

MM 1.5 : Maintenance breeding, seed production, enhancement of seed viability and studies on marker based purity evaluation

Principal Investigator: J. C. Patel, NAU, Surat

Target	Achievement
Evaluation of parental lines on the basis of heterosis and SCA	Crosses between the promising progenies of female and male were taken and were evaluated during the season. In future only promising/desirable progenies will be included.
Evaluation of progenies for fibre traits, biotic stress etc	Progenies resistant / tolerant to disease/pest have been identified. Susceptible progenies were discarded. Similarly progenies with desirable fibres properties are being retained
Cataloguing of (a) morphological and (b) genetic marker using molecular techniques available in the currently cultivated cotton varieties and hybrids	Morphological markers have been identified for each variety. Cataloguing of Genetic marker using molecular technique is also in progress at NRCDF, New Delhi and CICR, Nagpur
Devising new molecular techniques for identification of stable genetic characters for identification of cultivars	Work on identification of molecular markers for stable genetic characters is in progress at NRCDF, New Delhi & CICR, Nagpur
Large scale multiplication of seeds of purified varieties and parents of hybrids based on above studies	Sufficient quantity of genetically pure nucleus and breeder seed of different varieties and parental lines of hybrids have been produced to cater to the needs of the farmers for further multiplication.
Studied on seed crop management and post harvest preparation to ensure good seed health	The results of different treatments of supplemental foliar nutrients are encouraging. The trial is in progress since last two years, but not consistent hence continued during third year also.

In all 17 hybrids with their parents, 27 *G. hirsutum*, 3 *G. herbaceum* and 10 *G. arboreum* stable varieties were evaluated for easily identifiable morphological characters for quick and speedy GOT. The project is under operation at 16 different centers

Progress of work :

❖ Maintenance of genetic purity of released varieties and parents of hybrids

The problems and lacunae in the present system of maintenance breeding were identified and incorporation of remedial measures in the present system for better

maintenance of genetic purity was attempted. To isolate the better performing progenies of male and female of the hybrids and stable varieties, the progenies were evaluated for yield and its contributing traits and fibre quality characters with model bulk as checks and at most of the centres non significant results were obtained among progenies and checks. The poor performing progenies were discarded. For easy and speedy GOT some new easily identifiable characters have been identified since cotyledon stage. The present and new distinguishing marker characters were evaluated for their stability.

NAU, SURAT

Plant parts	Varieties/ Hybrid	Female	Male
	G.Cot Hy-8	G.Cot-10	Surat Dwarf
Leaves	Small leaves, Hairy	Dark green, Hairy	Green , Medium hairy
Petