FH-500	9.0	3467	34430	40	3.20	161	34	55	39.4	28.6	4.74	31.3
FH-505	25.0	2391	34430	31	2.90	183	35	56	39.5	27.0	4.80	28.2
FH-508	9.9	1913	33713	23	2.60	143	35	57	42.3	27.4	4.05	29.1

FH-512	7.6	2630	34430	43	3.00	184	36	56	40.0	27.5	4.75	28.8
FH-456	8.3	2056	34430	28	3.20	133	36	54	40.6	27.7	4.57	29.1
6006/15	4.2	2439	28692	35	2.80	200	36	53	38.7	27.3	4.47	29.5
FH-419	11.9	1913	34215	27	3.90	142	37	55	41.0	28.4	4.51	30.6
FH-504	12.5	2391	34430	33	2.20	198	38	56	37.4	28.9	4.64	30.7
FH-142*	12.7	2152	33892	30	4.10	177	36	54	40.2	27.7	4.28	29.1
LSD (0.05)	**281.50**											

The result of statistical analysis of yield is significant. Ten strains along with one standard FH-142 were tested for yield and fiber characteristics. FH-500 produced highest yield (3467 kg/ha) followed by FH-497 (2893 kg/ha) as compared with standard FH-142 (2152 kg/ha). As per GOT is concerned, the strains FH-508 has maximum GOT i.e., 42.3 % followed by FH-419 having 41.0 % GOT as compared with standard FH-142 (40.2 %). In case of staple length, the strain FH-504 have maximum staple length (28.9 mm) followed by the strain FH-497 with 28.7 mm staple length as compared with standard having 27.7 mm staple length. The lowest virus disease intensity (4.2 %) was found in strain 6006/15 followed by FH-512 having 7.6 % CLCuD as compared with standard having 12.7 % CLCuD.

PERFORMANCE OF PROMISING STRAINS IN AYT-2 DURING 2019-20 AT CRS,FSD

Variety	**CLCuD (%)**	**Yield (kg/ha)**	**Plant pop/ha**	**Bolls/pl**	**Av. Boll weight (g)**	**Plant Height (cm)**	**Days to 1st**		**Fibre**			
							Square	**Flower**	**GOT (%)**	**Length (mm)**	**Fineness (µg/in)**	**Strength (g/tex)**
FH-492	4.9	2546	34430	22	3.5	113	37	55	40.0	27.2	4.22	30.40
FH-495	9.7	2463	34430	32	3.7	130	35	56	40.5	27.3	4.54	29.90
FH-498	9.8	2917	34215	29	3.4	132	37	54	41.2	28.7	4.77	30.60
FH-453	3.5	2668	34430	18	3.9	103	33	54	40.8	28.8	4.19	28.10
FH-455	4.2	2135	34215	32	3.8	124	35	57	39.5	27.8	4.46	28.50
FH-503	6.9	2128	34430	28	3.8	122	35	55	39.5	27.3	4.33	29.10
FH-506	5.6	2702	34430	36	3.8	126	35	54	39.5	26.4	4.18	31.60
FH-507	2.8	2587	34430	29	3.5	113	35	56	42.9	27.1	4.29	30.70

FH-510	3.5	2350	34430	33	3.9	126	34	55	41.0	27.2	4.52	31.50
FH-511	15.4	2073	34251	26	3.2	120	36	57	40.6	27.7	4.10	32.90
FH-142*	15.3	2606	34430	22	3.4	107	34	53	40.4	27.4	4.60	30.50
LSD (0.05)	**188.32**											

The result of statistical analysis of yield is significant. Ten strains along with one standard FH-142 were tested for yield and fiber characteristics. FH-498 produced highest yield (2917 kg/ha) followed by FH-453 (2668 kg/ha) as compared with standard FH-142 (2606 kg/ha). As per GOT is concerned, the strains FH-507 has maximum GOT i.e., 42.9 % followed by FH-498 having 41.2 % GOT as compared with standard FH-142 (40.4 %). In case of staple length, the strain FH-453 have maximum staple length (28.8 mm) followed by the strain FH-498 with 28.7 mm staple length as compared with standard having 27.4 mm staple length. The lowest virus disease intensity (2.8 %) was found in strain FH-507 followed by FH-453 having 3.5 % CLCuD as compared with standard having 15.3 % CLCuD.

4. PROVINCIAL COORDINATED COTTON TRIALS (PCCT)

Provincial Coordinated Cotton Varietal Trials were governed by Director Cotton Research Institute, Multan. During the year 2019 was conducted including 27 cotton strains. All these varieties were received from the private sector and allied stations and sub-stations of Cotton Research Institute, Multan. The trial was planted at different locations with codes (PC-1 to PC-27). The results of Cotton Research Station, Faisalabadare given below.

Table. SUMMARIZED SEED COTTON YIELD OF ENTRIES INCLUDED IN PCCT DURING2019-20

PREVIOUS YEAR'S RESULTS OF PROVINCIAL COORDINATED COTTON TRIALS (PCCT), DURING THE YEAR 2019-20 AT CRS, FSD		
PC Code	**Yield (kg/ha)**	**CLCuD%**
PC-01	1793	2.50
PC-02	1524	7.50
PC-03	1130	10.00

PC-04	1453	2.50
PC-05	1309	2.50
PC-06	1399	2.50
PC-07	1811	5.00
PC-08	2367	2.50
PC-09	2188	17.50
PC-10	2421	2.50
PC-11	1865	27.50
PC-12	2098	15.00
PC-13	2044	17.50
PC-14	1955	10.00
PC-15	2188	2.50
PC-16	1901	5.00
PC-17	1990	5.00
PC-18	2026	7.50
PC-19	1990	5.00
PC-20	1704	12.50
PC-21	2170	10.00
PC-22	1829	2.50
PC-23	1883	2.50
PC-24	1650	5.00
PC-25	1739	15.00

PC-26	2188	20.00
PC-27	2349	15.00
LSD (0.05)	**206.20**	

In PCCT 2019-20 PC-10 gave maximum yield 2419kg/ha followed by PC-27 with 2349 kg/ha. The detailed results of various parameters in Provincial Coordinated Cotton Trial about morphological features, CLCuV incidence are given below.

Table MORPHOLOGICAL DATA OF ENTRIES INCLUDED IN PCCT 2019-20

Genotype	DAYS TO 1ST SQUARE	DAYS TO 1ST FLOWER	NODES	MON	SYMP	BOLLS	PLANT HEIGHT(cm)	BOLL WT(gms)
PC-01	38	51	7	2	24	32	106	3.65
PC-02	37	53	7	2	23	42	106	3.3
PC-03	35	51	9	1	31	45	100	4.35
PC-04	37	53	8	2	29	46	108	3.45
PC-05	38	50	7	1	12	16	132	3.45
PC-06	34	51	5	3	26	17	130	4.05
PC-07	36	50	8	2	14	27	110	2.2
PC-08	35	50	7	1	28	52	166	3.05
PC-09	38	52	9	3	24	38	170	3.4
PC-10	37	53	9	2	27	65	172	3.25
PC-11	34	50	8	2	28	80	176	3.35
PC-12	35	50	8	3	25	42	177	3.6
PC-13	35	53	8	1	32	55	174	3.8

PC-14	37	49	8	4	20	38	153	3.5
PC-15	35	50	8	1	24	38	136	3.45
PC-16	35	51	8	3	23	47	144	3.7
PC-17	34	50	7	2	20	42	134	3.25
PC-18	40	51	9	2	28	45	104	2.85
PC-19	38	53	8	2	16	23	134	3.05
PC-20	35	50	7	1	18	30	108	3.45
PC-21	33	53	9	3	10	24	138	3.75
PC-22	34	53	8	1	20	33	140	3.65
PC-23	41	53	7	2	25	56	120	4.05
PC-24	38	54	9	2	15	33	114	3.65
PC-25	43	53	7	1	19	28	136	3.8
PC-26	38	53	9	2	15	24	158	3.8
PC-27	36	53	8	2	30	58	168	3.45

3.2 NATIONAL COORDINATED VARIETAL TRIAL (NCVT)

The objective of this trial is to test the performance of new Varieties of different cotton research centers on national basis under different ecological zones. During year 2019-20, the trial was conducted at CRS Faisalabad, Set-A comprised of 24 varieties and SET-B comprised of 26 varieties. The results with respect to CLCuV incidence and yield are presented below:

PREVIOUS YEAR'S RESULTS OF NATIONAL COORDINATED VARIETAL TRIALS (NCVT), SET-A, DURING THE YEAR 2019-20 AT CRS, FSD

PC Code	**Yield (kg/ha)**	**CLCuD Index%**
PC-1901	2044	12.30
PC-1902	2546	8.20
PC-1903	1560	4.06
PC-1904	2152	19.01
PC-1905	1901	8.72
PC-1906	1255	3.66
PC-1907	1973	12.63
PC-1908	3228	7.98
PC-1909	1793	30.60
PC-1910	2044	10.08
PC-1911	2116	11.33
PC-1912	2295	6.41
PC-1913	2475	11.33
PC-1914	2259	25.78
PC-1915	2618	14.74
PC-1916	2851	7.59
PC-1917	1919	12.89
PC-1918	2277	8.59

PC-1919	2600	10.42
PC-1920	2277	7.37
PC-1921	1847	10.34
PC-1922	2044	11.18
PC-1923	2690	8.98
PC-1924	2152	3.95
LSD (0.05)	**187.52**	

Morphological TraitsNCVT-2019-20 (Set-A)									
Sr.	**PC Code**	**Days to 1st square**	**Days to 1st flower**	**Nodes/ Plant**	**Monopodia/ Plant**	**Sympodia/ Plant**	**Av. No. of Bolls/ Plant**	**Plant Height (cm)**	**Boll wt. (gms)**
1	**PC-1901**	33	53	8	3	23	30	133	3.2
2	**PC-1902**	32	48	7	1	22	24	107	3.5
3	**PC-1903**	33	49	8	1	25	27	116	4.0
4	**PC-1904**	31	45	8	2	23	30	122	3.5
5	**PC-1905**	31	49	9	1	25	34	142	3.1
6	**PC-1906**	45	63	7	3	23	18	174	3.3
7	**PC-1907**	31	47	9	2	17	23	87	3.2
8	**PC-1908**	31	52	9	2	22	33	117	4.0
9	**PC-1909**	31	46	9	2	28	36	162	3.7
10	**PC-1910**	32	50	9	0	17	25	101	3.2
11	**PC-1911**	33	50	8	1	19	21	122	4.0
12	**PC-1912**	30	47	8	1	25	35	144	2.6

13	**PC-1913**	31	50	8	1	19	24	105	3.7
14	**PC-1914**	32	51	8	2	22	25	145	3.1
15	**PC-1915**	32	51	9	3	20	26	121	3.1
16	**PC-1916**	32	50	9	2	18	29	109	2.8
17	**PC-1917**	34	51	10	2	21	25	137	3.5
18	**PC-1918**	31	49	9	1	21	37	116	3.3
19	**PC-1919**	31	49	9	2	27	36	134	3.3
20	**PC-1920**	31	49	8	1	24	34	147	3.5
21	**PC-1921**	31	51	9	1	28	35	157	3.8
22	**PC-1922**	33	50	9	3	24	36	146	2.8
23	**PC-1923**	31	49	9	2	21	25	117	3.5
24	**PC-1924**	31	49	9	1	23	17	103	3.2

PREVIOUS YEAR'S RESULTS OF NATIONAL COORDINATED VARIETAL TRIALS (NCVT), SET-B, DURING THE YEAR 2019-20 AT CRS, FSD

PC Code	**Yield (kg/ha)**	**CLCuD Index%**
PC-1925	2654	13.42
PC-1926	2905	20.96
PC-1927	2582	11.33
PC-1928	2331	26.05
PC-1929	1901	13.15
PC-1930	3031	29.30
PC-1931	2098	14.97

PC-1932	2313	7.07
PC-1933	2385	5.73
PC-1934	2654	6.90
PC-1935	2636	12.89
PC-1936	2206	12.11
PC-1937	2475	13.38
PC-1938	2815	11.46
PC-1939	2905	7.55
PC-1940	2385	5.91
PC-1941	2152	8.07
PC-1942	2439	6.97
PC-1943	1847	9.64
PC-1944	2313	5.26
PC-1945	2564	8.85
PC-1946	2672	8.59
PC-1947	2331	6.05
PC-1948	2170	4.69
PC-1949	2277	5.38
PC-1950	3138	7.94
LSD (0.05)	**173.98**	

Morphological TraitsNCVT-2019-20 (Set-B)								
PC-No.	**Days to 1st square**	**Days to 1st flower**	**Nodes/ Plant**	**Monopodia/ Plant**	**Sympodia/ Plant**	**Av. No. of Bolls/ Plant**	**Plant Height (cm)**	**Boll wt. (gms)**
PC-1925	32	51	6	2	19	21	115	3.5
PC-1926	31	51	7	1	22	24	140	3.9
PC-1927	31	51	5	3	21	23	118	3.5
PC-1928	32	55	5	2	21	24	143	3.4
PC-1929	32	51	5	0	21	20	129	3.0
PC-1930	33	53	6	2	22	24	153	2.7
PC-1931	32	50	4	1	20	21	153	2.6
PC-1932	33	50	5	2	22	20	136	2.8
PC-1933	33	50	7	3	23	27	124	2.7
PC-1934	32	48	7	1	20	28	137	3.3
PC-1935	33	49	9	1	19	20	133	2.6
PC-1936	33	53	10	1	21	30	124	4.0
PC-1937	32	52	9	1	21	22	115	3.6
PC-1938	32	49	7	2	22	24	127	4.1
PC-1939	33	50	7	1	22	27	136	4.1
PC-1940	30	51	8	3	21	33	125	2.9
PC-1941	31	53	7	3	24	31	138	4.1
PC-1942	32	48	7	1	27	26	153	4.1
PC-1943	31	50	6	0	22	23	131	3.7
PC-1944	33	52	7	1	21	22	146	2.9
PC-1945	32	52	7	2	19	22	117	3.3

PC-1946	31	52	8	2	19	19	115	3.5
PC-1947	31	49	7	1	22	31	134	3.3
PC-1948	31	49	6	1	24	18	119	4.1
PC-1949	32	50	7	2	22	22	115	3.3
PC-1950	33	51	6	1	20	24	125	3.1

5. AGRONOMIC PHASE

4.1SOWING DATE TRIAL ON PROMISING LINES OF COTTON

This experiment was conducted to evaluate yield performance of various promising strains at different sowing dates. The experiment replicated thrice and was laid out according to split-plot design having net plot size measuring 4.54×4.54 m. The sowing dates were randomized as main-plot and varieties as sub- plots. Three varieties viz AM-Cotton, FH-Super Cotton and FH-155 were used as an experimental material. The sowing dates started from 16th March and last date of sowing was 16th June with 15 days interval. The crop was sown by using 20kg/ha^{-1} fuzzy seed with hand chopa on beds. The plant spacing and row spacing was kept 30cm and 75cm respectively. Crop was fertilized @ 150-100-50 kg NPK/ ha^{-1}. All other agronomic and entomological practices were kept uniform and normal. The yield data recorded was analyzed by using software statistics.

TABLE : SEED COTTON YIELD (KG/HA) AS AFFECTED BY VARIOUS SOWING DATES, GENOTYPES AND THEIR INTERACTIONS

PREVIOUS YEAR'S RESULTS SOWING DATE TRIAL ON PROMISING LINES OF COTTON								
Treatment	**Treatments**	**Avg. No. of bolls**	**Av. Boll weight (g)**	**Yield Kg / Ha**	**GOT (%)**	**Fibre**		
						Length (mm)	**Strength (g/tex**	**Fineness (µg/in)**
D1 = 16th March 2019	**Super cotton**	50	3	2451	42	28.3	32.3	4.5
	AM-cotton	38	3	2289	43	27.5	22.4	4.4
	FH-155	37	4	2197	40	27.5	32.5	4.3
	Super cotton	34	3	2246	37	27.5	31.3	4.4
D2 = 1st April 2019	**AM-cotton**	32	3	1593	37	27.5	29.7	4.4
	FH-155	41	3	1760	39	27.7	27.5	4.5
	Super cotton	25	4	1458	37	28.2	30.1	4.5
	AM-cotton	36	3	1490	36	27.5	28.9	4.5
D3 = 16th April 2019	**FH-155**	44	4	1071	41	28	27.3	4.3
	Super cotton	32	3	1346	38	28.5	29.0	4.5

	AM-cotton	40	3	1306	38	27.3	30.2	4.4
	FH-155	25	3	780	36	27.5	32.9	4.1
D4 = 1st May 2019	**Super cotton**	37	3	1864	43	27.5	26.5	4.4
	AM-cotton	20	3	1577	42	27.4	28.9	4.6
	FH-155	37	3	1051	38	27.6	29.6	4.2
	Super cotton	22	3	1513	42	27.5	28.4	4.7
D5 = 16th May 2019	**AM-cotton**	25	4	1402	38	27.4	27.9	4.7
	FH-155	29	4	1083	41	28.0	28.6	4.3
	Super cotton	26	3	1258	42	28.0	27.6	4.9
	AM-cotton	20	4	1346	41	27.5	26.7	4.5
D6 = 1st June 2019	**FH-155**	21	3	971	41	28.9	32.5	3.6
	Super cotton	50	3	2451	42	28.0	32.3	4.3
	AM-cotton	38	3	2289	43	27.5	22.4	4.6
	FH-155	37	4	2197	40	27.5	32.8	4.4
D7 = 16th June 2019	**Super cotton**	34	3	2246	37	27.5	31.2	4.2
	AM-cotton	32	3	1593	37	27.5	29.6	4.4
	FH-155	41	3	1760	39	27.7	27.3	4.5
	Super cotton	25	4	1458	37	28.0	30.3	4.9

The data presented in above table disclosed that sowing dates, varieties and their interaction significantly affected the seed cotton yield. Irrespective of sowing dates, FH-AM cotton by yielding 1728.43 kg/ ha^{-1} seed cotton yield, surpassed other varieties. Irrespective of varieties, 16th March sowing date gave more seed cotton yield (2296 kg/ha) than all other sowing dates.

4.2 COTTON PLANTING DATE AND PLANT SPACING EFFECTS ON SEED COTTON YIELD AND FIBRE QUALITY

This study was conducted to evaluate yield performance of two cotton genotypes at various plant spacing's by keeping normal to maximum plant populations under four sowing dates. The experiment replicated thrice and was laid out according to split-split-plot design having net plot size measuring 5×3.78 m. The sowing dates were randomized as main-plot genotypes as sub-plot and spacing's as sub- sub plots.

FH-AM cotton and FH-155 was used as an experimental material. The crop was sown on beds with hand chopa by using 20kg/ha^{-1} fuzzy seed. Genotypes were tested under four sowing dates for different plant populations by using varying plant spacing's. The crop was fertilized @ 150-100-50 NPK kg/ ha^{-1}. All other agronomic and entomological practices were kept uniform and normal. The yield data recorded was analyzed by using software statistics.

SEED COTTON YIELD (KG/HA) AS AFFECTED BY VARIOUS SOWING DATES, GENOTYPES, SPACING'S AND THEIR INTERACTION

Sowing Date	Genotype	spacing	No. of bolls/plant	Boll wt(g)	Seed cotton yield (kg/ha)	GOT%	Fibre traits		
							Fibre length (mm)	Fibre strength (g/tex)	Fibre fineness (µg/inch)
15-04-2019	AM-cotton	15cm	33	3	1872	43	27.5	24.5	4.2
		30cm	36	3	1952	40	27.6	24.2	4.3
		45cm	32	3	1693	36	26.9	24.1	4.2
		60cm	33	3	2370	41	27.5	25.1	4.1
	FH-155	15cm	26	4	1354	41	28.0	32.0	4.6
		30cm	48	3	1414	40	27.6	24.8	4.4
		45cm	44	3	1354	37	27.8	26.4	4.4
		60cm	30	4	1214	37	27.5	28.6	4.0
1-05-2019	AM-cotton	15cm	29	3	1812	42	27.5	24.7	4.2
		30cm	40	3	1732	42	27.5	23.8	4.4
		45cm	36	3	1653	38	26.9	26.0	4.2
		60cm	34	3	2051	42	26.5	25.8	4.3
	FH-155	15cm	42	3	1453	41	28.0	31.4	3.6
		30cm	40	3	1533	44	27.0	32.2	4.2
		45cm	30	4	1234	39	26.5	26.2	4.4
		60cm	35	3	1407	40	26.5	31.9	4.0

		15cm	37	3	1872	42	27.5	25.0	4.4
		30cm	33	3	1593	42	26.9	24.8	4.0
	AM-cotton	**45cm**	32	3	1453	38	26.8	21.8	4.3
		60cm	40	3	1633	44	26.5	30.3	4.7
15-05-2019		**15cm**	40	3	1593	38	27.6	27.1	3.8
		30cm	21	3	1613	43	27.5	31.3	4.4
	FH-155	**45cm**	43	3	1653	38	28.0	23.9	4.3
		60cm	39	3	1712	43	27.8	27.4	4.2
		15cm	27	3	1633	42	27.6	24.6	4.3
		30cm	26	3	1035	43	28.6	23.7	4.4
	AM-cotton	**45cm**	27	3	1235	43	27.0	33.0	4.2
		60cm	21	3	1215	41	27.5	25.2	4.2
1-06-2019		**15cm**	29	4	1653	42	28.6	27.9	4.1
		30cm	26	4	1586	41	27.5	29.4	3.5
	FH-155	**45cm**	24	4	1414	38	27.5	32.3	4.1
		60cm	31	4	1513	38	27.6	28.4	3.8

The data presented in above table showed that sowing dates, plant spacing's, genotypes and their interaction significantly affected the seed cotton yield.

5. ENTOMOLOGICAL PHASE

5.1 SCREENING OF PROMISING LINES AGAINST SUCKING PESTS AND PINK BOLLWORM

The objective of this study was to screen promising lines against sucking pest and pink boll worm.

Table : RESPONSE OF SOME ADVANCED CULTIVARS OF COTTON TO SUCKING AND PINK BOLLWORM INCIDENCE

Sr. #	Entry	Sucking Insects population/leaf	Pink bollworm %age

		Thrips	Whitefly	Jassid	infestation
1	FH-466	11.23	9.47	3.11	26.65
2	FH-AM cotton	7.56	5.63	2.87	19.24
3	FH-444	8.33	6.25	2.56	21.33
4	FH-Supper cotton	7.27	5.42	2.24	20.72
5	FH-155	8.72	11.26	3.35	27.45
6	FH-490	7.45	7.33	2.70	20.96
7	FH-Anmol	8.24	6.87	2.98	22.34
8	FH-152	7.21	7.42	1.63	24.21
9	FH-Lalazar	9.73	8.21	2.45	36.72
10	FH-142	10.52	9.63	2.33	28.43

All the genotypes demonstrated significant variation with respect to thrips, whitefly, jassid and pink bollworm infestation. In case of thrips two genotypes FH-466 and FH-142 showed above ETL infestation of thrips 11.23 and 10.52/leaf, While the rest remain below ETL. In case of whitefly, all the genotypes showed above ETL population of whitefly, while FH-AM cotton and FH-Supper cotton proved relatively tolerant varieties with 5.63 and 5.42/leaf population. In case of jassid all the varieties showed above ETL population, while FH-152 proved relatively tolerant variety against jassid with 1.63/leaf population. In case pink bollworm infestation, maximum infestation was recorded in FH-Lalazar i.e. 36.72%. While relatively low infestation was recorded in FH-AM cotton i.e. 19.24%.

5.2 EFFICACY OF DIFFERENT NEW CHEMISTRY INSECTICIDES AGAINST COTTON WHITEFLY AND JASSID

The objective of this study was to find out most effective insecticides against cotton whitefly and jassid for their effective pest control program. All the insecticides gave significant results after 72 hours of application.

Sr.	**Treatments**	**Dose/**	**Percentage reduction of whitefly after**

No.	Common Name	Brand Name	acre	1 day	3 days	7 days	Average
1.	Pyriproxyfen	Priority 10.8 EC	500 ml	72.16	86.67	80.63	79.81
2.	Chlothianidin	Telsta 20% EC	200 ml	61.31	84.27	78.84	71.47
3.	Spirotetramate	Movento 240 SC	150+250 ml	46.24	73.21	77.23	65.56
4.	Matrine	Legend 5 AS	500 ml	68.33	79.92	74.79	71.01
5.	Flunicamid	Ulala 50% WG	80 gm	73.42	88.39	83.40	81.74

Sr. No.	Treatments		Dose/ acre	Percentage reduction of jassid after			
	Common name	Brand Name		24 hours	72 hours	168 hours	Average
1.	Dinotefuran	Oshin 20% SG	100 gm	60.67	87.70	81.62	76.66
2.	Nitenpyram	Pyramid 10% AS	200 ml	53.80	84.18	77.37	71.78
3.	Flunicamid	Ulala 50% WG	60 gm	66.61	87.34	79.86	78.60
4.	Dimethoate	Sanitox 40 EC	400 ml	64.32	81.09	75.64	73.68
5.	Thiacloprid	Talent 480 SC	200 ml	52.63	79.11	71.08	67.61

Against whitely Flunicamid 50% WG showed maximum reduction (88.39%) after 72 hours of treatment followed byPyriproxyfen10.8 EC and Chlothianidin 20% EC with 86.67 and 84.27% reduction. while lowest reduction was recorded in Pyriproxyfen 10.8 EC i.e. 44.90% after 24 hours of application. while in case of jassid Dinotefuran 20% SG showed maximum reduction (87.70%) after 72 hours of treatment followed by, Flunicamid 50% WG Dimethoate 40 EC and Nitenpyram 10% AS with 87.34, 84.18 and 81.09% reduction. Whereas, lowest reduction was recorded in Thiacloprid 480 SC i.e. 52.63%. after 24 hours of application.

COTTON RESEARCH STATION, VEHARI

1. WEATHER (2019)

Average data for temperature, relative humidity and precipitation during the crop season is as under:-

Month	**Temperature (^{0}c)**		**Mean Relative Humidity (%)**		**Rain Fall (mm)**
	Mean Maximum	**Mean Minimum**	**8AM**	**4PM**	
January	17.06	6.90	81.95	72.04	7
February	18.5	7.5	80.1	59.3	38
March	23.84	12.19	74.84	57.88	6
April	34.29	19.20	65.87	42.82	22.5
May	38.51	23.93	51.77	37.19	22
June	40.87	28.16	43.83	29.77	12
July	40.0	29.67	73.48	59.74	12
August	39.3	29.4	81.8	71.5	18
Sep	37.76	27.96	76.0	63.86	20
Oct	32.0	21.0	78.3	65.5	13
Nov	26.3	13.2	78.9	68.2	2
Dec	17.1	6.8	87.1	73.5	9

2. BREEDING PHASE

1.1 MAINTENANCE AND ENRICHMENT OF GENEPOOL

216 local and exotic genotypes were maintained at CRS, Vehari during 2019-20. Data were recorded for CLCuV intensity and other parameters also. All the entries showed CLCuV symptoms but the intensity varied.

The rating of the genotypes was done according to the rating scale (0-4):-

Table 1.1 Characters of gene pool entries along with their range.

Character	Range
Yield/Plant (g)	55 - 260
Plant Height (cm)	70 – 180
No. of Bolls/Plant	11 – 42
Boll weight (g)	2.0 – 3.8
CLCuV infection (Rating)	01– 4
No. of Monopodial Branches	0 – 6
No. of Sympodial Branches	6 - 39
Nodes to first fruiting branch	4 – 10
Leaf Shape	Okra, Narrow & Broad
Leaf size	Small – Large
GOT %	20.6 – 45.2
Staple Length (mm)	22.58 - 30.36
Fiber Fineness (µg/inch)	3.86 - 5.97
Fiber Strength (g/tex)	18.3 -35.5

List of gene pool entries given as Annexure-1

Sr. No	Name of Entry	Sr. No	Name of Entry	Sr. No	Name of Entry
1	CHINA-14	73	M-8	145	VH-255
2	CH-43	74	MLR-11	146	VH-289
3	CH-12	75	PC-6107	147	VH-240

4	CH-8	76	SUPER SHAHEEN	148	VH-395
5	CHINA-10	77	SARMAST	149	6050/13
6	CHINA-13	78	PRS-72	150	VH-369
7	CHINA-32	79	PC-10/15	151	VH-259
8	CH-18	80	S-55	152	NIA-78
9	CH-	81	PC-13/15	153	03/03
10	CHINA-8	82	SP-586-CHAR	154	M-6
11	CH-38	83	PC-16/15	155	GAURI
12	CH-49	84	PC-12/07	156	US-3155
13	CH-41	85	PC-22/15	157	M-9
14	CH-42	86	PCB-6/15	158	M-T
15	CHINA-16	87	PC-5/07	159	VH-306
16	CHINA-20	88	PC-9/15	160	5013
17	CH-50	89	SHAHEEN	161	VH-307
18	CH-58	90	BTS-BIG BOLL	162	US-3114
19	CHINA-05	91	BRL-1	163	US-3090
20	CHINA-03	92	UCD-58	164	4049/04
21	CHINA-09	93	3701	165	H-406/07
22	CHINA-02	94	VH-297	166	H-101
23	CHINA-01	95	V-6	167	HNF-189
24	CHINA	96	IUB-222/S	168	LA-5166
25	CHINA-25	97	VH-300	169	LUMANHA
26	V-1	98	NEXT-12	170	L-S-S
27	CHINA-52	99	BRL-II	171	10/07
28	CN-285	100	MAST-38	172	NIBGE-4
29	P-2	101	VRS-BIG BOLL	173	321/TALL
30	CHINA-06	102	BTA-1	174	MNH-786

31	CH-33	103	B-69	175	OSR-189
32	CLENCLE	104	BT-1507	176	MLR-22
33	CHINA-24	105	BTA-HL-27/63	177	2085
34	CH-50	106	2006/XT	178	2070/09
35	CH-59	107	HK	179	6005/13
36	CHINA-21	108	N-874	180	N-878
37	CHINA-15	109	VH-281	181	NIAB-BT-2
38	COOKAR	110	VR-36	182	FH-142
39	CH-42	111	M-5	183	FH-NOOR
40	V-2	112	MG-6	184	FH-930
41	326	113	TMA-1	185	F-124
42	VH-383	114	BR-CHASS-1	186	VH-292
43	VH-345	115	BELTAKINE	187	M-7
44	NCVT-13/14	116	BR-1	188	M-S
45	VH-346	117	BR-107	189	VH-208
46	MG-1	118	VH-291	190	VH-280
47	VH-404	119	BARLADNSE	191	NT-1401
48	V-1	120	DH-SA-3	192	VR-33
49	VH-195	121	AB-4	193	VH-327
50	VRS-1	122	ASP-1	194	VH-282
51	VR-31	123	ACALE-571	195	VR-38
52	VH-260/9	124	ACALE-1571	196	N-112
53	VR-35	125	AMBA-2364	197	VH-305
54	V-5	126	ASP-2	198	NIAB-N-2
55	VH-319/S	127	A-BIG BOLL	199	M-3
56	VH-250	128	ASP-59	200	6018
57	124 TALL	129	ANMOL	201	VR-37

58	V-4	130	AZ-18	202	OKRA-548
59	V-3	131	A-637	203	NCVT-20/14
60	N-208	132	AC-252	204	NIBGE-6
61	VH-189	133	NCVT-4/14	205	VH-261
62	VH-350	134	VH-285	206	NO-20
63	41/51	135	N-777	207	VH-345
64	2307	136	M-414	208	VR-32
65	VH-257	137	VH-363	209	VH-398
66	3043	138	VH-GULZAR	210	VH-225
67	US-3197	139	VH-206	211	CEMB-GRG
68	RELINE-AWIS	140	VH-387	212	US-3113
69	RESHAM	141	VR-39	213	MAST-38
70	N-449	142	VH-264	214	6006/13
71	MNH-886	143	VH-390	215	NCVT-12
72	6028/13	144	VH-260	216	NIBGE-7
				217	BS-18

1.2 STUDY OF FILIAL GENERATIONS

The following F_1 to F_6 filial generations were studied in breeding area of Cotton Research Station, Vehari during the year 2019-20. Selection was done keeping in view yield performance, CLCuV incidence and fiber quality traits. The detail of breeding material planted and number of plants selected during 2019-20 is anchored in Table 1.2.1.

Table 1.2.1. BREEDING MATERIAL STUDIED DURING THE YEAR 2019-20

Sr. No.	**Generations**	**Crosses**	
		Entries Studied	**Crosses/PSS Selected**
1	F_1	47	44 Progenies Finally Selected out of 299 PSS

2	F_2	30	23 Progenies Finally Selected out of 261 PSS
3	F_3	47	48 Progenies Finally Selected out of 242 PSS
4	F_4	86	16 Progenies Finally Selected out of 158 PSS
5	F_5	87	32 Progenies Finally Selected out of 199 PSS
6	F_6	152	14 Lines Finally Selected for PYT's out of 20 lines

Cotton leaf curl virus incidence, seed cotton yield and fiber quality in filial generations (F_1 to F_6) during the year 2019-20 is given as under:

Table1.2.2 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_1 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuV %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inch)	S.T. (g/tex)
1001/1	18	57.6	39.4	28.56	4.23	25.7
1001/2	*	67.7	37.8	27.22	3.76	27.9
1001/3	*	94.2	38.1	27.49	3.96	29.1
1001/4	*	58.5	37.3	28.98	4.32	32

1003/1	22	52.8	39.6	27.46	4.69	35.3
1003/2	*	66.4	38.1	27.54	4.37	31.7
1003/3	*	52.7	37.6	27.82	3.92	34.9
1003/4	*	59.7	39.9	27.29	4.54	28.1
1003/5	*	35.5	37.4	27.62	4.62	28.6
1004/1	27	32.5	37.9	27.3	3.76	29.6
1004/2	*	47.7	38.5	29.66	4	29.2
1004/3	*	57.4	39.2	28.71	3.6	29.3
1005/1	28	99.3	37.9	28.47	4.24	30.4
1005/2	*	40.0	39.8	29.55	3.73	32
1006/1	33	59.9	41.1	27.93	4.5	24.1
1006/2	*	84.9	39.2	28.02	3.98	31.1
1007/1	22	43.8	41.1	29.15	4.01	26.8
1007/2	*	93.0	43.8	28.61	4.14	26.1
1007/3	*	51.4	39.1	28.84	4.27	28.3
1008	25	96.0	53.4	27.23	4.42	28.7
1009/1	*	52.1	57.8	28.49	4.5	35.3
1009/2	*	34.2	38.6	27.88	4.84	31.9
1011/1	24	126.0	39.5	29.91	4.93	33.1
1011/2	*	221.1	37.9	30.88	4.77	27
1015	24	266.5	40.7	27.62	4.85	33.6
1016/1	25	85.3	37.9	29.47	4.54	33.2
1016/2	*	139.4	37.0	31.74	4.65	36.7
1017/1	23	104.0	39.0	27.33	4.57	32.3
1017/2	*	101.3	38.6	27.26	4.69	32.3
1018	20	65.8	36.6	29.27	4.66	29
1021/1	26	119.6	37.4	30.54	3.68	37.7
1021/2	*	114.5	36.2	29.55	4.34	31.9

1023	25	101.7	37.9	27.98	3.8	33.8
1025	36	105.5	40.3	30.36	4.57	29.4
1026	33	59.6	38.9	28.48	4.87	32.8
1027	38	106.2	39.3	27.28	4.41	30.6
1029	33	41.7	38.6	27.43	4.85	26.6
1034	25	108.0	36.2	29.97	4.83	28.1
1042	21	114.1	38.5	29.64	4.52	33.7
1045	25	138.8	36.8	29.9	4.86	28.7
1046	26	142.5	36.6	29.43	4.55	33.2
1047	22	108.6	37.1	27.55	4.46	25.8

In F-1 CLCuV ranged from 18.0 % to 38.0 % and the lowest virus percentage (18.0 %) was recorded for the strain 1001/1. G.O.T. ranged from 36.2 % to 57.8 % .The highest G.O.T. (57.8%) was found in the strain 1009/1. The staple length ranged from 27.22 mm to 31.74 mm. The highest staple length was found in the strain 1004/3. The mike (fineness) ranged from 4.87 (ug/inh) to 3.6 (ug/inh). The lowest mike was found in the strain 1026. The staple strength ranged from 24.1 g/tex to 35.3 g/tex. The highest staple strength was found in the strain 1009/1.

Table 1.2.3 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_2 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuV %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inch)	S.T. (g/tex)
2001/1	24	83.2	40.9	28.14	4.71	29.1
2001/2	22	86.8	39.7	27.48	4.95	30.4
2001/3	31	95.7	39.7	27.53	4.76	30
2001/4	29	109.2	40.6	28.41	4.79	31.1
2002	41	105.6	39.5	29.62	4.96	34
2004	45	71.3	39.7	28.25	4.96	27.5
2009	36	78	39.2	28.19	4.75	29.9
2016	25	105	38.2	30.4	4.49	34.2
2020	26	60.8	41.0	27.89	4.52	30.9

2021	17	130.2	40.3	30.24	4.59	29.2
2022	22	132	40.1	27.21	3.81	24.3
2026	26	99	40.4	28.14	4.53	30.4
2027	19	96	39.5	34.86	5	22.6
2028	100	40.0	41.7	27.13	4.47	33.4
2030	100	59.9	45.5	27.27	4.34	28

In F-2 CLCuV ranged from 17 % to 100% and the lowest virus percentage (17 %) was recorded for the strain 2021. G.O.T. ranged from 38.2% to 45.5% .The highest G.O.T. (45.5 %) was found in the strain 2030. The staple length ranged from 27.13 mm to 34.86 mm. The highest staple length was found in the strain 2027. The staple strength ranged from 22.6 g/tex to 34.2.0 g/tex. The highest staple strength was found in the strain 2016**.**

Table 1.2.4 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_3 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuV %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inch)	S.T. (g/tex)
3078	24	32.2	38.2	28.5	4.93	29.2
3080	22	36.2	39.2	28.01	4.6	30.5
3081/1	31	62.6	38.5	29.06	3.83	34.7
3081/2	29	72.1	39.9	28.45	3.87	35.7
3087	41	78.8	39.2	28.56	4.05	39.3
3096	45	156.3	39.2	28.82	4.6	32.9
3103	36	80.9	39.3	29.12	4.49	35.2
3104	25	25.7	38.5	28.1	4.62	32.9
3116	26	62.8	38.1	28.6	4.75	36.4

In F-3 CLCuV ranged from 22 % to 45% and the lowest virus percentage (22 %) was recorded for the strain 3080. G.O.T. ranged from 38.1% to 39.9% .The highest G.O.T. (39.9 %) was found in the strain 3081. The staple length ranged from 28.01 mm to 29.12 mm. The highest staple length was found in the strain 3103. The staple strength ranged from 29.2 g/tex to 39.3 g/tex. The highest staple strength was found in the strain 3087**.**

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Table 1.2.5 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_4 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuV %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inch)	S.T. (g/tex)
4001	9.1	131	39.9	28.99	4.19	32.2
4008	10.6	141	39.9	27.44	4.63	26.3
4014	10	120	39.4	27.91	3.63	30.5
4016	14.5	110	37.2	28.12	4.02	31.8
4019	15.1	110	37.6	27.43	3.76	32.7
4021	9.8	112	38.2	27.61	4.51	34.3
4037	11	115	41.3	27.7	4.53	28
4041	18.2	98	40.5	29.81	4.65	30.3
4048	12.3	121	37.5	29.2	4.71	31.3
4066	9.9	125	37.8	28.56	3.87	32.1
4073	6.3	141	37.9	27.79	4.85	25.3
4082	5.1	155	38.0	27.67	4.32	27.3
4083	13	118	43.0	27.95	4.56	35.1
4083	22	107	38.0	29.61	4.85	30.7
4084	13	1112	39.7	24.86	30	29.07

In F-4 CLCuV ranged from 5.1 % to 22% and the lowest virus percentage (5.1 %) was recorded for the strain 4082. G.O.T. ranged from 37.2% to 43.0% .The highest G.O.T. (43.0 %) was found in the strain 4083. The staple length ranged from 24.86 mm to 29.81 mm. The highest staple length was found in the strain 4041. The staple strength ranged from 25.3 g/tex to 35.1 g/tex. The highest staple strength was found in the strain 4083**.**

Table 1.2.6 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_5 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuV %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inch)	S.T. (g/tex)
5002	23	165	39.9	28.3	3.71	24.8
5003	18	140	38.9	28.34	4	25.8
5005	25	101	39.1	28.5	4.33	29.9

5007	15	118	37.7	28.58	3.69	23.2
5010	16	106	38.3	27.83	3.98	23.2
5011	26.3	110	38.8	29.87	3.74	25.6
5013	14	95	38.7	28.69	4.32	23.3
5014	23	122	39.7	29.59	4.31	23.1
5031	10	110	39.9	28.42	4.52	29.7
5036	8.9	98	41.8	27.56	4.26	25.3
5036	16.4	88	38.7	28.54	4.07	27.8
5036	8.8	120	42.1	29.32	4.54	30.3
5048	13.1	112	42.2	28.37	4.03	29
5049	18.1	142	38.0	27.81	3.55	28.7
5056	22.6	106	37.6	28.62	3.88	27.5
5057	14	122	40.8	28.04	4.25	25.7
5059	8.9	108	39.1	30.44	4.27	29.2

In F-5 CLCuV ranged from 8.8 % to 26.3% and the lowest virus percentage (8.8 %) was recorded for the strain 5036. G.O.T. ranged from 37.6% to 42.2% .The highest G.O.T. (42.2 %) was found in the strain 5048. The staple length ranged from 27.56 mm to 30.46 mm. The highest staple length was found in the strain 5059. The staple strength ranged from 23.1 g/tex to 30.3 g/tex. The highest staple strength was found in the strain 5036**.**

Table 1.2.7 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_6 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuV %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inch)	S.T. (g/tex)
6006	25	110	38.0	28.13	4.22	29.3
6006	30	125	37.9	28.46	4.1	29.9
6008	22	98	38.3	28.06	3.38	27.1
6010	25	104	37.4	28.06	3.65	31.9
6012	31	91	37.7	29.37	4.72	32.5
6015	31	90	37.3	29.77	4.8	24.2
6027	19	106	38.9	28.37	4.82	30.7
6063	14	115	40.4	27.7	30.7	24.1

In F-6 CLCuV ranged from 14 % to 31% and the lowest virus percentage (14 %) was recorded for the strain 6063. G.O.T. ranged from 37.3% to 40.4% .The highest G.O.T. (40.4 %) was found in the strain 6063. The staple length ranged from 27.7 mm to 29.7 mm. The highest staple length was found in the strain 6015. The staple strength ranged from 24.1 g/tex to 31.9 g/tex. The highest staple strength was found in the strain 6010**.**

3. EVALUATION PHASE

3.1 PRELIMINARY YIELD TRIALS

PYT-1

Preliminary Yield Trials were conducted for yield tests of the superior lines that have gone through the process of selection following Pedigree method. These lines were selected from filial populations keeping in view several improved traits like disease resistance, better yield performance in diverse conditions, insect resistance and quality traits. During 2019-20, 16 lines were evaluated for their yield performance against the check FH-142 in two trials. Several lines performed better than check variety not only in terms of yield but also with respect to CLCuV and fiber traits. The summarized results are given in Tables below.

Table 2.1.1 SUMMARIZED YIELD RESULTS OF PRELIMINARY YIELD TRIAL-1 DURING THE YEAR 2019-20

Sr. No	Variety	Yield (kg/ha)	CLCuV % age	Pl. Ht. (cm)	Nodes/ Plant	Plant pop/ha	1st Flowering Days	1st Opening Days	G.O.T (%)	St. L. (mm)	F. Str. (g/tex)	Mike (µg/inch)
1	VH-406	303	25.0	159	33	33965	45	91	39.8	30.3	33.7	4.0
2	VH-412	573	48.7	155	33	31573	49	95	40.2	30.1	35.0	4.4
3	VH-423	1719	48.3	150	32	30975	51	98	40.2	25.4	34.5	5.4
4	VH-424	1605	46.7	160	31	31095	50	96	40.2	25.3	35.5	4.9
5	VH-425	1251	46.7	155	31	34205	51	101	40.4	25.1	35.5	5.3
6	VH-426	587	35.0	144	30	33128	49	102	42.4	27.0	32.2	5.0
7	VH-427	1214	45.5	172	32	31693	49	94	37.7	27.1	31.6	4.4
8	VH-428	1234	40.2	182	35	32650	48	96	38.2	30.6	33.0	4.4
9	FH-142	828	40.0	162	32	28344	48	97	39.2	26.0	33.2	4.5

LSD at 5%=287.43 Results are significant

The eight strains viz. VH-406, VH-412, VH-423, VH-424, VH-425, VH-426, VH-427, VH-428 along with one standard were tested for yield and fiber charachteristics. Data was analyzed. VH-423 produced higher yield(1719 kg/h) followed by VH-424 (1605 Kg/hec) as compared with standard FH-142 (828 kg/hec) as per G.O.T concerned the strain VH-426 has maximum G.O.T i.e 42.4% followed by VH-424 having 40.2% G.O.T as compared with standard FH-142(39.2 %).In case of staple length, the strain VH-428 has maximum staple length (30.6 mm) followed by the strain VH-406 with 30.3 mm staple length as compared with standard having 26.0 mm staple length The lowest virus disease intensity (25.0%) was found in VH-406 as compared with standard having 40.0% CLCuD

Table 2.1.2 SUMMARIZED YIELD RESULTS OF PRELIMINARY YIELD TRIAL-2 DURING THE YEAR 2019-20

Sr. No	Variety	Yield (kg/ha)	CLCuV % age	Pl. Ht. (cm)	Nodes/ Plant	Plant pop/ha	1st Flowering Days	1st Opening Days	G.O.T (%)	St. L. (mm)	F. Str. (g/tex)	Mike (µg/inch)
1	VH-429	910	30.5	129	27	33846	45	94	39.6	27.6	29.9	5.0
2	VH-430	1189	35.5	139	30	30377	50	98	40.5	28.7	28.7	4.6
3	VH-431	1237	38.3	138	29	33607	47	101	39.7	26.8	28.5	4.6

4	VH432	1286	38.5	133	28	32769	45	98	39.5	26.8	26.3	4.5
5	VH-433	1447	35.5	157	29	32291	49	101	40.1	28.8	27.7	4.5
6	VH-434	1227	40.5	121	28	32291	47	102	38.8	25.6	30.9	5.3
7	VH-435	966	35.5	121	28	28225	50	98	37.8	26.5	27.1	4.8
8	VH-436	644	38.5	157	130	28584	47	98	39.1	27.2	30.5	4.5
9	FH-142	1090	40.5	152	113	30736	48	99	37.3	26.7	27.9	4.6

LSD at 5%=374.61Results are significant

The eight strains viz. VH-429, VH-430, VH-431, VH-432, VH-433, VH-434, VH-435, VH-436 along with one standard were tested for yield and fiber charachteristics. Data was analyzed. VH-433 produced higher yield (1447 kg/h) followed by VH-432 (1286 Kg/hec) as compared with standard FH-142 (1090 kg/hec). As per G.O.T is concerned the strain VH-430 has maximum G.O.T i.e 40.5 % followed by VH-433 having 40.1 % G.O.T as compared with standard FH-142(37.3 %). In case of staple length, the strain VH-430 has maximum staple length (28.7 mm) followed by the strain VH-429 with 27.6 mm staple length as compared with standard having 26.7 mm staple length. The lowest virus disease intensity (30.5 %) was found in VH-429 as compared with standard having 40.5 % CLCuD.

3.2 ADVANCED YIELD TRIALS

AYT-1

The advanced Yield Trials were conducted at the station during 2019-20 to check the performance of previously selected lines from Preliminary Yield Trials. Various promising lines were included in the trials. The results of Advanced Yield Trials indicated superiority of several lines over check variety FH-142. Detailed results of AYTs are presented below.

Table 2.2.1 SUMMARIZED YIELD RESULTS OF ADVANVED YIELD TRIAL-1 DURING THE YEAR 2019-20

Sr. No	Variety	Yield (kg/ha)	CLCuV % age	Pl. Ht. (cm)	Nodes/ Plant	Plant pop/ha	1st Flowering Days	1st Opening Days	G.O.T (%)	St. L. (mm)	F. Str. (g/tex)	Mike (µg/inch)
1	VH-348	1210	65.0	155	21	27178	46	93	37.9	27.2	28.6	4.0
2	VH-351	2156	25.0	179	22	29959	50	96	38.9	28.9	29.1	4.4
3	VH-355	1890	33.0	150	21	29152	49	99	35.9	26.9	28.0	3.9
4	VH-357	969	27.0	154	23	26909	51	95	34.9	26.6	27.5	4.2
5	VH-371	862	52.5	124	19	22604	48	102	38.5	28.3	32.2	4.3

6	VH-379	1036	55.0	189	25	30318	48	98	39.0	26.0	30.1	4.3
7	VH-381	1040	50.0	185	19	28255	47	95	37.7	27.3	28.9	4.7
8	VH-387	1256	23.5	165	25	25295	48	102	39.0	26.5	30.7	4.4
9	VH-389	828	28.5	150	16	27806	50	101	37.0	28.6	31.9	4.4
10	VH-399	1327	45.5	588	21	29600	51	101	38.1	25.7	26.4	3.8
11	FH-142	1023	50.5	148	23	25384	48	99	37.8	28.3	31.8	3.9

LSD at 5%=287.43 Results are significant

The ten strains viz. VH-348, VH-351, VH-355, VH-357, VH-371, VH-379, VH-381, VH-387, VH-389, VH-399 along with one standard were tested for yield and fiber characteristics. Data was analyzed. VH-351 produced higher yield (2156 kg/ha) followed by VH-355 (1890 Kg/ha) as compared with standard FH-142 (1023 kg/ha). As per G.O.T is concerned the strain VH-379 & VH-351 has maximum G.O.T i.e 39.0 % followed by VH-351 having 38.9 % G.O.T as compared with standard FH-142(37.8 %). In case of staple length, the strain VH-351 has maximum staple length (28.9 mm) followed by the strain VH-389 with 28.6 mm staple length as compared with standard having 28.3 mm staple length. The lowest virus disease intensity (25.0%) was found in VH-351 as compared with standard having 50.5 % CLCuD.

Table 2.2.2 SUMMARIZED YIELD RESULTS OF ADVANVED YIELD TRIAL-2 DURING THE YEAR 2019-20

Sr. No	Variety	Yield (kg/ha)	CLCuV % age	Pl. Ht. (cm)	Nodes/ Plant	Plant pop/ha	1st Flowering Days	1st Opening Days	G.O.T (%)	St. L. (mm)	F. Str. (g/tex)	Mike (µg/inch)
1	VH-405	860	22.5	178	29	25384	46	95	39.8	28.7	32.3	3.8
2	VH-407	654	25.7	172	28	26640	49	99	35.6	27.4	28.3	4.0
3	VH-409	828	38.6	152	19	25115	48	102	37.8	27.3	27.2	4.0
4	VH-410	1081	55.2	175	26	24487	49	99	39.2	28.3	27.0	4.3
5	VH-411	787	15.6	163	24	24577	51	98	39.6	28.4	28.9	3.9
6	VH-413	1103	35.0	150	23	20720	48	99	38.5	28.8	29.3	4.0
7	VH-415	926	20.0	175	21	21438	52	101	38.2	30.8	29.4	4.0

8	VH-416	1050	35.0	173	22	21079	49	99	39.6	31.0	30.3	4.1
9	VH-418	1830	45.6	169	21	23232	50	102	39.0	29.4	26.3	4.2
10	VH-419	1040	12.2	160	24	25205	51	99	37.1	27.7	27.2	4.0
11	FH-142	887	42.5	166	21	26281	49	101	36.9	27.2	28.5	3.8

The ten strains viz. VH-405, VH-407, VH-409, VH-410, VH-411, VH-413, VH-415, and VH-416. VH-418, VH-419 along with one standard were tested for yield and fiber characteristics. Data was analyzed. VH-418 produced higher yield (1830 kg/ha) followed by VH-413 (1103 Kg/ha) as compared with standard FH-142 (887 kg/ha). As per G.O.T is concerned the strain VH-405 has maximum G.O.T i.e 39.8 % followed by VH-416 having 39.6% G.O.T as compared with standard FH-142(36.9%). In case of staple length, the strain VH-416 has maximum staple length (31.0 mm) followed by the strain VH-415 with 30.8 mm staple length as compared with standard having 27.2 mm staple length. The lowest virus disease intensity (12.2%) was found in VH-419 as compared with standard having 42.5% CLCuD.

3. EVALUATION OF OUT STATION RESEARCH TRIALS

3.1 PROVINCIAL COORDINATED COTTON TRIALS

The Provincial Coordinated Cotton Trial (PCCT) comprised several genotypes from various research centers of Punjab. Twenty eight entries were tested in PCCT during 2019-20. Among new varieties developed at Cotton Research Station, Vehari included in PCCT were VH-189, VH-383 and VH-402. The results of trials are given below:-

Table 3.1 SUMMARIZED SEED COTTON YIELD RESULTS OF ENTRIES INCLUDED IN PCCT DURING THE YEAR 2019-20

Strain	CLCV %	Yield kg/hec	G.O.T %	S.L (mm)	Mike (ug/inch)	Fibre Strength (g/tex)
PC-1	100	1335	37.3	26.6	4.01	30.8
PC-2	100	1843	36.1	24.06	3.6	23
PC-3	100	1162	35.8	26.6	3.55	25.6
PC-4	100	1244	33.9	23.87	3.97	29.7
PC-5	100	792	35.4	25.24	3	26
PC-6	100	995	38.2	26.50	4.39	26.7
PC-7	100	1500	38	29.4	3.5	29.9
PC-8	100	1596	36.5	28.86	4.02	29.4
PC-9	100	1557	39.7	25.75	4.27	27.7
PC-10	100	1697	39.5	24.75	3.70	27.7
PC-11	100	802	38.1	24.4	3.64	27.1
PC-12	100	762	38.1	25.51	3.75	27.8
PC-13	100	1310	37.9	23.18	3.78	22.3
PC-14	100	1548	34.3	25.42	4.14	29.3

PC-15	100	867	36.9	26.8	4.33	31.3
PC-16	100	1859	37.5	23.94	4.29	28.6
PC-17	100	1308	39.3	24.12	4.31	26.8
PC-18	100	1775	40.5	24.79	4.35	24
PC-19	100	2189	37.5	27.65	4.14	29.6
PC-20	100	1486	36.1	28.16	3.88	28.9
PC-21	100	1305	37.6	26.59	4.09	27.5
PC-22	100	1171	37.4	27.86	4.37	29
PC-23	100	1231	36	24.91	4.31	23.9
PC-24	100	1405	39	26.29	4.3	30
PC-25	100	1379	39.5	26.25	4.73	28
PC-26	100	1577	36.8	28.48	4.69	29.2
PC-27	100	1667	37.6	25.50	4.72	23.9
PC-28	69.0	2374	37.8	28.08	4.9	28.5

Data was analyzed all the strains were highly significant in yield. Twenty Eight (PC-1 TO PC-28) were tested for yield and fiber characteristics. Two strains PC-28 (2374 kg/ha) and PC-19 (2189 kg/ha) produced more yield. As per G.O.T % was concerned, the strain PC-9 has G.O.T 39.7 % followed by PC-18 having G.O.T. 40.5%. In case of staple length, the strain PC-8 has 28.86 mm, while strain PC-7 has 29.4 mm.

4. NATIONAL COORDINATED VARIETAL TRIAL (NCVT SET A, B, C & D)

National Coordinated Varietal Trials are governed by Pakistan Central Cotton Committee (PCCC), which receives the delinted cotton seed from public sector Research Institutes all over the country and from interested private sector organizations. PCCC codes the candidate strains and sends seed to different Research Station for evaluation. Cotton Research Station, Vehari also received the seed of 102 coded strains in four sets (A,B,C & D) during the year 2019-20.The strains were sown according to plan and

normal agronomic practices were adopted throughout the season. The results with respect to CLCuV incidence and yield were presented in Table 3.2.1 to 3.2.4.

Table 3.2.1 PERFORMANCE OF NEW VARIETIES IN NCVT SET-A DURING 2019-20 AT CRS, VEHARI

Sr #	Strain	Decoding	CLCV %	Height (cm)	Pop/ Hec	Yield kg/hec	G.O.T %	S.L (mm)	Mike (ug/inch)	Fibre Strength (g/tex)
1	PC-1901	-	53.3	149	33583	1297	43.3	27.31	5.80	29.5
2	PC-1902	-	65.0	118	35735	1450	42.9	23.90	4.79	27.0
3	PC-1903	-	63.3	110	35592	1604	41.1	26.60	4.99	33.5
4	PC-1904	-	55.0	121	35018	1171	39.9	27.36	4.56	19.1
5	PC-1905	-	58.3	121	36596	1119	36.7	25.62	4.29	24.6
6	PC-1906	-	46.7	132	36596	2546	41.3	26.57	4.71	28.9
7	PC-1907	-	45.0	103	34013	1142	41.1	25.36	4.57	29.7
8	PC-1908	-	51.7	123	34731	839	40.6	26.12	5.17	27.0
9	PC-1909	-	46.7	134	35448	872	41.6	25.13	4.94	22.7
10	PC-1910	TASSCO -115	53.3	96	35305	652	36.5	25.09	4.22	22.7
11	PC-1911	TASSCO -112	60.0	107	34157	1277	37.8	27.48	4.69	25.9
12	PC-1912	TAHAFUZ-15	58.3	120	35161	1262	38.8	24.37	4.56	25.0
13	PC-1913	DIAMOND-2	53.3	112	30569	1070	39.7	25.76	5.07	26.5
14	PC-1914	SUNCROP-3	50.0	133	33583	1270	42.1	26.80	4.67	27.2
15	PC-1915	CIM-602(BT-STANDARD)	46.7	121	36166	1044	38.4	27.70	3.92	25.2
16	PC-1916	TAHAFUZ-12(C-11)	46.7	126	35592	1488	41.8	25.86	4.40	25.7

17	PC-1917	SUNCROP(C-11)	58.3	117	33296	1089	41.7	25.37	4.47	25.7
18	PC-1918	SAYBAN-209	55.0	112	35018	1206	41.5	26.10	4.57	25.7
19	PC-1919	SAIM-102	58.3	123	28560	1468	40.8	25.74	4.51	25.4
20	PC-1920	ROHI-2	55.0	141	33139	1013	42.6	26.27	4.45	25.8
21	PC-1921	ROHI-1	61.7	141	33870	820	37.4	28.34	3.89	28.6
22	PC-1922	TJ-KING(C-11)	56.7	126	32291	933	42.6	26.08	4.79	26.0
23	PC-1923	-	51.7	126	34874	1604	40.4	25.87	4.81	27.6
24	PC-1924	NS-211	48.3	120	32722	1065	42.6	24.37	4.90	21.1

The result of statistical analysis of yield was significant. Twenty Four strains (PC-1 TO PC-1924) were tested for yield and fiber characteristics. Two strains PC-1906 (2546 kg/ha) and PC-1903 (1604 kg/ha) produced more yield. As per G.O.T % was concerned, the strain PC-1901 has G.O.T 43.3% followed by PC-1902 having G.O.T. 42.9%. In case of staple length, the strain PC-1921 has 28.34 mm, while strain PC-1915 has 27.70 mm.

ble 3.2.2 PERFORMANCE OF NEW VARIETIES IN NCVT SET-B DURING 2019-20 AT CRS,VEHARI

Sr #	Strain	Decoding	CLCV %	Height (cm)	Pop/ Hec	Yield kg/hec	G.O.T %	S.L (mm)	Mike (ug/inh)	Fibre Strength (g/tex)
1	PC-1925	EYE-22	45.0	132	34013	741	40.0	27.33	4.66	30.5
2	PC-1926	EYE-111	43.3	123	33439	1146	38.5	24.09	4.79	22.4
3	PC-1927	EYE-20	53.3	118	29995	1153	40.7	26.97	4.46	25.2
4	PC-1928	RUSTAM-BEEJ-111(CKC)	51.7	120	28416	567	40.7	25.76	4.75	28.1
5	PC-1929	RUSTAM-BEEJ-11(C11)	53.3	116	31573	619	43.0	27.3	4.87	26.9
6	PC-1930	RUSTAM-11	51.7	124	36022	1496	39.6	25.57	4.83	25.4
7	PC-1931	ICI-2424	51.7	127	27699	1181	43.2	25.73	4.70	24.1
8	PC-1932	YBG-2323(CKC)	58.3	114	19231	820	42.7	27.79	4.89	24.2
Sr #	**Strain**	**Decoding**	**CLCV %**	**Height (cm)**	**Pop/ Hec**	**Yield kg/hec**	**G.O.T %**	**S.L (mm)**	**Mike (ug/inch)**	**Fibre Strength (g/tex)**
9	PC-1933	YBG-2222(C-11)	76.7	101	27555	1276	41.9	26.11	4.69	24.2
10	PC-1934	-	53.3	124	32578	1124	40.7	26.12	4.87	26.6
11	PC-1935	CIM-602 (BT-STANDARD)	48.3	130	30856	840	38.6	27.86	3.58	24.4
12	PC-1936	-	55.0	124	29421	841	41.8	28.77	4.47	22.2
13	PC-1937	-	50.0	127	28416	860	40.4	26.36	4.42	26.8
14	PC-1938	-	45.0	136	20092	680	34.7	25.59	4.28	19.8
15	PC-1939	-	53.3	133	14782	777	43.1	26.15	4.63	22.1

16	PC-1940	-	41.7	110	17939	658	40.4	25.57	4.50	27.3
17	PC-1941	BF-1	50.0	106	33870	1193	37.9	26.52	4.24	24.2
18	PC-1942	-	48.3	120	26694	1385	43.7	26.92	5.09	23.5
19	PC-1943	-	58.3	105	30712	900	40.2	27.56	4.39	26.8
20	PC-1944	BAHAR-136	53.3	115	34300	1559	40.9	27.45	4.73	18.9
21	PC-1945	ASPL-710	55.0	95	29995	1320	41.2	26.77	5.34	24.1
22	PC-1946	ASPL-709	55.0	104	32722	1353	40.0	26.05	5.03	25.7
23	PC-1947	IR-NIBGE-15	66.7	109	27555	1219	37.0	26.09	4.43	27.6
24	PC-1948	IR-NIBGE-14	51.7	125	26837	1427	39.2	28.53	4.46	28.4
25	PC-1949	IR-NIBGE-13	55.0	105	26837	1375	39.2	26.69	4.40	31.3
26	PC-1950	NIAB-SANAB-M	50.0	133	34013	1416	41.8	29.15	4.26	27.9

The result of statistical analysis of yield was significant. Twenty Six strains (PC-25 TO PC-1950) were tested for yield and fiber characteristics. Two strains PC-1944 (1559 kg/ha) and PC-1948 (1427 kg/ha) produced more yield. As per G.O.T % was concerned, the strain PC-1942 has G.O.T 43.7% followed by PC-1939 having G.O.T. 43.1%. In case of staple length, the strain PC-1950 has 29.15 mm, while strain PC-1936 has 28.77 mm.

Table 3.2.3 PERFORMANCE OF NEW VARIETIES IN NCVT SET-C DURING 2019-20 AT CRS,VEHARI

Sr #	Strain	Decoding	CLCV %	Height (cm)	Pop/ Hec	Yield kg/hec	G.O.T %	S.L (mm)	Mike (ug/inch)	Fibre Strength g/tex
1	PC-1951	NIAB -512	55.0	124	30999	1417	42.2	26.38	4.04	27.4
2	PC-1952	NIAB -973	56.7	130	21671	723	39.5	28.81	4.73	27.4
3	PC-1953	NIAB -819	48.3	121	27268	766	40.5	26.56	4.70	22.4
4	PC-1954	NIAB -135	63.3	123	34874	1516	42.1	26.74	4.38	26.3
5	PC-1955	NIAB -1011	61.7	118	35018	1267	41.8	27.44	4.33	23.8
6	PC-1956	NIA-89	56.7	96	33152	651	39.4	26.95	4.38	27.4

7	PC-1957	IUB-73	50.0	101	28847	647	41.2	26.34	4.88	25.1
8	PC-1958	VH-383	60.0	106	31430	908	41.2	24.91	4.61	20.2
9	PC-1959	VH-189	61.7	114	32578	916	38.5	26.32	4.81	26.3
10	PC-1960	CIM-602 (BT-STANDARD)	56.7	114	38606	690	38.4	26.59	3.68	28.5
11	PC-1961	VH-402	65.0	131	32148	695	39.6	29.27	4.14	21.4
12	PC-1962	SLH-33	53.3	112	21384	811	41.1	28.47	4.44	26.5
13	PC-1963	RH-KASHISH	55.0	88	28560	195	40.8	26.67	4.29	23.5
14	PC-1964	RH-AFNAN-2	61.7	136	36884	1138	37.4	25.41	4.30	27.9
15	PC-1965	RH-670	60.0	131	31717	547	40.4	29.60	4.25	24.9
16	PC-1966	GH-HAMALIYA	63.3	116	37027	1547	40.6	24.35	4.86	27.0
17	PC-1967	GH-SULTAN	58.3	113	37458	1025	40.0	25.66	4.80	24.1
18	PC-1968	GH-UHAD	60.0	111	39036	1332	39.4	24.15	4.65	22.9
19	PC-1969	FH-ANMOL	53.3	104	33870	1101	40.6	27.46	4.51	29.9
20	PC-1970	FH-492	63.3	113	28703	1272	40.9	28.09	4.90	23.9
21	PC-1971	FH-155	60.0	133	28990	904	40.1	29.40	4.46	25.6
22	PC-1972	FH-SUPER-COTTON-2017	53.3	115	30569	1280	39.5	28.81	4.66	26.8
23	PC-1973	FH-AM-COTTON-2017	55.0	99	22675	933	38.2	24.72	4.76	23.3
24	PC-1974	BH-224	50.0	131	35592	1122	40.1	26.92	4.26	19.2
25	PC-1975	BH-223	56.7	104	28703	1069	40.8	25.19	5.16	22.7

The result of statistical analysis of yield was significant. Twenty five strains (PC-1951 TO PC-1975) were tested for yield and fiber characteristics. Two strainsPC-1966 (1547 kg/ha) and PC-1954 (1516 kg/ha) produced more yield. As per G.O.T % was concerned, the strain PC-1951 has G.O.T 42.2 % followed by PC-1954 having G.O.T. 42.1%. In case of staple length, the strain PC-1965 has 29.60 mm, while strain PC-1971

has 29.40 mm.

Table 3.2.4 PERFORMANCE OF NEW VARIETIES IN NCVT SET-D DURING 2019-20 AT CRS, VEHARI

Sr #	Strain	Decoding	CLCV %	Height (cm)	Pop/ Hec	Yield kg/hec	G.O.T %	S.L (mm)	Mike (ug/inch)	Fibre Strength g/tex
1	PC-1976	MNH-1050	50.0	106	33009	650	39.3	29.21	4.91	20.0
2	PC-1977	MNH-1035	43.3	128	32004	1366	42.0	26.09	4.65	26.1
3	PC-1978	CEMB-KLEAN-COTTON-6	45.0	119	32435	1221	41.3	27.44	5.20	25.5
4	PC-1979	CEMB-KLEAN-COTTON-5	43.3	112	33439	1230	41.5	25.71	5.07	26.5
5	PC-1980	CEMB-KLEAN-COTTON-4	38.3	109	35018	1352	41.9	26.14	5.14	24.8
6	PC-1981	CEMB-KLEAN-COTTON-3	41.7	113	31430	973	41.6	27.32	4.97	23.9
7	PC-1982	CRIS-638	50.0	113	31286	522	41.9	26.24	5.64	21.1
8	PC-1983	CRIS-673	50.0	116	33726	1338	37.7	24.08	5.05	28.1
9	PC-1984	CRIS-671	51.7	120	33152	715	38.0	29.59	4.89	22.2
10	PC-1985	BT-CYTO-535	51.7	123	34157	1261	38.0	27.69	4.50	27.8
11	PC-1986	BT-CYTO-533	40.0	107	28847	716	40.0	26.78	5.30	28.3
12	PC-1987	BT-CIM-785	53.3	142	30138	774	39.5	27.96	4.78	24.4
13	PC-1988	BT-CIM-775	30.0	151	32435	1552	36.9	29.22	3.54	25.4

14	PC-1989	BT-CYTO-511	36.7	113	32004	1657	38.9	28.26	4.85	30.3
15	PC-1990	BT-CIM-789	60.0	106	27986	1267	41.7	25.39	5.10	24.7
16	PC-1991	BT-CIM-678	48.3	217	31286	589	40.8	27.20	4.31	24.2
17	PC-1992	BT-CIM-303	46.7	113	31717	1437	40.0	26.36	4.90	24.4
18	PC-1993	CIM-602(BT-STANDARD)	56.7	106	33439	751	39.3	25.58	3.78	23.5
19	PC-1994	CYTO-124 (NON-BT STANDARD)	71.7	97	32148	188	40.8	28.44	4.34	24.3
20	PC-1995	NIAB-929	45.0	132	30425	1119	39.1	27.50	5.14	28.3
21	PC-1996	NIA-88	35.0	98	35161	616	37.5	24.36	4.67	25.7
22	PC-1997	-	58.3	121	23824	838	38.0	29.43	4.88	29.5
23	PC-1998	CRIS-644	63.3	82	34587	535	39.2	27.35	5.12	28.2
24	PC-1999	CYTO-226	60.0	83	33296	400	39.3	25.86	4.29	23.3
25	PC-2000	-	53.3	113	34444	1345	41.9	24.95	4.45	23.1
26	PC-2001	-	50.0	107	33296	1217	42.1	24.36	5.24	18.6
27	PC-2002	MZM-7	41.7	103	32004	769	40.4	28.07	4.27	21.4

The result of statistical analysis of yield was significant. Twenty seven strains (PC-1976 TO PC-2002) were tested for yield and fiber characteristics. Two strains PC-1989 (1657 kg/ha) and PC-1988 (1552 kg/ha) produced more yield. As per G.O.T % was concerned, the strain PC-1977 has G.O.T 42.0 % followed by PC-2001 having G.O.T. 42.1%. In case of staple length, the strain PC-1984 has 9.59 mm, while strain PC-1997 has 29.43 mm.

5. AGRONOMIC PHASE

4.1VARIETAL BEHAVIOUR UNDER DIFFERENT SOWING DATES

After various testing procedures, estimation of appropriate sowing time for a particular variety is necessary. In this trial three new strains namely VH-189, VH-383 and VH-402 were tested on 8 different sowing dates i.e. **01-03-2019 to 16-06-2019** with an interval of 15 days. The yield data of the trial is given below:-

Table 4.1.1 RESULTS OF VARIETAL BEHAVIOR UNDER DIFFERENT SOWING DATES DURING 2019-20

Yield Data of Sowing Date Trial 2019-20 at CRS Vehari					
Treatment	**Variety**	**Avg. No. of Bolls**	**Avg. Boll Weight**	**Avg. Yield kg/ha**	**G.O.T %**
D-1 01.03.19	VH-189	14	2.8	1475	38.0
	VH-383	13	2.9	1435	35.8
	VH-402	16	2.4	1485	36.76
D-2 16.03.19	VH-189	11	2.6	1078	37.9
	VH-383	15	2.7	1232	36.4
	VH-402	13	2.3	1214	35.9
D-3 01.04.19	VH-189	12	2.5	1467	38.4
	VH-383	17	2.6	1220	36
	VH-402	14	2.9	1354	37.3
D-4 16.04.19	VH-189	15	2.9	1220	38.2
	VH-383	13	3.1	1545	36.7
	VH-402	18	2.3	955	37.3
D-5 01.05.19	VH-189	11	2.9	1353	37.3

	VH-383	16	3.0	659	37.2
	VH-402	10	2.8	541	37.0
D-6 16.05.19	VH-189	9	2.6	382	36.9
	VH-383	5	2.8	442	36.7
	VH-402	8	2.7	440	37.0
D-7 01.06.19	VH-189	8	2.5	490	38.4
	VH-383	9	2.9	439	37.4
	VH-402	7	2.8	439	34.1
D-8 16.06.19	VH-189	7	2.8	275	37.1
	VH-383	6	3.2	275	36.8
	VH-402	6	2.8	239	37.5

VH-189 and VH-402 performed better when sown on 01.03.19. While VH-383 Performed better when sown on 16.04.19.

6. DEVELOPMENTAL PROJECTS

5.1 COMMISSIONED RESEARCH FOR DEVELOPMENT OF COTTON SEED

One project titled “COMMISSIONED RESEARCH FOR DEVELOPMENT OF COTTON SEED” is under progress at Cotton Research Station, Vehari. The Purpose of the Project is to check seed pilferage and acquisition of new germplasm for genetic improvement, Production of pure seed and enhancement of seed quality, Insertion of CLCuV resistance through conventional breeding, Insertion of CLCuV resistance, heat tolerance and better fiber quality through conventional

Breeding for development of climate smart varieties and Biosafety clearance of the developed Bt lines.

The results are given below

Table 5.1.1 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_2 GENERATION UNDER ADP PROJECT DURING THE YEAR 2019-20

Family No.	Plant Height (cm)	No. of Green Bolls/ Plant	No. of Opened Bolls/ Plant	CLCuV Disease Index (%)	FIBER			
					GOT (%)	Length (mm)	Fineness (µg/inch)	Strength (g/tex)
V192001	156	5	12	35.0	42.43	29.2	4.7	40.9
V192002	193	14	18	25.0	39.13	27.7	5.0	37.1
V192003	163	11	19	55.0	41.07	28.0	4.7	40.9
V192004	132	8	18	45.0	41.94	27.6	5.2	41.9
V192005	147	10	24	40.0	39.11	29.1	5.0	31.4
V192006	122	6	30	40.0	39.25	26.1	4.9	41.0
V192007	142	9	18	30.0	40	30.0	4.9	44.6
V192008	142	12	35	25.0	45.09	28.3	4.8	40.3
V192009	140	13	17	35.0	40.31	28.5	4.7	29.0
V192010	124	6	28	30.0	38.01	29.1	4.7	43.7
V192011	129	8	29	35.0	38.65	29.7	4.5	48.3
V192012	136	17	17	60.0	40	28.7	4.5	40.4
V192013	147	6	21	25.0	41.62	28.3	4.4	42.1
V192014	145	5	15	25.0	39.31	29.1	4.8	41.9
V192015	161	8	24	55.0	40.84	27.5	4.9	30.3
V192016	149	8	20	40.0	39.36	28.9	4.5	37.6
V192017	153	9	29	25.0	41.74	27.8	4.9	40.7

V192018	176	15	19	35.0	42.96	28.9	4.7	38.3
V192019	177	14	24	25.0	39.96	29.1	4.9	35.2
V192021	160	10	19	25.0	41.8	26.1	5.6	37.0
V192022	179	19	14	30.0	41.96	27.6	5.1	23.0
V192023	184	15	19	25.0	40	29.1	4.8	41.1
V192024	175	9	14	75.0	42.27	27.3	4.8	28.0
V192025	182	13	16	40.0	40.11	30.0	4.7	40.1
V192026	162	8	17	25.0	40.27	27.0	4.0	40.4
V192028	192	14	24	40.0	41.04	28.0	4.7	35.1
V192029	155	6	14	25.0	38.63	28.6	4.7	37.0

In ADP F-2 CLCuV ranged from 25.0 % to 75.0% and the lowest virus percentage (25.0 %) was recorded for the strains V192002, V192008, V192013, V192014, V192017, V192019, V192021, V192023, V192026 & V192029. G.O.T. ranged from 38.01% to 45.09% .The highest G.O.T. (45.09 %) was found in the strain V192008. The staple length ranged from 26.1 mm to 30.0 mm. The highest staple length was found in the strain V192007. The Mike ranged from 4.0 µg/inch to 5.6 µg/inch. The best Staple Mike was found in the strain V192026. The staple strength ranged from 23.0 g/tex to 48.3 g/tex. The highest staple strength was found in the strainV192011**.**

Table 5.1.2 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_3 GENERATION UNDER ADP PROJECT DURING THE YEAR 2019-20

Family No.	Plant Height (cm)	No. of Green Bolls/ Plant	No. of Opened Bolls/ Plant	CLCuV Disease Index (%)	Fiber			
					GOT (%)	Length (mm)	Fineness (µg/inch)	Strength (g/tex)
V193001	134	6	11	35.0	40.28	29.99	3.99	28.9
V193002	168	9	13	25.0	39.01	27.96	4.63	27.4
V193007	136	7	25	15.0	41.00	27.62	4.87	28.3
V193014	174	10	18	40.0	42.65	28.54	4.25	27.0
V193015	160	10	9	35.0	40.34	29.39	4.70	29.7
V193016	115	5	15	25.0	41.48	27.80	4.32	24.8
V193020	172	8	16	20.0	38.94	27.87	4.63	28.2
V193021	165	8	22	40.0	38.08	28.48	4.59	24.4
V193025	194	11	17	15.0	40.07	29.35	4.76	30.7
V193040	131	10	9	40.0	38.52	28.33	4.65	29.5
V193046	153	6	11	40.0	38.56	28.70	4.38	30.5
V193051	155	7	7	30.0	38.99	27.64	4.67	27.3
V193063	164	7	14	60.0	38.99	28.81	4.65	30.3
V193065	137	14	10	45.0	40.82	28.43	4.19	28.9
V193068	162	7	12	40.0	40.44	29.44	4.33	30.1
V193076	132	5	16	40.0	39.69	29.43	4.86	29.0
V193077	118	5	12	40.0	38.11	30.85	4.54	24.5

In ADP F-3 CLCuV ranged from 15.0 % to 60.0% and the lowest virus percentage (15.0 %) was recorded for the strains V193007 & V192025. G.O.T. ranged from 38.08% to 42.65% .The highest G.O.T. (42.65 %) was found in the strain V193014. The staple length ranged from 27.62 mm to 30.85 mm. The highest staple length was found in the strain V193037. The Mike ranged from 3.99 µg/inch to 4.87 µg/inch. The best Staple Mike was found in the strain V193001. The staple strength ranged from 24.5 g/tex to 30.5 g/tex. The highest staple strength was found in the strainV193046.

ANNUAL REPORT 2019-20

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1. WEATHER DATA

MONTH	TEMPERTAURE (˚C) 2019		MEAN RELATIVE HUMIDITY (%) 2019	RAIN FALL(mm) 2019
	MEAN MAXIMUM	MEAN MINIMUM		
JANUARY	22.2	7.0	95.3	8.0
FEBRUARY	23.4	9.0	92.0	19.5
MARCH	28.4	15.0	90.2	17.5
APRIL	40.0	22.3	62.7	1.0
MAY	41.9	25.0	61.4	17.8
JUNE	44.3	30.3	70.3	11.0
JULY	42.1	29.7	76.0	28.8
AUGUST	41.5	28.6	82.8	67.0
SEPTEMBER	40.2	27.7	82.2	0.5
OCTOBER	36.5	20.2	84.2	20.5
NOVEMBER	28.0	14.5	91.0	13.7
DECEMBER	22.7	7.5	92.4	7.8
Total				213.1

2. BREEDING PHASE

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. The different ladders of breeding phase that were covered at CRS Khanpur during 2019-2020 are mentioned as under:

1.1 MAINTENANCE AND ENRICHMENT OF GERMPLASM

Cotton germplasm at CRI, Khanpur comprised of 220 genotypes. Data on morphological and fiber quality parameters were recorded. Salient features of the germplasm are given below:

Table 1.1.1 SALIENT FEATURES OF GERMPLASM AT CRI, KHANPUR

Characteristics	**Range**
CLCuD Incidence (% age)	8.0-76.9
Boll Weight (g)	1.4-3.7
No of Bolls	6.0-28
Plant Height (cm)	76-185
G.O.T. (%)	31.5-43.4
Staple Length (mm)	24.1- 33.7
Fibre Fineness (µg/inch)	3.5-5.7
Fiber Strength (g/tex)	25.3 – 45.4

1.2. STUDY OF FILIAL GENERATIONS

Single plant selections were made from the promising breeding material in different segregating generations (F_1 to F_5) for further testing for seed cotton yield, fiber traits and cotton leaf curl virus disease. The detail of breeding material planted and number of plants selected during 2019-2020 is anchored in Table 1.2.1.

Table1.2.1 FILIAL GENERATIONS STUDIED DURING THE YEAR 2019-20

Generations	**Total sown**		**Selected**	
	Crosses	**Plants/Progenies**	**Crosses**	**Plants/Progenies**
F_1	36	806	30	30
F_2	30	30	36	471
F_3	30	120	19	48

F_4	25	52	23	48
F_5	20	27	16	17
F_6	23	24	23	24
Total	**164**	**1059**	**147**	**638**

Data of filial generations (F_1 to F_6) during the year 2019-20 is given as under:

Table1.2.2 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_1 GENERATION DURING THE YEAR 2019-20

Strain No.	CLCuV (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Monp /pl	GOT (%)
1101	11	182	32.5	3.5	175	1	43.9
1189	4.0	191	37.8	3.7	154	2	40.5
1395	8.0	177	32.2	3.6	162	2	43.9

In F_1 CLCuV% ranged from 4.0 to 21.2 % out of total 470 selected plant progenies and the lowest virus percentage (4.0 %) was recorded for the strain 1189. GOT ranged from 34.0 to 43.9 %. The highest GOT. (43.9 %) was found in the strain1070, 1101, 1316 & 1395. The best harmonious combinations were 1189, 1101, 1316 & 1395.

Table 1.2.3 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_2 GENERATION DURING THE YEAR 2019-20

Entry/ Family No.	CLCuV (%)	Plant Height (cm)	Plant Population (No.)	No. of Bolls/ Plant (No.)	Nodes /plant	GOT (%)
2001	1.1	95.5	1308	24.0	15.4	31.0-45.0
2002	1.9	105.1	1117	21.1	16.0	31.9-43.6

2003	1.5	106.1	1294	20.6	14.0	31.5-39.6
2004	1.8	99.1	1104	17.2	14.0	32.5-40.1
2005	1.1	146.4	1201	17.4	16.1	35.7-43.7
2006	1.8	114.8	1083	21.2	15.6	37.6-42.7
2007	2.2	106.6	1255	18.9	14.8	40.5-44.5
2008	2.1	123.5	1156	23.7	15.7	32.7-41.9
2009	1.4	116.3	1332	19.1	14.2	34.5-41.1
20010	2.0	117.8	1249	14.7	12.3	35.0-42.8
20011	2.1	114.2	1315	16.6	15.0	38.3-43.6
20012	1.8	114.6	1123	18.6	14.7	37.7-43.6
20013	2.4	103.9	914	16.3	14.8	35.6-44.2
20014	2.0	106.0	1135	11.6	14.9	38.3-41.8
20015	2.1	80.9	1089	12.7	14.7	36.7-42.8
20016	1.3	110.0	1198	18.4	13.6	36.5-42.3
20017	1.6	107.1	1054	24.0	14.7	37.8-43.8
20018	1.7	108.4	1021	20.7	14.6	38.5-43.5
20019	1.8	107.1	1068	16.3	16.1	37.0-43.8
20020	1.7	104.9	1035	19.3	13.4	35.9-42.9
20021	1.7	82.0	1067	15.5	14.9	33.5-43.4
20022	1.2	102.7	1005	18.2	14.1	35.1-41.9
20023	2.0	92.8	1126	21.1	14.8	36.2-43.1
20024	1.5	92.7	1150	17.9	14.8	35.3-42.4
20025	2.4	93.0	948	23.6	14.4	35.3-43.9
20026	2.7	116.3	1066	17.2	15.2	33.6-42.2
20027	2.0	113.0	1132	15.3	15.3	35.0-41.9
20028	2.2	110.6	1011	33.3	15.1	36.6-43.3

20029	1.4	79.3	1156	11.2	14.1	37.0-43.9
20030	2.0	101.8	1120	19.5	15.0	36.3-46.7

In F-2 CLCuV ranged from 1.1 to 2.7 % and the lowest virus percentage (1.1 %) was recorded for the strain 2001. G.O.T. ranged from 31.0 % to 45 % .The highest G.O.T. (45 %) was found in the strain H-2001. The Height ranged from 79.3 cm to 146.4 cm. Plant population ranged from 914 to 1332. Maximum number of bolls were observed in 20028 (33.3).

Table 1.2.4 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_3 GENERATION DURING THE YEAR 2019-20

Strain No	CLCuV (%)	Plant Height (cm)	Plant Population (No.)	No. of Bolls (No.)	Nodes/plant (No.)	GOT (%)
30000321	8.6	86.1	58	20.5	17.9	39.4
3000042	9.5	98.0	63	17.0	19.4	40.8
3000043	6.5	109.5	62	18.2	20.7	39.6
3000045	7.9	136.8	63	28.5	21.9	39.1
3000048	11.5	110.7	61	19.3	19.8	38.9
3000049	4.8	147.8	62	21.4	24.7	32.8
30000410	12.7	121.2	55	17.5	21.6	39.0
30000413	7.9	142.1	63	22.7	19.9	39.0
30000415	13.6	115.6	59	21.3	20.4	38.5
30000417	6.3	145.7	63	16.4	20.9	37.9
30000420	9.6	136.2	52	19.8	20.9	38.2
30000421	8.8	116.9	34	24.4	21.8	35.4
30000428	14.3	163.7	35	23.5	19.1	38.5

3000051	14.3	146.2	49	27.6	20.8	38.9
30000510	5.2	162.9	58	20.5	16.8	37.8
30000511	11.1	142.7	63	23.2	21.3	34.8
30000514	17.3	158.1	52	23.9	23.0	38.9
3000074	6.5	127.6	62	21.1	20.6	37.5
3000095	11.5	139.7	52	18.8	20.1	34.4
30000922	6.3	110.4	63	14.2	19.5	33.7
30001010	8.8	147.3	57	27.7	22.5	38.6
30001113	7.9	96.6	63	14.0	17.4	35.6
30001117	7.1	105.0	56	13.5	18.8	37.1
3000118	7.9	110.1	63	16.0	16.9	40.4
3000129	8.5	108.8	47	19.1	17.2	40.3
3000132	12.0	136.1	50	17.2	20.1	33.9
3000155	16.3	96.4	43	22.6	20.9	41.0
30001529	9.5	115.0	63	26.2	22.1	36.3
3000161	15.0	114.7	60	17.8	20.6	41.8
3000177	18.0	137.1	50	16.3	22.1	39.4
30001720	5.3	176.0	57	23.1	19.1	37.9
30001723	6.8	163.1	59	17.5	16.1	41.1
3000203	7.3	136.2	55	19.2	18.2	35.3
30002025	8.3	148.3	60	16.5	22.0	39.7
30002037	6.5	144.2	62	22.3	21.1	38.5
30002112	11.9	138.9	42	24.0	20.2	40.1
30002219	22.9	148.5	35	16.2	19.4	39.4

30002325	10.2	193.0	59	22.6	20.9	35.7
30002326	12.2	215.2	49	15.1	17.4	33.5
30002411	10.5	166.8	57	21.9	18.1	37.9
3000254	10.2	139.4	59	16.7	17.2	41.3
3000267	6.3	139.4	63	12.8	19.0	34.4
30002626	17.9	122.3	39	24.0	20.3	39.4
3000276	8.5	82.0	59	14.3	19.6	35.5
3000277	15.0	101.4	40	20.9	16.0	36.7
30002711	6.3	120.1	48	15.7	15.3	37.3
30002713	9.1	107.9	33	22.8	16.8	37.3
30002715	4.0	129.5	50	22.2	16.6	38.4
30002717	11.1	112.2	45	16.0	14.6	37.4
30002719	6.8	118.3	59	15.0	17.7	38.9
30002729	4.8	120.2	62	15.4	16.7	38.6
30002743	7.7	101.2	52	9.9	17.2	40.1
3000283	9.3	133.0	43	18.4	18.7	39.4
30002824	7.0	122.6	57	17.9	17.8	35.5
30002825	11.5	116.1	52	19.3	20.8	37.5
3000299	12.7	136.4	63	14.8	20.2	34.6
30002912	6.9	166.3	58	24.0	25.6	37.9
30002915	11.1	174.8	63	21.6	21.8	36.2
30002929	16.3	202.6	49	20.4	23.5	39.7
30002937	17.9	194.8	39	29.0	22.2	36.7
30002943	10.0	143.2	30	16.4	18.5	36.7

30002950	5.8	181.0	52	20.2	20.9	34.5
30002954	10.3	159.0	58	23.4	17.7	37.0
30002952	5.0	133.3	60	19.0	16.4	35.4
3000302	5.4	128.5	56	21.9	20.4	40.2
3000309	7.9	107.3	63	21.0	18.1	39.1
30003015	8.5	162.2	59	20.8	19.7	39.7
30003026	4.8	122.9	63	21.4	18.8	40.2
30003029	9.8	141.8	61	22.2	19.0	39.0
30003044	10.2	107.2	59	20.0	20.2	38.8
3000012	9.5	119.1	63	19.3	17.3	37.7
30000317	5.3	104.9	57	21.1	18.6	39.0
30000319	9.1	87.6	55	17.0	16.6	41.9
30000412	7.9	116.9	63	19.5	18.9	40.7
3000058	11.5	134.5	52	25.9	22.8	33.7
3000062	7.9	166.1	63	26.4	24.0	38.7
3000068	5.1	124.1	59	20.6	18.7	38.3
3000098	9.1	145.0	55	20.9	18.5	37.6
3000103	5.4	151.7	56	32.0	21.5	39.7
3000105	9.8	140.1	51	23.5	23.2	35.5
30001022	6.4	168.8	47	38.8	23.8	40.3
3000115	8.7	159.4	46	25.0	19.7	41.9
30001119	17.5	177.7	40	27.2	22.8	40.0
3000134	29.2	193.7	24	20.8	20.1	41.3
3000137	23.1	152.5	26	31.0	19.7	38.3

3000145	7.5	175.5	53	27.4	21.5	39.3
3000171	9.6	178.6	52	21.6	19.9	35.5
30001734	11.3	138.3	53	21.5	21.2	39.8
3000189	6.0	111.2	50	25.5	16.0	40.7
30001816	6.9	95.2	58	16.6	17.0	40.0
3000205	15.7	92.2	51	17.6	19.1	38.3
30002012	7.9	107.6	63	11.3	17.2	35.9
30002016	16.7	111.1	54	23.0	19.7	35.3
30002035	6.5	96.5	62	15.6	15.3	36.0
30002036	6.1	97.0	49	28.1	19.6	34.1
30002043	6.9	111.9	58	21.0	16.1	39.8
3000227	7.7	145.3	52	28.4	19.0	38.4
30002221	8.6	121.7	58	20.8	17.8	37.8
30002313	11.1	96.4	63	17.9	18.1	42.2
30002317	20.0	105.6	35	21.6	17.5	40.1
3000246	10.0	81.2	40	12.5	15.6	39.2
3000252	14.8	151.1	61	18.7	19.6	38.8
30002522	8.6	105.0	58	18.7	18.9	37.7
3000279	15.4	112.9	52	28.2	18.8	39
30002716	9.6	120.4	52	17.5	18.8	40.9
30002738	9.5	158.2	63	19.0	19.2	41.7
30002740	6.6	165.1	61	21.6	19.8	33.7
30002742	14.3	188.3	42	22.8	22.1	37.7
30002821	16.2	204.2	37	17.3	23.7	39.3

30002830	7.1	185.8	56	19.3	21.2	38.6
3000295	7.5	137.5	53	18.3	17.8	40.7
3000296	6.5	119.7	62	20.1	19.4	39.5
30002917	15.1	108.0	53	15.7	20.3	41.2
30002921	10.3	107.5	58	16.1	15.6	43.1
30002923	11.5	112.5	52	18.6	17.4	41.2
30002935	6.9	137.3	58	21.0	15.2	38.4
30003016	7.1	106.9	56	22.8	16.2	37.8
30003020	8.8	108.7	57	24.4	13.7	34.5
30003033	7.9	124.1	63	18.1	17.7	37.3
30003038	6.8	170.6	59	20.1	20.6	39.9

In F_3 CLCuV (%) ranged from 04.0 to 29.2 % and the lowest virus percentage (4.0%) was recorded for the strain 30002715. Number of bolls/plants ranged from 12.5 -38.8. GOT (%) ranged from 31.8 to 43.1 %. The highest GOT. (43.1%) was found in strain 30002921. One of the best harmonious combinations were 30002715 and 30002921.

Table 1.2.5(a) SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_4 GENERATION DURING THE YEAR 2019-20

Strain No.	**CLCuV (%)**	**Yield/Pl (g)**	**Bolls/pl**	**Av. Boll weight (g)**	**Plant Height (cm)**	**Monp /pl**	**GOT (%)**
4001912	11	156	48	3.3	146	2	40.9
4004412	15	166	45	3.5	135	1	41
4005922	8	187	39	3.7	145	3	43.1
4001923	5	138	34	3.2	155	2	40.2

In F_4 CLCuV% ranged from 5.0 to 25.7 % and the lowest virus percentage (5.0 %) was recorded for the strain 4001923. Maximum Av. Number of bolls/plant was observed in 4001912. Av. Boll weight was maximum for 4005922. GOT ranged from 33.0 to 43.1 %. The highest GOT. (43.1 %) was found in the strain 4005922. The best harmonious combinations were 4001912, 4004412, 4005922 and 4001923.

Table 1.2.6 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_5 GENERATION DURING THE YEAR 2019-20

Strain No.	CLCuV (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Monp /pl	GOT (%)
500353	11	177	49	3.4	144	2	40.4
5001143	6	142	44	3.5	138	1	40.1
5001521	5	155	41	3.9	139	1	40.5
5004221	7	161	48	3.6	144	1	41.7

In F_5 CLCuV % ranged from 5 to 27.5 % and the lowest virus percentage (5.0 %) was recorded for the strain 5001521. Maximum Number of bolls/plant was recorded 500353 and boll weight was 3.9g in 5001521. GOT% ranged from 34.8 to41.7 %. The highest GOT. (41.7 %) was found in the strain 5004221. The best harmonious combination were 500353, 5001143, 5001521 and 5004221.

Table 1.2.7 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_6 GENERATION DURING THE YEAR 2019-20

Strain No.	CLCuV (%)	Yield/Pl (g)	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Monp /pl	GOT (%)
600546	7	167	44	3.9	166	1	42.5
6004115	12	158	44	3.3	158	0	41.1
5116/06	8	170	51	3.2	139	2	40.8

In F_6 CLCuV% ranged from 8 to 23.2 % and the lowest virus percentage (7.0 %) was recorded for the strain 600546. Number of bolls/plant was maximum in 5116/06 (51 bolls) and boll weight was 3.9 for 600546. GOT ranged from 34.0 to 44.3 %. The highest GOT. (44.3 %) was found in the strain 5008312. The best harmonious combinations were 600546, 6004115 and 5116/06.

Table 1.3.1 FRESH CROSSES (F_1) 2019-20

Cross #	Parentage	Cross #	Parentage
1	C4P9 ×CEMB-KC-1	16	C30P29×ICI-2323
2	C4P10×CEMB-KC-1	17	C13P23P1(H-125)×ICI-2323
3	C5P14×CEMB-KC-1	18	C15P1P2(H-135)×ICI-2323
4	C9P5×CEMB-KC-1	19	C18P2P1(H-148)×CEMB-101
5	C15P29×CEMB-KC-2	20	C23P11P5(H-209)×CEMB-101
6	C27P19×CEMB-KC-2	21	C4P16P4(H-35)×CEMB-KC-1
7	C27P29×CEMB-KC-2	22	C4P19P1(H-39)×CEMB-KC-1
8	C28P24×CEMB-KC-2	23	C4P24P3(H-45)×CEMB-KC-2
9	C29P12×CEMB-101	24	C4P25P1(H-51)×CEMB-KC-2
10	C29P15×CEMB-101	25	RH-Afnan-2×UZBK-1
11	C29P29×CEMB-101	26	RH-670 ×UZBK-1
12	C29P34×CEMB-101	27	RH-Kasish×UZBK-1
13	C30P2×ICI-2323	28	RH-Manthar×UZBK-1
14	C30P15×ICI-2323	29	RH-668×UZBK-1
15	C30P26×ICI-2323	20	RH-662×UZBK-1

Total successfully attempted Crosses = 30

3 EVALUATION PHASE

2.1 PRELIMINARY YIELD TRIALS

The objective of Preliminary Yield Trial (PYT) is to evaluate 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 virus disease. Cultivars at this stage were subjected to a reduced selection pressure and the selected lines were progressed to the Advanced Yield Trials. During year 2019-20, 22 lines/strains were planted in 2 PYTs with different genotypes per trial along with one standard variety (FH-142). Detailed results of each PYT are given below:

Table 2.1.1PERFORMANCE OF PROMISING STRAINS IN PYT-1DURING 2019-20 AT CRI KHANPUR

Variety	CLCuV (%)	Yield (kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		GOT (%)	Fibre		
							Bud	Days to Flower		Length (mm)	Fineness (µg/in)	Strength (g/tex)
C17P2	6.80	1746	44148	28	2.47	149.7	30	48	40.8	27.68	4.20	21.6
C6P1	9.38	1568	45788	17	2.50	113.2	31	49	41.5	25.48	4.02	26.7
C1P4	5.67	1540	47838	19	2.45	110.2	30	47	40.4	24.00	3.74	22.9
C6P2	9.41	1447	49205	19	2.55	125.7	32	49	39.1	26.85	3.58	23.5
C9P5	7.69	1388	46062	18	2.37	124.7	33	48	38.8	26.21	4.81	25.4
FH-142 (std.)	7.61	1380	39501	24	2.64	148.0	30	49	42.9	27.61	4.63	24.0
C18P1P2	5.08	1349	36494	23	2.48	125.2	27	46	42.0	28.81	4.28	22.0
C9P1	9.09	1310	45242	19	2.56	121.3	30	48	37.3	28.34	3.12	27.8
C34P3P3	6.67	1250	47975	20	2.29	144.6	28	46	40.4	25.71	4.30	22.2
C5P3	5.41	1203	46062	17	2.69	110.7	29	48	39.2	28.78	4.60	27.5

C34P4P1	8.67	1179	29660	28	2.19	109.3	28	47	43.6	28.34	4.65	22.1
5116/06	8.29	1010	48522	13	2.57	139.3	27	46	40.8	29.62	4.26	21.9
LSD (0.05)		819.78										

The result of statistical analysis of yield is significant (P < 0.05). Maximum yield kg/ha was observed in C17P2 (1746 kg/ha). Whereas, minimum was recorded for **5116/06** (1010 kg/ha). Minimum CLCuV % was observed in **C18P1P2** (5.08%).

Table 2.1.2 PERFORMANCE OF PROMISING STRAINS IN PYT-2 DURING 2019-20 AT CRI KHANPUR

Variety	CLCuV (%)	Yield (kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		GOT (%)	Fibre		
							Bud	Flower		Length (mm)	Fineness (µg/in)	Strength (g/tex)
C18P1P2	5.7	1552	45788	17	3.05	166.2	29	48	41.4	30.60	4.17	26.6
C83P1P2	6.8	1350	46198	11	2.52	163.2	29	49	42.2	27.57	4.08	23.6
C41P1P5	9.1	1278	46608	15	2.34	155.7	29	49	41.0	28.65	4.80	30.7
C5P4P6	5.1	1228	43055	19	2.57	142.1	28	47	42.2	27.54	4.90	23.9
C67P2P1	7.7	1212	44421	17	2.46	143.2	29	48	43.7	30.30	4.77	27.3
C38P1P1	9.4	1154	46472	18	2.30	171.8	30	47	42.8	28.12	4.24	27.9
C20P1P2	9.4	1075	48112	19	2.45	171.9	32	50	42.2	25.29	3.66	27.8
C76P2P1	6.7	946	41004	18	2.16	130.7	28	46	40.8	29.18	4.40	25.8
C15P4P3	8.7	945	41004	16	2.78	141.9	31	49	42.3	28.19	4.77	24.9
C73P1P1	8.3	931	49479	16	2.08	130.6	31	48	43.2	28.57	3.98	30.9
C18P1P4	5.4	913	47975	15	2.52	161.3	30	48	40.8	27.21	3.80	30.5
FH-142 (std.)	7.6	899	37724	19	2.52	145.6	31	49	41.2	25.05	4.46	26.5
LSD (0.05)		589.54										

The result of statistical analysis of yield is significant (P < 0.05). Maximum yield kg/ha was observed in **C18P1P2** (1552 kg/ha). Whereas, minimum was recorded for **FH-142 (std.)** (899 kg/ha). Minimum CLCuV % was observed in **C5P4P6** (5.1%).

2.2 ADVANCE YIELD TRIALS (AYTS)

The objective ofAdvanced Yield Trial (AYT) entails the evaluation of newly advanced cotton lines selected from the PYT for yield and other important quantitative traits. During year 2019-20 about 22 lines/strains alongwith one check FH-142 were planted to assess their yield potential and their fiber quality. Detailed results of AYTs are presented below:

Table 2.2.1PERFORMANCE OF PROMISING STRAINS IN AYT-1 DURING 2019-20 AT CRI KHANPUR

Variety	CLCuV (%)	Yield (kg/ha)	Plant pop/ ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		GOT (%)	Fibre		
							Bud	Flower		Length (mm)	Fineness (µg/in)	Strength (g/tex)
C16P5	5.40	2081	49205	21	2.82	145.4	28	43	40.3	29.38	3.88	24.0
FH-142	10.62	1912	24603	25	2.59	142.8	30	46	41.9	27.25	4.60	21.2
C6P3P1	7.55	1709	40184	26	2.04	143.9	27	44	41.1	29.74	4.39	29.7
C17P1	6.46	1682	33214	22	2.72	107.6	28	45	42.5	26.26	4.27	24.5
C35P11	7.29	1539	39774	22	2.40	141.1	28	45	43.2	26.95	4.58	23.0
C13P3	6.69	1494	34444	16	2.22	151.9	28	45	42.7	26.42	4.26	27.0
C12P1	15.24	1493	43465	11	2.84	141.8	28	46	39.8	28.76	4.21	28.1
C6P3	7.10	1486	42645	16	2.47	126.6	28	43	42.2	28.10	4.79	25.9
C9P3	5.95	1458	45515	16	2.47	120.7	28	44	42.4	29.27	4.74	26.5
C6P3	3.49	1446	41824	17	2.51	132.3	28	44	41.4	26.97	4.27	26.1

C6P9	9.02	1416	33214	17	2.42	122.9	28	44	40.9	26.33	4.15	28.3
C40P2	5.73	1223	42645	14	2.30	108.4	28	44	40.5	26.87	4.52	29.1

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed in C616P5 (2081 kg/ha). Whereas, minimum was recorded for C40P2 (1223 kg/ha). Minimum CLCuV % was observed in C6P3 (3.49%).

Table 2.2.2 PERFORMANCE OF STRAINS IN AYT-2 DURING 2019-20 AT CRI KHANPUR

Variety	CLCuV (%)	Yield (kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Days to 1st		GOT (%)	Fibre		
							Bud	Flower		Length (mm)	Fineness (µg/in)	Strength (g/tex)
RH-669	9.0	1799	36357	24	2.44	151.5	28	44	43.6	27.46	4.36	30.0
RH-670	7.3	1772	44968	19	3.12	134.6	29	44	41.2	28.37	4.33	25.1
RH-662	5.4	1754	48112	16	2.90	141.4	30	45	39.2	28.15	4.19	25.0
RH-Afnan	3.5	1681	47018	19	2.65	151.1	29	45	40.9	25.66	4.32	32.5
C4P12P3	7.1	1561	46198	17	2.83	130.7	29	45	42.7	29.94	4.72	24.3
RH-661	5.9	1560	48249	19	2.73	162.3	29	44	40.1	27.50	3.90	26.3
FH-142	10.6	1556	39911	19	2.57	141.0	28	45	42.2	27.35	4.26	25.9
C5P4P1	7.6	1518	45242	18	2.69	134.0	29	45	40.3	28.12	4.38	25.7
43/14	15.2	1471	36767	18	2.41	159.6	28	44	43.4	26.89	4.53	25.0
C4P8P1	5.7	1398	42918	14	2.84	131.7	29	45	42.7	27.23	4.91	28.1
C4P2P3	6.5	1234	44421	15	2.17	161.9	29	45	41.2	28.86	4.14	27.9
C4P2P2	6.7	997	47018	10	2.61	149.5	29	45	41.4	28.22	4.56	33.1
LSD (0.05)		661.58										

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed in **RH-669** (1799 kg/ha). Whereas, minimum was recorded for **C4P2P2** (997 kg/ha). Minimum CLCuV % was observed in **RH-Afnan** (3.5%).

2. PROVINCIAL COORDINATED COTTON TRIAL (PCCT)

The objective of this trial is to test the performance of new promising strains of different cotton research centers of Punjab under different ecological zones. During year 2019-20 the trial was conducted at CRI, Khanpur, Set-1 comprised of 24 Bt. Strains and Set-2 comprised of 03 non-Bt. The results are presented in Table 2.3.1 to 2.3.2.

Table 2.3.1PERFORMANCE OF NEW STRAINS IN PCCT (*BT.*) SET-1 DURING 2019-20 AT CRI KHANPUR

Sr.	Varieties	PP/ha	Yield kg/ ha	PH (cm)	Bolls/ plant	Nodes/ plant	1st Flower (Days)	1st boll open (days)	Av.Boll Wt (g)	CLCuv %	GOT%
1	**PCCT-1**	46045	1712	134.2	19.8	32	46	94	2.42	9.4	40.00
2	**PCCT-2**	42935	1843	141.8	22.9	32	45	96	2.45	17.8	41.47
3	**PCCT-3**	43653	1482	126.7	14.9	32	48	92	3.30	26.6	40.33
4	**PCCT-4**	45447	1783	141.0	14.3	33	48	97	3.21	16.8	38.50
5	**PCCT-5**	42098	1510	136.4	15.3	32	46	96	2.95	7.1	40.57
6	**PCCT-6**	44370	1369	116.9	12.6	30	47	95	2.95	14.6	38.83
7	**PCCT-7**	39347	1700	137.4	28.5	35	47	95	2.34	20.4	43.07
8	**PCCT-8**	46284	2063	125.1	21.1	35	46	94	2.34	10.6	41.03
9	**PCCT-9**	41859	1635	142.9	19.5	36	45	92	2.33	16.0	42.83
10	**PCCT-10**	46045	1956	147.8	16.7	37	45	91	2.55	10.6	41.97
11	**PCCT-11**	43772	1034	140.2	18.3	37	46	94	2.30	34.2	41.67
12	**PCCT-12**	35879	1134	132.3	17.7	34	47	94	2.21	24.7	40.57
13	**PCCT-13**	46643	1628	134.9	16.6	33	47	95	2.44	25.6	42.23

14	**PCCT-14**	34444	1826	134.6	23.6	33	47	95	2.54	25.3	41.70
15	**PCCT-15**	31454	1409	122.2	17.7	31	46	93	2.55	22.4	41.17
16	**PCCT-16**	45088	2153	131.4	19.1	34	47	94	2.67	19.4	41.80
17	**PCCT-17**	38510	1554	133.2	18.8	32	45	94	2.38	18.9	42.33
18	**PCCT-18**	43414	1704	137.9	20.2	35	47	96	2.33	21.5	44.23
19	**PCCT-19**	45088	2092	133.1	14.9	33	48	96	2.64	22.5	42.40
20	**PCCT-20**	38510	1838	126.0	30.7	34	46	92	2.47	19.3	41.23
21	**PCCT-21**	43174	1888	137.8	22.2	36	48	96	2.59	30.5	42.60
22	**PCCT-22**	42457	1658	131.0	17.4	36	46	94	3.08	24.5	41.83
23	**PCCT-23**	35999	1557	130.8	21.6	33	46	91	2.80	20.3	41.80
24	**PCCT-24**	41739	1421	131.5	19.7	31	48	95	2.58	18.1	41.60

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed in **PCCT-16** (2153 kg/ha). Whereas, minimum was recorded for **PCCT-11** (1034 kg/ha). Minimum CLCuV % was observed in **PCCT-5** (7.1%).

Table 2.3.2PERFORMANCE OF NEW STRAINS IN PCCT (non-*BT*.) SET-2 DURING 2019-20 AT CRI KHANPUR

PCCT-2										
Varietal Code	**PP/ha**	**Yield kg/ ha**	**PH (cm)**	**Bolls/ plant**	**Nodes/ plant**	**1st Flower (Days)**	**1st boll open (days)**	**Av.Boll Wt (g)**	**CLCuv %**	**GOT%**
PCCT-25	46404	1410	124.7	14.7	34	49	101	2.6	13.1	39.8
PCCT-26	44968	1661	127.6	16.5	33	45	103	2.6	16.8	39.2
PCCT-27	41141	1773	134.6	15.0	37	48	103	2.9	12.8	40.7

The result of statistical analysis of yield is significant (P < 0.05). Maximum yield kg/ha was observed in **PCCT-27** (1773 kg/ha). Whereas, minimum was recorded in **PCCT-25** (1410 kg/ha). Minimum CLCuV % was observed in **PCCT-27** (12.8%).

3. NATIONAL COORDINATED VARIETAL TRIAL (NCVT)

The objective of this trial is to test the performance of new Varieties of different cotton research centers on national basis under different ecological zones. During year 2019-20 the trial was conducted at CRI Khanpur, Set-A comprised of 24 varieties, Set-B comprised of 26 and Set-C comprised of 25 varieties. The results are presented in Table 3.3.1, 3.3.2 and 3.3.3.

Table 3.3.1 **PERFORMANCE OF NEW VARIETIES IN NCVT SET-A DURING DURING 2019-20 AT CRI KHANPUR**

Sr #	Strain	Decoding	Plant Population/ha	Plant Height (CM)	Days to 1st Bud (Days)	Days to 1st Flower (Days)	No. of Bolls/plant (No.)	Av. Bolls weight (g)	GOT (%)	CLCuV (%)	Yield kg/ha
1	**1901**	**1901**	41364	141.7	31	49	25	2.8	**44.2**	10.1	2190
2	**1902**	**1902**	44352	142.4	32	47	25	2.9	**43.2**	7.8	2359
3	**1903**	**1903**	45070	124.4	31	47	17	2.8	**40.2**	2.4	2034
4	**1904**	**1904**	46265	122.4	31	47	22	2.7	**39.3**	7.2	1926
5	**1905**	**1905**	45907	153.9	32	47	22	3.1	**41.2**	8.5	2039
6	**1906**	**1906**	43276	154.2	32	48	16	2.3	40.8	3.3	2169
7	**1907**	**1907**	41722	123.0	32	46	20	2.6	41.5	6.6	1733
8	**1908**	**1908**	41603	133.5	32	45	21	2.8	40.4	9.2	2452
9	**1909**	**1909**	42081	139.7	31	44	18	2.6	39.1	10.5	1816
10	**1910**	**Tassco-115**	45667	97.4	31	47	15	2.2	38.8	8.6	1546

11	**1911**	**Tassco-112**	43874	115.2	32	48	17	2.5	42.9	6.5	2018
12	**1912**	**Tahafuz-15**	40885	130.8	31	46	18	2.7	39.2	8.8	2033
13	**1913**	**Diamond-2**	39690	128.0	31	44	23	2.8	37.3	6.9	2106
14	**1914**	**Suncrop-3**	45428	147.8	30	45	20	2.8	40.4	9.5	2106
15	**1915**	**CIM-602 (Bt-Standard)**	42320	124.1	32	46	21	2.0	39.2	9.3	1602
16	**1916**	**Tahafuz-12(C-II)**	44831	114.5	31	48	23	2.2	43.8	7.7	2489
17	**1917**	**Suncrop(C-II)**	46385	119.5	32	48	19	2.7	39.4	8.0	1853
18	**1918**	**Sayban-209**	47819	116.6	32	46	24	2.6	38.6	6.3	2006
19	**1919**	**Saim-102**	43037	126.6	32	47	24	2.6	43.5	7.8	2713
20	**1920**	**Rohi-2**	41364	135.1	32	47	20	2.3	42.4	9.5	1607
21	**1921**	**Rohi-1**	37179	134.8	31	47	18	2.9	38.1	6.4	1930
22	**1922**	**TJ-King(C-II)**	43994	145.6	32	48	18	3.0	39.8	6.8	1822
23	**1923**	**1923**	37538	151.6	31	46	19	2.6	39.5	6.1	2223
24	**1924**	**NS-211**	44113	131.0	30	44	19	3.1	39.4	3.8	2615
LSD	**(0.05)**										**453.83**

The result of statistical analysis of yield is significant ($P < 0.05$). Twenty four strains (A-1 TO A-24) were tested for yield and related characteristics. Maximum yield kg/ha was observed in **Saim-102** (2713 kg/ha). Whereas, minimum was recorded in **Tassco-115** (1546 kg/ha). Minimum CLCuV % was observed for **1903** (2.4%).

Table 3.3.2 PERFORMANCE OF NEW VARIETIES IN NCVT SET-B DURING 2019-20 AT CRI KHANPUR

Sr #	Strain	Decoding	Plant Population (No.)	Plant Height (CM)	Days to 1st Bud (Days)	Days to 1st Flower (Days)	No. of Bolls/plant (No.)	Av. Bolls weight (g)	GOT (%)	CLCuV (%)	Yield kg/ha
1	**1925**	**Eye-22**	44831	116.4	31	48	14	2.5	39.3	13.1	1491
2	**1926**	**Eye-111**	44382	123.0	31	46	20	2.6	40.9	15.1	1672
3	**1927**	**Eye-20**	45578	113.2	30	46	16	2.7	38.1	15.1	1645
4	**1928**	**Rustam-Beej-111(CKC)**	40646	118.9	30	48	22	2.4	40.5	16.4	1637
5	**1929**	**Rustam-Beej-11(C-II)**	44681	143.5	32	47	22	2.5	39.2	13.1	1848
6	**1930**	**Rustam-11**	43486	118.5	32	48	19	2.5	41.7	17.3	1908
7	**1931**	**ICI-2424**	44831	115.5	31	47	17	2.5	39.8	19.4	2087
8	**1932**	**YBG-2323(CKC)**	37060	120.3	30	48	18	2.3	40.2	17.6	1874
9	**1933**	**YBG-2222(C-II)**	40646	109.7	30	45	17	2.1	39.4	12.4	1826
10	**1934**	**1934**	42141	115.2	31	47	14	2.5	39.9	17.4	1999
11	**1935**	**CIM-602 (Bt-Standard)**	31830	113.5	33	48	17	2.2	39.9	18.5	1365
12	**1936**	**1936**	34669	128.3	32	47	19	2.7	40.5	17.7	1479
13	**1937**	**1937**	34669	115.5	31	49	17	2.5	40.3	19.8	1416
14	**1938**	**1938**	36910	122.8	31	47	15	2.8	40.9	21.7	1496
15	**1939**	**1939**	36761	118.0	31	46	17	2.3	42.1	21.1	1784
16	**1940**	**1940**	27645	114.9	32	47	25	2.6	41.5	17.3	1703
17	**1941**	**BF-1**	33772	107.9	31	48	16	2.8	40.2	11.7	1840
18	**1942**	**1942**	38255	112.0	30	47	14	2.5	40.7	15.5	1402
19	**1943**	**1943**	35566	112.7	32	46	17	2.5	39.8	15.2	1312
20	**1944**	**Bahar-136**	37359	115.4	31	46	16	2.8	42.2	13.5	1872
21	**1945**	**ASPL-710**	46474	105.2	31	45	16	3.0	38.4	17.0	1979
22	**1946**	**ASPL-709**	34221	94.7	32	48	15	2.6	38.9	13.9	1716

23	**1947**	**IR-NIBGE-15**	40945	108.2	31	48	15	2.6	39.3	16.9	2002
24	**1948**	**IR-NIBGE-14**	39003	118.7	32	47	19	2.5	40.9	12.2	1655
25	**1949**	**IR-NIBGE-13**	40347	110.3	32	48	15	2.8	41.1	15.9	1842
26	**1950**	**NIAB-SANAB-M**	35715	132.9	33	48	22	2.4	40.5	12.6	1712
LSD **(0.05)**											**552.77**

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed in **ICI-2424** (2087 kg/ha). Whereas, minimum was recorded in **1943** (1312 kg/ha). Minimum CLCuV % was observed in **BF-1** (11.7%).

Table 3.3.3 PERFORMANCE OF NEW VARIETIES IN NCVT SET-C DURING 2019-20 AT CRI KHANPUR

Sr #	Strain	Decoding	Plant Population (No.)	Plant Height (CM)	Days to 1st Bud (Days)	Days to 1st Flower (Days)	No. of Bolls/plant (No.)	Av. Bolls weight (g)	GOT (%)	CLCuV (%)	Yield kg/ha
1	**1951**	**NIAB-512**	37807	139.8	29	45	18	2.5	37.3	13.1	2149
2	**1952**	**NIAB-973**	35864	123.6	29	47	13	2.3	38.9	15.1	1187
3	**1953**	**NIAB-819**	38255	120.5	28	46	14	2.1	41.1	15.1	1154
4	**1954**	**NIAB-135**	41991	142.9	30	47	21	2.3	40.5	16.4	2339
5	**1955**	**NIAB-1011**	42141	142.5	29	47	19	2.3	41.2	13.1	2487
6	**1956**	**NIA-89**	45129	97.0	30	45	14	2.0	40.7	17.3	1092
7	**1957**	**IUB-73**	41095	111.4	29	46	16	2.4	39.8	19.4	1712
8	**1958**	**VH-383**	37359	121.7	29	48	15	2.7	42.2	17.6	1465
9	**1959**	**VH-189**	38704	123.7	28	47	20	2.7	42.4	12.4	1764
10	**1960**	**CIM-602 (Bt-Standard)**	44831	125.8	29	59	12	2.3	39.4	17.4	1680
11	**1961**	**VH-402**	36910	147.7	29	47	13	2.7	40.9	18.5	1391
12	**1962**	**SLH-33**	39750	143.2	28	47	16	2.5	38.7	17.7	1790
13	**1963**	**RH-Kashish**	39600	143.2	29	47	17	2.8	39.3	19.8	1616
14	**1964**	**RH-Afnan-2**	45428	153.7	29	47	22	2.7	40.9	21.7	2078
15	**1965**	**RH-670**	43187	139.7	29	47	19	2.8	41.1	21.1	1707
16	**1966**	**GH-Hamaliya**	43934	141.2	30	48	20	2.9	40.9	17.3	2126
17	**1967**	**GH-Sultan**	44681	114.3	29	48	15	3.1	43.9	11.7	2057
18	**1968**	**GH-Uhad**	44831	139.4	29	46	18	2.7	39.5	15.5	2198
19	**1969**	**FH-Anmol**	38704	127.8	30	48	18	2.7	39.8	15.2	1795
20	**1970**	**FH-492**	39003	126.3	29	49	15	2.9	42.2	13.5	1738
21	**1971**	**FH-155**	42290	124.4	29	47	15	3.0	37.4	17.0	1860

22	**1972**	**FH-Super-Cotton-2017**	43934	117.8	29	46	19	2.7	39.7	13.9	1989
23	**1973**	**FH-AM-Cotton-2017**	42589	125.8	31	47	15	2.7	40.1	16.9	1972
24	**1974**	**BH-224**	44831	136.2	29	47	19	2.4	39.2	12.2	2086
25	**1975**	**BH-223**	42141	124.2	30	49	17	2.6	38.2	15.9	2269
LSD (0.05)											**356.04**

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed in **NIAB-1011** (2487 kg/ha). Whereas, minimum was recorded in **NIA-89** (1092 kg/ha). Minimum CLCuV % was observed in **RH-Afnan-2** (6.9%).

4. AGRONOMIC PHASE

Agronomic research program aims at developing agronomic practices that can be easily adopted by the cotton growers and managing the cotton crop with judicious use of inputs to obtain the maximum yield with minimum inputs. In order to achieve this objective, Agronomists of Cotton Research Institute Khanpur conducted the following experiments during 2019-20.

4.1. Effect of different sowing dates on growth and yield of new genotypes of cotton

The objective of trial was to find out the impact of different sowing times on growth, yield and fiber quality of new evolved genotypes of cotton under local conditions of Khanpur (Rahim yar khan) Experiment was laid out according to split plot arrangement with three replications. The crop was sown as per treatment on six different sowing dates. The plant spacing was kept 30 cm and all the other agronomic practices were kept uniform and normal. The results are described below.

Table 4.1 EFFECT OF DIFFERENT SOWING DATES ON YIELD OF NEW GENOTYPES OF COTTON

Treatment	Treatments	Avg. no. of bolls	Av. Boll weight (g)	Yield Kg / Ha	GOT (%)
D1 = 1st April 2019	**RH-670**	32	3.2	4361.1	39.2
	RH-Kashish	30	2.7	3404.7	38.4
	RH-Afnan-2	31	2.8	3768.2	37.7
	FH-142	32	3.3	4495.0	39.6
D2 = 16th April 2019	**RH-670**	30	3.1	3940.3	39.7
	RH-Kashish	29	2.6	3175.2	39.8
	RH-Afnan-2	31	3	3959.4	37.8

	FH-142	30	3.1	3863.8	39.1
D3 = 1st May 2019	**RH-670**	29	2.7	3347.3	40.4
	RH-Kashish	27	2.5	2888.3	38.3
	RH-Afnan-2	27	2.7	3117.8	38.7
	FH-142	25	2.7	2945.7	40.5
D4 = 16th May 2019	**RH-670**	20	2.5	2142.3	42.1
	RH-Kashish	19	2.6	2065.8	39.3
	RH-Afnan-2	21	2.6	2352.7	38.4
	FH-142	21	2.7	2410.1	41.0
D5 = 1st June 2019	**RH-670**	18	2.5	1912.8	41.2
	RH-Kashish	15	2.5	1568.5	38.6
	RH-Afnan-2	18	2.5	1912.8	39.4
	FH-142	17	2.6	1836.3	39.5
D6 = 16th June 2019	**RH-670**	12	2.2	1109.4	39.4
	RH-Kashish	12	2.3	1071.2	38.1
	RH-Afnan-2	11	2.4	1147.7	36.9
	FH-142	12	2.5	1224.2	37.8
LSD (0.05)				**1126.4**	

The result of statistical analysis of yield is significant ($P < 0.05$). **D1 = 1st April 2019** was best sowing time in terms of yield. The results revealed that seed cotton yield decreased with delay in sowing time. **FH-142** produced maximum seed cotton yield of 4495.0kg per hectare when sown on 1-04-2019 followed by **RH-670** (4361.1Kg/ha) . Minimum seed cotton yield was produced by all strains when sown on 16thJune 2019. It is concluded that sowing of cotton after 16thMay decreased seed cotton yield significantly . The best sowing time is 1st week of April to 2nd week of May in order to get maximum seed cotton yield.

4.2 EFFECT OF PLANT SPACING ON THE PRODUCTIVITY OF NEW PROMISING COTTON STRAINS.

The main objective of this trial was to determine the optimum plant spacing for getting maximum seed cotton yield from new cotton strains.

Table 4.2 EFFECT OF PLANT SPACING ON THE PRODUCTIVITY OF NEW PROMISING COTTON STRAINS

Sr. #	Treatments		PP/ha	Plant Height (cm)	No. of Bolls/ Plant	Boll Weight (g)	Yield (Kg/ha)
1	RH-670	S1 (15.0 cm)	85931	136.4	16	2.4	3227.8
2		S2 (22.5 cm)	57292	144.0	23	2.5	3281.6
3		S3 (30.0 cm)	42951	149.0	29	2.7	3496.8
4		S4 (37.5 cm)	34343	151.3	32	2.9	3066.4
5	RH-Kashish	S1 (15.0 cm)	85230	148.0	15	2.5	3174.0
6		S2 (22.5 cm)	57008	157.5	23	2.6	3335.4
7		S3 (30.0 cm)	42546	178.7	29	2.6	3443.0
8		S4 (37.5 cm)	33851	172.3	29	2.8	2743.6

9	**RH-Afnan-2**	**S1 (15.0 cm)**	83797	152.5	15	2.4	3120.2
10		**S2 (22.5 cm)**	56724	161.7	22	2.5	3174.0
11		**S3 (30.0 cm)**	42249	165.1	30	2.6	3389.2
12		**S4 (37.5 cm)**	32873	179.1	31	2.8	2797.4
LSD (0.05)							**394.55**

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed at **S3 (30.0 cm)** in all varieties**.** So, **S3 (30.0 cm)** is best plant spacing.

4.3 Effect of topping on the yield and quality of Cotton variety; FH-Lalazar and FH-142

The main objective of this trial was to study the economics of topping v/s normal crop.

Table 4.3 Effect of topping on the yield and quality of Cotton variety; FH-Lalazar and FH-142

Treatments	No. of Sympodia/plant	No. of Monopdia/plant	Av. No. of Bolls/plant	Av. Boll Weight (g)	Yield kg/ha
Topping (3.5 ft)	23.6	2.0	25	2.7	2812
Topping (4.0 ft)	24.8	2.2	26	2.8	2855
Topping (4.5 ft)	27.0	2.4	26	2.9	2985
Normal (5.8 ft)	21.4	1.8	25	2.6	2768
LSD (0.05)					**142.44**

The result of statistical analysis of yield is significant ($P < 0.05$). Maximum yield kg/ha was observed in Topping at 4.5 ft (2985 kg/ha**).**

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COTTON RESEARCH STATION, SAHIWAL

WEATHER

MONTH	TEMPERTAURE (˚C) 2019		MEAN RELATIVE HUMIDITY (%)	RAIN FALL(mm)	RAIN FALL(mm)
	MEAN MAXIMUM	MEAN MINIMUM	2019	2019	2018
JANUARY	16.48	3.08	70.28	3.11	0.0
FEBRUARY	18.48	6.33	71.28	0.10	0.0
MARCH	18.48	7.08	72.75	3.11	0.0
APRIL	25.25	22.16	74.0	24.13	17.90
MAY	38.4	23.1	58.4	26.0	0.0
JUNE	41.4	26.9	56.7	6.0	8.04
JULY	38.0	27.8	75.0	64.6	123.2
AUGUST	37..0	27.5	80.1	55.1	37.0
SEPTEMBER	36.2	26.3	83.6	31.2	Trace
OCTOBER	131.8	19.5	82.5	4.0	0.0
NOVEMBER	24.1	13.4	85.7	3.0	Trace
DECEMBER	16.6	6.5	93.3	8.0	0.0
Total				228.35	186.14

1. BREEDING PHASE

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. The different ladders of breeding phase that were covered at CRS Sahiwal during 2019-2020 are mentioned as under:

1.1 MAINTENANCE AND ENRICHMENT OF GERMPLASM

Cotton germplasm at CRS, Sahiwal comprised 158 genotypes. Data on morphological and fiber quality parameters were recorded. Salient features of the germplasm are given below:

Table 1.1.1 SALIENT FEATURES OF GERMPLASM AT CRS, SAHIWAL

Characteristics	**Range**
CLCuD Incidence (% age)	15 – 60
Boll Weight (g)	2.5–4.0
No of Bolls	20 – 48
Plant Height (cm)	85 – 170
G.O.T. (%)	32 – 42
Staple Length (mm)	28 -31
Fibre Fineness (µg/inch)	3.5-4.9
Fiber Strength (g/tex)	26.0-40.8

2. STUDY OF FILIAL GENERATIONS

Single plant selections were made from the promising breeding material in different segregating generations (F_1 to F_5) for further testing for seed cotton yield, fiber traits and cotton leaf curl virus disease. The detail of breeding material planted and number of plants selected during 2019-2020 is anchored in Table 1.2.1.

Table1.2.1 FILIAL GENERATIONS STUDIED DURING THE YEAR 2019-20

Generations	Total sown	Selected	
	Crosses	Crosses	Progenies/ Plants
F_1	48	48	-
F_2	24	18	87
F_3	14	7	34
F_4	11	7	26
F_5	8	4	11

F_6	6	6	4
Total	101	90	162

Cotton leaf curl virus incidence, seed cotton yield and fiber quality in filial generations (F_1 to F_6) during the year 209-20 is given as under:

Table1.2.2 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_1 GENERATION DURING THE YEAR 2019-20

FAMILY #	CLCuD %	YIELD/PT (g)	G.O.T. %	S.L. (mm)	MIKE (ug/inh)	S.T. (g/tex)
1005	15	55.4	40	29	4.0	33
1008	9	78	41	28	4.1	32
1010	11	70.8	39	29	4.3	30
1012	17	65.4	40	28	4.0	31
1014	10	76.7	41	28	3.9	32
1016	11	81	40	29	4.1	30
1017	14	86	41	28	4.0	31
1020	17	76.4	40	28	4.3	30
1022	12	78.4	39	29	4.1	31
1025	10	80.6	40	29	4.2	32
1032	10	86	38	29	4.1	31
1034	13	68	39	28	4.2	30
1038	14	67.6	38	29	4.3	31

In F-1 CLCuV ranged from 9 to 17% and the lowest virus (9%) was recorded for the strain 1008. Number of bolls/plant and boll weight ranged from 20-31 and 2.5-4.1g respectively and GOT ranged from 38-41. The highest GOT (41 %) was found in the strain 1008. The staple length ranged from 28-29mm. the highest staple length was found in the strain 1005. The mike value ranged from3.9 to 4.3 µg/in. The lowest mike was found in the strain 1004. The staple strength ranged from 30 to 33g/tex. The highest staple strength was found in the strain 1005. The best harmonious combinations were 1004,1005,1008.

Table 1.2.3 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_2 GENERATION DURING THE YEAR 2019-20

Strain	CLCuD%	Yield /pl (g)	GOT%	Length(mm)	Fineness(µg/in)	Strength(g/tex)
2008	18	62	40	29	4.0	32
2012	14	72	38	30	4.1	31
2014	11	70.3	39	28	4.0	32
2017	12	67	40	29	3.9	30
2019	17	72	38	28	3.9	30
2022	20	70	39	29	4.0	31
2023	10	73.9	41	30	3.9	32
2025	15	67.2	40	28	3.9	32
2026	13	71.5	39	30	4.1	32
2027	14	67	40	29	3.9	33
2028	21	72	41	28	3.9	30
2030	14	71	39	28	4.1	32
2031	13	67.5	38	28	4.1	32
2033	11	57.6	40	29	3.9	32
2034	12	74	41	28	3.9	31

In F-2 CLCuV ranged from 10 to 21% and the lowest virus %(10%) was recorded for the strain 2023. Number of bolls/plant and boll weight ranged from 18-24 and 2.4-3.5g respectively. GOT ranged from 38-41. The highest GOT (41 %) was found in the strain 2034. The staple length ranged from 28-30mm. the highest staple length was found in the strain 2012. The mike value ranged from3.9 to 4.1 µg/in. The lowest mike was found in the strain 2028. The staple strength ranged from 30 to 32g/tex. The highest staple strength was found in the strain 2027. The best harmonious combinations were 2023, 2027, 2028,2034.

Table 1.2.4 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_3GENERATION DURING THE YEAR 2019-20

Strain #	CLCuD%	Yield /pl (g)	Plant Height (cm)	GOT %	Fibre Length(mm)	Fineness(µg/in)	Strength(g/tex)
3007	16	75	177	40	28	3.9	30
3009	17	68	148	39	29	4.1	31
3012	19	77	155	38	29	3.9	32
3015	21	60	172	40	28	3.9	30
3017	22	79.7	156	41	29	4.0	32
3019	20	55.4	148	38	28	3.9	31
3023	19	83	171	40	29	4.1	33
3027	18	68	172	41	28	3.9	32
3028	17	76	146	38	29	4.0	31
3029	19	56.8	145	39	28	3.9	32
3030	21	72.5	148	39	29	3.9	30
3033	20	74.5	174	41	28	4.0	32
3035	22	71.2	177	42	29	3.9	33
3036	20	68	154	40	28	4.1	32
3037	17	60.2	151	39	29	3.9	31
3038	21	69.5	150	41	28	3.9	30
3041	22	71.2	156	39	29	4.0	32

In F-3 CLCuV ranged from 16 to 22% and the lowest virus (16%) was recorded for the strain 3007. Number of bolls/plant and boll weight ranged from 19-25 and 2.5-3.6g respectively. GOT ranged from 38-41. The highest GOT (41 %) was found in the strain 3017. The staple length ranged from 28-29mm. the highest staple length was found in the strain 3009. The mike value ranged from3.9 to 4.1 µg/in. The lowest mike was found in the strain 3007. The staple strength ranged from 30 to 33g/tex.

The highest staple strength was found in the strain 3035. The best harmonious combinations were 3007, 3009, 3017,3035.

Table 1.2.5 SALIENT FEATURES OF SOME OUTSTANDING COMBINATIONS OF F_4 GENERATION

Strain #	CLCuD%	Yield /pl (g)	Plant Height (cm)	GOT %	Fibre Length(mm)	Fineness(µg/in)	Strength (g/tex)
4007	23	71	170	38	29	3.9	32
4009	19	56	144	40	28	4.0	30
4010	17	58	155	41	28	3.8	30
4011	22	71	159	42	29	3.9	31
4018	25	81	161	43	28	4.0	30
4023	18	66	171	39	29	3.9	32
4024	20	80.4	145	40	28	3.8	31
4027	17	68.4	165	39	29	3.9	30
4028	19	74	139	38	28	4.2	32
4031	21	58.4	159	40	29	4.0	33
4033	25	70.6	167	41	28	3.9	32
4035	22	62	177	41	28	3.8	31
4048	24	59.4	154	40	29	3.9	30
4040	23	74.4	165	38	29	3.9	31
4041	21	86.5	170	40	28	4.0	32
4042	18	76	158	40	29	4.0	32
4043	21	72.6	140	38	29	4.1	31

In F-4 CLCuV ranged from 17 to 25% and the lowest virus (17%) was recorded for the strain 4027. Number of bolls/plant and boll weight ranged from 19-28 and 2.5-3.6g respectively. GOT ranged from 38-41. The highest GOT (41 %) was found in the strain 4033. The staple length ranged from 28-29mm. the highest staple length was found in the strain 4007. The mike value ranged from3.9 to 4.2 µg/in. The lowest mike was found in the strain 4027. The staple strength ranged from 30 to 32g/tex. The highest staple strength was found in the strain 4023. The best harmonious combinations were 4007, 4027, 4033.

Table 1.2.6 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_5 GENERATION

Strain #	CLCuD%	Yield /pl (g)	Plant Height (cm)	GOT %	Fibre Length (mm)	Fineness (µg/in)	Strength (g/tex)
5007	20	56	155	40	29	4.1	31
5008	25	85	156	42	28	4.2	32
5010	20	56	171	41	29	3.9	32
5012	18	55	166	39	28	3.9	32
5017	19	75.4	168	40	28	4.1	30
5019	21	66	145	38	29	3.9	31
5020	21	66	149	41	28	4.0	32
5022	19	65	173	42	28	3.9	30
5023	18	72	165	39	29	3.9	31
5024	20	66	167	41	29	4.0	31
5026	20	67	156	43	29	4.1	32
5028	19	69.8	171	40	28	4.0	31
5030	21	66.2	166	42	28	3.9	30

5031	22	71.5	173	39	28	3.9	32
5033	21	67	169	40	29	4.0	32
5035	25	55	171	41	29	4.1	31
5038	19	60	158	42	29	4.0	32

In F-5 CLCuV ranged from 18 to 25% and the lowest virus (18%) was recorded for the strain 5012. Number of bolls/plant and boll weight ranged from 19-28 and 2.5-3.5g respectively. GOT ranged from 38-42. The highest GOT (42 %) was found in the strain 5022. The staple length ranged from 28-29mm. the highest staple length was found in the strain 5019. The mike value ranged from3.9 to 4.2 µg/in. The lowest mike was found in the strain 5012. The staple strength ranged from 30 to 32g/tex. The highest staple strength was found in the strain 5017. The best harmonious combinations were 5012, 5017, 5022.

Table 1.2.7 SALIENT FEATURES OF SOME HARMONIOUS COMBINATIONS OF F_6 GENERATION

Strain #	CLCuD%	Yield /pl (g)	Plant Height (cm)	GOT%	Fibre Length(mm)	Fineness(µg/in)	Strength(g/tex)
6007	25	73	165	39	29	3.9	32
6009	20	85	158	38	29	4.0	31
6010	19	69	166	41	28	4.1	30
6012	19	62	169	42	28	4.0	32
6014	18	77.5	171	40	29	3.9	31
6016	23	76.3	156	39	29	3.9	30
6017	20	78	159	40	28	4.0	32
6019	18	69.8	161	39	29	4.1	32
6021	19	60	151	40	28	4.1	31
6023	22	76.6	155	41	29	3.9	32
6025	20	86	169	39	28	4.1	31
6027	21	72.2	165	40	28	4.0	31
6029	26	69.5	158	41	29	3.9	31
6032	21	88	161	40	29	3.9	32
6033	19	69.8	175	41	29	4.0	31
6036	23	65.6	177	40	28	3.9	31
6040	21	68.2	169	41	29	4.1	30

In F-6 CLCuV ranged from 19 to 26% and the lowest virus (19%) was recorded for the strain 6012. Number of bolls/plant and boll weight ranged from 19-31 and 2.5-3.5g respectively. GOT ranged from 38-42. The highest GOT (42 %) was found in the strain 6012. The staple length ranged from 28-29mm. the highest staple length was found in the strain 6007. The mike value

ranged from3.9 to 4.1 µg/in. The lowest mike was found in the strain 6023. The staple strength ranged from 30 to 32g/tex. The highest staple strength was found in the strain 6017. The best harmonious combinations were 6007, 6012,6017.

3. EVALUATION PHASE

2.1 PRELIMINARY YIELD TRIALS

The objective of Preliminary Yield Trial (PYT) is to evaluate 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 virus disease. Cultivars at this stage were subjected to a reduced selection pressure and the selected lines were progressed to the Advanced Yield Trials. During year 2019-20, 22 lines/strains were planted in 3 PYTs with different genotypes per trial along with one standard variety (FH-142). Detailed results of each PYT are given below:

3.2 ADVANCE YIELD TRIALS (AYTS)

The objective ofAdvanced Yield Trial (AYT) entails the evaluation of newly advanced cotton lines selected from the PYT for yield and other important quantitative traits. During year 2019-20 about 20 lines/strains alongwith one check FH-142 in each trial were planted to assess their yield potential and their fiber quality. Detailed results of AYTs are presented below:

Table:2.2.1 PERFORMANCE OF PROMISING STRAINS IN AYT-1 DURING 2019-20 AT CRS SAHIWAL

Variety	CLCuD %	Yield (kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st Flower	Days to 1st Open boll	GOT%	Fibre Length (mm)	Fibre Fineness (µg/in)	Fibre Strength (g/tex)
SLH-35	18	2561	36505	25	3.0	152	18	48	88	39	29	4.2	31
SLH-38	11	2306	37110	22	3.2	171	20	51	82	40	28	4.1	30
SLH-49	10	2354	36040	21	3.0	158	19	44	87	39	28	4.2	32

SLH-50	20	2564	37800	20	3.1	165	20	41	88	41	28	3.9	31
SLH-54	21	2506	36410	23	2.8	169	18	52	86	41	29	3.9	32
SLH-66	19	2206	34620	25	2.5	171	19	53	89	39	29	4.0	30
SLH-68	22	2456	37540	20	3.6	169	18	50	85	40	29	4.1	31
FH-142	22	2402	36005	25	2.9	168	19	49	91	38	28	4.0	30

According to results highest seed cotton yield was produced by the strain SLH-50 (2564 kg ha^{-1}) followed by the SLh-35 (2561 kg ha^{-1}) and SLH-68 (2456 $kgha^{-1}$), FH-142 (standard) produced 2402 kg ha^{-1} seed cotton yield. Highest boll weight was produced by the strain SLH-68 (3.6g) followed by the SLH-50 (3.1g). Maximum lint percentage was obtained from strain SLH-50 (41%) followed by the SLH-68 (40%). Highest staple length was obtained from SLH-35 (29mm) followed by SLH-38 (28mm), micronaire value was between 4.5 to 4.9 µg $inch^{-1}$.

Table:2.2.2 PERFORMANCE OF PROMISING STRAINS IN AYT-2 DURING 2019-20 AT CRS SAHIWAL

Variety	CLCuD%	Yield(kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st Flower	Days to 1st Open boll	GOT%	Fibre Length(mm)	Fibre Fineness(µg/in)	Fibre Strength(g/tex)
SLH-55	18	2303	35340	25	3.0	159	21	50	91	40	28	3.9	31
SLH-58	15	2517	38610	19	2.9	156	19	48	88	39	29	3.9	32
SLH-60	11	2122	36540	23	3.6	165	18	49	89	38	29	4.0	30
SLH-78	20	2044	36570	24	3.5	169	22	50	91	41	28	4.3	31
SLH-79	19	2214	34250	26	2.5	171	21	50	89	40	29	4.1	30
SLH-81	18	2402	39210	23	3.0	149	20	51	81	40	28	4.0	31
FH-142 (std.)	22	2203	38050	26	2.9	168	20	49	88	39	28	3.9	32

Data revealed that highest seed cotton yield was harvested from SLH-58 (2517 kg ha^{-1}) followed by the SLH-81 (2402 kg ha^{-1}) and commercial standard FH-142 produced 2203 kg ha^{-1} seed cotton yield. Maximum boll weight was obtained from SLH-60 (3.6g) followed by the SLH-78 (3.5g). Highest lint was produced by the SLH-78 (41%) and SLH-79 (40%), maximum staple length was recorded for SLH-58 (29mm). All strains had acceptable range of micronaire value, lowest CLCuD index was recorded for SLH-60 (11%).

Table:2.2.3 PERFORMANCE OF PROMISING STRAINS IN AYT-3 DURING 2019-20 AT CRS SAHIWAL

Variety	CLCuD%	Yield(kg/ha)	Plant pop/ha	Bolls/pl	Av. Boll weight (g)	Plant Height (cm)	Node/pl	Days to 1st Flower	Days to 1st Open boll	GOT%	Fibre Length(mm)	Fibre Fineness(µg/in)	Fibre Strength(g/tex)
SLH-39	23	2402	36206	23	3.5	169	18	59	90	39	29	4.0	32
SLH-42	18	2316	37511	18	2.8	158	21	49	89	40	28	3.9	31
SLH-43	10	2021	35401	24	3.9	171	20	50	87	41	28	4.1	32
SLH-69	21	2142	37470	29	3.6	165	19	52	90	42	29	4.0	32
SLH-72	22	2344	36310	28	2.9	168	22	53	88	41	28	4.0	31
SLH-74	19	2301	38302	25	3.4	169	18	60	86	39	29	3.9	32
SLH-75	20	2203	36501	27	3.8	170	23	61	87	40	28	3.9	31
FH-142 (std.)	21	2401	37040	29	2.8	159	21	55	90	41	29	4.0	31

Data revealed that highest seed cotton yield was harvested from SLH-39 (2402 kg ha^{-1}) followed by commercial standard FH-142 produced 2401 kg ha^{-1} seed cotton yield. Maximum boll weight was obtained from SLH-43 (3.9g) followed by the SLH-75 (3.8g). Highest lint was produced by the SLH-69 (42%) maximum staple length was recorded for SLH-39 (29mm). All strains had acceptable range of micronaire value, lowest CLCuD index was recorded for SLH-43 (10%).

4. PROVINCIAL COORDINATED COTTON TRIAL (PCCT)

The objective of this trial is to test the performance of new promising strains of different cotton research centers of Punjab under different ecological zones. During year 2019-20 the trial was conducted at CRS Sahiwal, Set comprised of 27 Bt. Strains .The results with respect to CLCuV incidence and yield were presented in Table 2.3.1.

Table 2.3.1PERFORMANCE OF NEW STRAINS IN PCCT (*BT.*) SET-1 DURING 2019-20 AT CRS SAHIWAL

Variety Code	Yield ($kgha^{-1}$)	Lint Yield ($kgha^{-1}$)	GOT (%)	Staple Length (mm)	Micronaire ($\mu g\ inch^{-1}$)	Fiber Strength ($g\ tex^{-1}$)	CLCuD (%)	Plant population (ha)
PC-1	2081	867	41.67	24.8	4.3	25.8	30.3	42735
PC-2	2201	902	41.00	25.9	4.6	25.8	35.9	42735
PC-3	1881	759	40.33	26.9	5.1	27.9	21.5	42920
PC-4	2005	789	39.33	24.6	4.8	25.3	23.8	42365
PC-5	1708	672	39.33	25.2	4.1	26.3	15.3	41995
PC-6	2207	920	41.67	26.5	4.6	26.4	28.5	43105
PC-7	2401	1025	43.00	25.3	4.2	26.2	28.3	42920
PC-8	2104	912	43.33	25.3	5.2	25.8	37.7	42735
PC-9	1914	798	41.67	25.7	5.2	25.6	30.7	39220
PC-10	2026	864	42.67	26.1	4.9	26.7	29.4	42180
PC-11	1933	805	41.67	25.7	4.2	26.8	22.6	40330
PC-12	2102	855	40.67	26.3	4.9	27.8	26.6	43105
PC-13	1873	793	42.33	26.1	4.8	27.7	33.1	43105
PC-14	2007	836	41.67	23.8	4.9	24.7	30.7	42735

PC-15	2114	846	40.00	25.8	4.8	25.7	33.7	39300
PC-16	2076	830	40.00	26.1	4.9	27.1	22.7	43290
PC-17	2107	899	42.67	25.3	4.6	26.1	31.1	41625
PC-18	2050	841	41.00	26.1	4.7	29.8	25.7	42920
PC-19	1750	706	40.33	24.8	4.9	25.8	22.9	42920
PC-20	2309	977	42.33	26.6	3.8	27.3	21.6	42735
PC-21	2065	833	40.33	26.7	4.7	27.8	26.6	38850
PC-22	1877	751	40.00	25.6	4.5	25.5	15.0	41810
PC-23	1866	740	39.67	23.8	4.0	24.7	21.2	41995
PC-24	1953	853	43.67	26.3	4.8	26.5	37.3	39960
PC-25	2163	844	39.00	26.5	4.9	26.4	14.5	43475
PC-26	2000	840	42.00	25.4	4.8	26.9	35.7	41070
PC-27	1820	752	41.33	24.6	4.9	25.3	35.2	40515

Data presented in table revealed that highest seed cotton yield was produced by the strain PC-7 (2401 kg ha^{-1}) followed by the PC-20 (2309 kg ha^{-1}) and PC-6 (2207 kg ha^{-1}). Lowest seed cotton yield was harvested from PC-5 (1708 kg ha^{-1}). Maximum lint was harvested from PC-24 (43.67%) followed by the PC-8 (43.33%) and PC-7 (43%). Maximum staple length was produced by the PC-3 (26.9 mm), all strains had micronaire value in acceptable range except PC-3, PC-8, PC-9 and PC-13 and fiber strength was also in good range for all the strains.

3.NATIONAL COORDINATED VARIETAL TRIAL (NCVT)

The objective of this trial is to test the performance of new Varieties of different cotton research centers on national basis under different ecological zones. During year 2019-20 the trial was

conducted at CRS Sahiwal, The results with respect to CLCuV incidence and yield were presented in Tables

Table-3..1: Performance of Bt Candidate Strains in NCVT (Set-A) at CRS Sahiwal during 2019-20.

Strain Code	Strain Name	Yield (kg ha^{-1})	Boll Weight (g)	GOT (%)	Staple Length (mm)	Fiber Strength (g tex^{-1})	Mike (µg inch^{-1})	Plant Population (ha^{-1})
PC-1901	1901	2344	2.8	41.0	25.2	26.6	4.5	39347
PC-1902	1902	3100	2.5	38.5	25.0	24.5	4.4	39886
PC-1903	1903	2381	2.7	39.0	26.2	25.6	5.1	41323
PC-1904	1904	3024	2.5	38.5	25.7	25.6	4.7	41144
PC-1905	1905	2948	2.6	40.5	24.9	25.3	4.4	41323
PC-1906	1906	2079	2.9	40.5	25.5	26.5	4.6	42042
PC-1907	1907	3326	2.9	39.0	28.1	30.0	4.1	42222
PC-1908	1908	3629	2.6	38.5	25.9	26.5	4.7	42042
PC-1909	1909	2268	2.7	37.8	26.3	27.9	4.6	41862
PC-1910	Tassco-115	2117	2.5	39.0	24.1	23.8	4.9	41683
PC-1911	Tassco-112	3024	2.7	40.5	25.5	26.7	4.2	42042
PC-1912	Tahafuz-15	3704	3.0	40.2	26.8	26.7	5.3	42401
PC-1913	Dimond-2	2873	2.8	39.7	26.1	27.8	4.5	39886
PC-1914	Suncrop-3	2268	3.0	38.8	25.3	26.9	5.1	42401
PC-1915	CIM-602 (Bt Std.)	2495	2.7	40.0	26.8	27.8	3.7	42401
PC-1916	Tahafuz-12 (C-II)	3175	2.5	41.2	25.2	26.0	5.0	42222
PC-1917	Suncrop (C-II)	2268	2.9	41.0	23.2	23.5	4.9	41683

PC-1918	Sayban-209	2722	2.4	39.0	25.1	26.2	4.8	42222
PC-1919	Saim-102	3213	2.9	38.6	24.6	25.7	4.4	42042
PC-1920	Rohi-2	2948	3.0	39.0	24.3	25.0	4.7	39706
PC-1921	Rohi-1	2835	2.8	37.9	26.0	26.8	4.3	41683
PC-1922	TJ-King (C-II)	2306	3.0	38.3	25.2	25.4	4.3	41862
PC-1923	1923	3062	3.0	38.5	25.0	25.1	5.2	41144
PC-1924	NS-211	2268	3.2	38.5	25.6	25.5	4.5	41862

The results indicated that the strain Tahafuz-15 produced highest seed cotton yield 3704 kg ha^{-1} followed by the 1908 with 3629 kg ha^{-1} while 1906 produced lowest seed cotton yield that is 2079 kg ha^{-1} against the standard variety CIM-620 that produced 2495 kg ha^{-1}.

The strain Tahafuz-12 (C-II) produced highest lint percentage i.e. 41.2% followed by the 1901 and Sun crop i.e. 41.0%. The strain 1907 produced highest staple length i.e. 28.1mm and lowest value of staple length was observed in Sun crop (C-II) i.e. 23.2mm. All strains had acceptable range of micronaire value except CIM-602. Value of fiber strength was above standard for all strains.

Table-3.2: Performance of candidate Strains in NCVT (Set-B) at CRS Sahiwal during 2019-20.

Strain Code	**Strain Name**	**Yield (kg ha^{-1})**	**Boll Weight (g)**	**GOT (%)**	**Staple Length (mm)**	**Fiber Strength (g tex^{-1})**	**Mike (µg $inch^{-1}$)**	**Plant Population (ha^{-1})**
PC-1925	Eye-22	2608	2.8	41.5	28.1	28.2	4.2	40784

PC-1926	Eye-111	3024	2.4	41.0	26.1	26.0	4.8	42222
PC-1927	Eye-20	3402	2.3	38.5	28.3	28.5	4.5	42042
PC-1928	Rustam-Beej-111 (CKC)	3100	2.2	38.5	25.2	25.6	5.3	41323
PC-1929	Rustam-Beej-11 (C-II)	2381	2.6	39.0	26.6	25.5	4.7	42042
PC-1930	Rustam-11	3289	2.8	39.5	25.9	25.3	5.1	41862
PC-1931	ICI-2424	3704	2.9	41.6	25.7	25.9	4.6	41862
PC-1932	YBG-2323 (CKC)	2797	2.9	39.0	24.7	25.4	4.3	39706
PC-1933	YBG-2222 (C-II)	2948	2.5	38.5	26.6	26.8	4.6	42222
PC-1934	1934	2835	2.5	38.5	27.4	28.8	3.8	41503
PC-1935	CIM-602 (Bt Std.)	2986	3.1	39.0	25.9	25.6	4.5	41862
PC-1936	1936	2948	3.1	37.5	26.0	25.3	4.2	40605
PC-1937	1937	2797	3.0	41.5	26.5	26.6	4.1	41503
PC-1938	1938	3364	3.4	40.5	26.5	26	5.1	41683
PC-1939	1939	3213	2.9	41.0	26.5	27.2	4.7	37730
PC-1940	1940	3213	2.6	40.5	25.1	25.3	4.5	39706
PC-1941	BF-1	2570	2.6	39.5	25.7	25.6	4.7	42222
PC-1942	1942	3440	2.5	39.0	25.7	26.0	4.0	41503
PC-1943	1943	3024	3.3	38.5	24.5	24.0	5.0	40964
PC-1944	Bahar-136	2759	2.5	37.5	24.9	25.8	4.6	41503
PC-1945	ASPL-710	3402	2.6	37.5	24.4	24.2	5.0	42042
PC-1946	ASPL-709	3024	2.9	39.5	24.5	24.7	4.7	41683
PC-1947	IR-NIBGE-15	3878	2.9	37.5	24.3	25.7	4.0	37910

PC-1948	IR-NIBGE-14	4120	2.0	39.0	25.8	26.8	4.0	40964
PC-1949	IR-NIBGE-13	3856	2.5	42.0	25.1	26.5	4.5	42042
PC-1950	NIAB-SANAB-M	3402	2.2	42.5	26.0	26.0	4.2	42222

The data presented in table-2.2 showed that strain IR-NIBGE-14 produced highest seed cotton yield i.e. 4120 kg ha^{-1} followed by the IR-NIBGE-15 and IR-NIBGE-13 by producing 3878 kg ha^{-1} and 3856 kg ha^{-1} seed cotton yield respectively. Lowest seed cotton yield was produced by the Rustam-Beej-11 (C-II) i.e. 2381 kg ha^{-1}.

Data also revealed that highest lint was produced by the NIAB-SANAB-M i.e. 42.5% followed by the IR-NIBGE-13 and ICI-2424 they produced 42.0% and 41.6% lint respectively. Highest staple length was produced by the strain Eye-20 i.e. 28.3mm followed by the strain Eye-22 that produced 28.1mm lengthy fiber. Very short fiber was produced by the 1943 that produced only 24.5mm length of fiber. Micronaire of all strains were in good range except 1934, Rustam-Beej-111 (CKC), Rustam-11 and 1938.

Table-3.3: Performance of Candidate Strains in NCVT (Set-C) at CRS Sahiwal during 2019-20.

Strain Code	Strain Name	Yield (kg ha^{-1})	Boll Weight (g)	GOT (%)	Staple Length (mm)	Mike (µg inch^{-1})	Fiber Strength (g tex^{-1})	Plant Population (ha^{-1})
PC-1951	NIAB-512	3629	3.1	40.5	26.8	26.3	4.1	42042
PC-1952	NIAB-973	3289	3.0	40.7	27.4	27.7	4.1	41862
PC-1953	NIAB-819	3062	2.7	42.0	25.8	26.4	4.5	37191
PC-1954	NIAB-135	3364	3.0	41.0	26.9	27.2	4.6	41862
PC-1955	NIAB-1011	3478	2.8	40.5	25.9	26.3	3.8	40784
PC-1956	NIA-89	1966	2.4	41.5	25.5	26.2	4.4	41862
PC-1957	IUB-73	2722	3.0	39.2	26.3	26.9	4.6	40066
PC-1958	VH-383	3591	2.8	38.7	27.8	28.2	4.8	41862
PC-1959	VH-189	3629	3.0	37.0	27.3	28.3	3.8	41503
PC-1960	CIM-602 (Bt Std.)	2986	3.1	41.0	26.5	26.1	4.7	42042
PC-1961	VH-402	3402	3.0	41.0	26.6	27.5	4.1	41503
PC-1962	SLH-33	3289	3.0	37.8	27.6	28.6	4.5	41144
PC-1963	RH-Kashish	2948	2.9	42.0	27.4	28.5	3.7	41144
PC-1964	RH- Afnan-2	3062	3.1	39.2	25.2	26.3	4.5	42042
PC-1965	RH-670	3553	2.5	38.0	24.0	28.8	3.9	40784
PC-1966	GH-Hammaliya	3100	2.6	40.5	25.8	25.9	4.4	42042
PC-1967	GH-Sultan	3062	2.5	41.0	27.4	27.1	4.4	40964
PC-1968	GH-Uhad	3478	3.0	41.5	26.2	26.3	4.6	41683
PC-1969	FH-Anmol	2684	3.0	40.1	25.3	25.9	4.8	37011

PC-1970	FH-492	2759	2.7	41.5	27.9	28.7	3.7	37011
PC-1971	FH-155	3289	3.1	38.5	25.7	26.8	4.2	38628
PC-1972	FH-Super Cotton-2017	3213	3.3	41.5	26.2	26.7	4.8	41503
PC-1973	FH-AM-Cotton-2017	3364	3.2	40.0	24.9	25.2	4.6	37371
PC-1974	BH-224	3289	2.7	41.5	23.8	24.3	4.4	39167
PC-1975	BH-223	2835	3.1	40.5	24.9	25.1	4.5	40245

The data presented showed that the strain NIAB-512 and VH-189 produced highest seed cotton yield i.e. 3629 kg ha^{-1} followed by the VH-383 that produced 3591 kg ha^{-1}seed cotton yield respectively. Lowest seed cotton yield was harvested from NIA-89 i.e. 1966 kg ha^{-1} respectively.

Data also revealed that highest lint percentage was produced by the strains NIAB-819 and RH-Kashish i.e. 42.0 %. Longest staple was produced by the strain FH-492 i.e. 27.9 followed by the VH-383 that produced 27.8 mm lengthy fiber. All strains produced micronaire in acceptable range except NIAB-1011, VH-189, RH-Kashish and FH-492.

Table-3.4: Performance of Candidate Strains in NCVT (Set-D) at CRS Sahiwal during 2019-20.

Strain Code	**Strain Name**	**Yield (kg ha^{-1})**	**Boll Weight (g)**	**GOT (%)**	**Staple Length (mm)**	**Fiber Strength (g tex^{-1})**	**Mike (µg $inch^{-1}$)**	**Plant Population (ha^{-1})**
PC-1976	MNH-1050	2306	3.0	39.5	26.9	27.4	3.9	40425
PC-1977	MNH-1035	2797	3.1	40.5	26.5	27.9	5	40784
PC-1978	CEMB-Klean-Cotton-6	3364	2.6	40.5	23.9	24.4	3.8	41503
PC-1979	CEMB-Klean-Cotton-5	3515	2.8	38.5	26.6	26.2	3.7	40964
PC-1980	CEMB-Klean-Cotton-4	3478	3.0	41.3	27.5	28.7	4.1	42401
PC-1981	CEMB-Klean-Cotton-3	3667	2.5	41.5	25.4	26.7	4.2	41683
PC-1982	CRIS-638	3402	2.6	41.0	25.1	26.6	4.5	41503
PC-1983	CRIS-673	2986	2.7	39.8	25.6	26.8	4.6	35574

PC-1984	CRIS-671	3364	2.6	38.5	24.8	25.7	4.6	41323
PC-1985	Bt-Cyto-535	3402	2.7	41.3	25.2	25.1	4.9	38089
PC-1986	Bt-Cyto-533	2759	2.8	40.9	24.9	24.7	4.7	41503
PC-1987	Bt-CIM-785	2835	2.7	39.5	27.4	29.7	4.6	39347
PC-1988	Bt-CIM-775	3402	3.1	40.0	25.6	26.7	3.7	41503
PC-1989	Bt-Cyto-511	3100	3.0	38.5	27.2	28	4.3	37730
PC-1990	Bt-CIM-789	2911	3.1	39.0	25.6	25	4.3	35933
PC-1991	Bt-CIM-678	2684	2.8	40.0	26.7	26.5	4.6	38449
PC-1992	Bt-CIM-303	2873	2.6	39.0	24.6	25	4.5	36472
PC-1993	CIM-602 (Bt Standard)	3024	2.7	38.5	26.2	26.6	4	41323
PC-1994	Cyto-124 (Non Bt Std.)	1966	2.8	39.5	28.7	28.6	4.1	41144
PC-1995	NIAB-929	3289	3.1	41.0	25.9	26.5	4.9	40784
PC-1996	NIA-88	2495	3.0	38.6	25.5	25.8	5.4	42222
PC-1997	1997	2608	2.7	38.0	27.4	27.2	4.9	40245
PC-1998	CRIS-644	3137	2.7	40.0	25.6	26	4.9	41683
PC-1999	Cyto-226	2306	3.0	40.5	28.3	28.1	4.1	37730
PC-2000	2000	3289	2.5	38.8	27.2	28.3	4.1	39886
PC-2001	2001	3364	2.8	38.5	26.6	27.4	4.7	38269
PC-2002	MZM-7	3515	2.7	39.8	26.9	27	3.7	41323

Data presented revealed that highest seed cotton yield was harvested from CEMB-Klean-Cotton-3 i.e. 3667 kg ha^{-1} followed by the CEMB-Klean-Cotton-5 and MZM-7 i.e. 3515 kg ha^{-1}. Lowest yield was harvested from Cyto-124 (1966 kg ha^{-1}). Highest lint percentage was obtained from CEMB-Klean-Cotton-5 that was 41.5%. Highest staple length was produced by the Cyto-124 (28.7mm) and Cyto-226 (28.3mm) and CEMB-Klean-Cotton-4 (27.5mm). Lowest staple length was observed in CEMB-Klean-Cotton-6 (23.9mm)

Micronaire value of the strains was in range except MNH-1050, CEMB-Klean-Cooton-6, CEMB-Klean-Cooton-5, Bt-CIM-775, NIA-88 and MZM-7. Fiber strength of all the strains were in good range.

5. AGRONOMIC PHASE

Agronomic research program aims at developing agronomic practices that can be easily adopted by the cotton growers and managing the cotton crop with judicious use of inputs to obtain the maximum yield with minimum inputs.

Sowing Date Trial

Studies were conducted on promising strains SLH-33, SLH-35, SLH-37 against the standard FH-142 at six sowing dates, starting from 16th March to 1st June at 15 days interval, to find the optimum sowing time for advanced strains under Sahiwal conditions. Each treatment was replicated three times in split plot design. Plot size was maintained 20' × 7.5'. The observations for seed cotton yield was recorded on the net plot basis and then converted into kg ha^{-1}. The data of seed cotton yield (kg ha^{-1}) plant population (ha^{-1}), plant height (cm), bolls $plant^{-1}$, boll weight (g), is presented in Table 3.1

Table-4.1: Results of Sowing Date Trial Sown at Cotton Research Station, Sahiwal during the Year 2019-20.

Sowing Dates	Genotypes	Yield (kg ha^{-1})	Plant Population (ha^{-1})	Plant Height (cm)	Bolls $Plant^{-1}$	Boll Weight (g)
16th March	SLH-33	1776	35551	131.9	16.7	3.7
	SLH-35	2681	35983	136.9	16.3	4.0
	SLH-37	1832	35720	157.9	16.3	4.0
	FH-142	2433	35830	148.9	19.3	3.8
1st April	SLH-33	1737	34424	136.6	19.3	3.7
	SLH-35	1859	34784	160.6	21.3	3.5
	SLH-37	2418	39753	151.7	19.3	3.1
	FH-142	2170	36261	132.1	18.3	3.7
16th April	SLH-33	1703	33127	135.4	21.7	3.6
	SLH-35	2190	36545	142.8	21.7	3.8
	SLH-37	1192	32210	152.9	25.0	3.6

	FH-142	3163	35946	142.5	21.0	3.7
1st May	SLH-33	1314	30685	125.9	20.0	3.2
	SLH-35	1786	33621	142.6	20.7	3.6
	SLH-37	1353	34363	148.6	21.3	3.3
	FH-142	1650	33942	135.4	16.7	3.8
16th May	SLH-33	1046	32064	118.9	15.7	3.3
	SLH-35	1144	33291	124.6	12.0	3.2
	SLH-37	1036	33925	136.5	14.0	3.3
	FH-142	1046	36047	127.8	11.3	3.6
1st June	SLH-33	949	36794	80.4	8.7	1.9
	SLH-35	852	35182	85.7	12.3	1.5
	SLH-37	706	31396	88.2	5.2	4.5
	FH-142	414	35393	81.9	9.7	1.2

The data given in above table-3.1 indicated that on an average 16th April was the best sowing date and all strains produced best yield at this date. SLH-35 produced highest seed cotton yield (2681 kg ha-1) followed by the SLH-37 which produced 2418 kg ha^{-1}.

4.2 Plant Spacing Trial

The experiment was conducted to determine the optimum plant spacing for newly developed strains SLH-33 and SLH-55 against the standard FH-142 at 15 cm, 22.0 cm, 30.0 cm and 45.0 cm plant spacing. Row × Row distance was kept as 2.5 feet. A split plot design replicated thrice with plot size of 20' × 7.5' was maintained. The observations for seed cotton yield of seed cotton was recorded on the net plot basis and then converted into kg ha^{-1}. The data for seed cotton yield (kg ha^{-1}) plant population (ha^{-1}) plant height (cm), bolls $plant^{-1}$, boll weight (g), were recorded and presented in Table-3.2.

Table-4.2: Results of Plant Spacing Trial sown at Cotton Research Station, Sahiwal during the Year, 2018-19.

Genotypes	Plant Spacing	Yield (kg ha^{-1})	Plant Population (ha^{-1})	Plant Height (cm)	Bolls $Plant^{-1}$	Boll Weight (g)
SLH-33	15cm	893.7	24879.2	121.3	18.5	2.7
	22cm	966.2	26087.0	117.3	17.8	2.9
	30cm	**1207.7**	21014.5	118.7	18.9	3.3
	45cm	1062.8	20289.9	118.0	18.1	3.2
SLH-55	15cm	966.2	21739.1	124.7	18.9	2.5
	22cm	1425.1	22222.2	122.3	19.5	2.7
	30cm	**1666.7**	21256.0	118.0	19.7	3.5
	45cm	1401.0	20048.3	120.7	19.1	3.1
FH-142	15cm	1280.2	23671.5	124.3	15.5	2.8
	22cm	1352.7	24396.1	112.0	16.9	3.3
	30cm	**1425.1**	23671.5	114.3	17.9	3.4

45cm	1401.0	22946.9	106.3	17.8	3.1

The data given in above table revealed that on an average 30 cm was the best plant spacing for both strains (SLH-33 and SLH-55).

4.3 Fertilizer Efficacy Trial

In order to find out the optimum fertilizer dose for newly developed strains an experiment was designed by including the two promising strain SLH-19, SLH-33 and FH-142. Six fertilizer levels were tested by utilizing different doses of nitrogen, phosphorous and potash fertilizer. Row distance was kept as 2.5 feet. A split plot design replicated thrice with plot size of 30'×5' was maintained. The observations for seed cotton yield of seed cotton was recorded on the net plot basis and then converted into kg ha^{-1}. The data for seed cotton yield (kg ha^{-1}) plant population (ha^{-1}) plant height (cm), bolls $plant^{-1}$, boll weight (g), is presented in table 4.3

Table-4.3: Results of Fertilizer Efficacy Trial sown at Cotton Research Station, Sahiwal during the Year, 2019-20.

Genotypes	Fertilizer Treatments N:P:K	Seed cotton Yield (kg ha^{-1})	Plant Population (ha^{-1})	Plant Height (cm)	Bolls $Plant^{-1}$	Boll Weight (g)
SLH-19	T_1 (115:23:0)	809.7	21423.4	115.3	15.5	2.6
	T_2 (138:23:0)	984.0	19971.0	117.7	15.9	3.4
	T_3 (161:46:25)	1180.1	19244.7	116.0	16.1	3.3
	T_4 (184:69:50)	**1405.2**	19607.8	119.0	16.5	3.9
	T_5 (207:69:50)	1151.1	22149.6	120.7	16.0	3.9
	T_6 (230:92:50)	947.7	22875.8	115.0	15.7	3.6
SLH-33	T_1 (115:23:0)	955.0	22149.6	115.0	15.8	3.1
	T_2 (138:23:0)	1063.9	21060.3	125.3	16.3	3.2
	T_3 (161:46:25)	1274.5	23602.0	124.3	16.2	3.4
	T_4 (184:69:50)	**1456.1**	19244.7	121.7	17.9	3.8

	T_5 (207:69:50)	1339.9	19607.8	125.3	15.5	3.7
	T_6 (230:92:50)	1260.0	19244.7	120.7	14.9	3.2
FH-142	T_1 (115:23:0)	907.8	21423.4	124.3	14.2	3.6
	T_2 (138:23:0)	951.3	18518.5	121.7	14.9	3.8
	T_3 (161:46:25)	1114.7	24328.2	123.0	15.1	3.8
	T_4 (184:69:50)	**1296.3**	23965.1	128.0	15.7	4.1
	T_5 (207:69:50)	1187.4	19971.0	119.3	15.0	4.0
	T_6 (230:92:50)	1096.6	18881.6	121.0	14.4	3.9

The data given in table 3.3 revealed that on an average maximum seed cotton yield was obtained when N, P and K were used at ratio of 184:69:50 kg ha^{-1}.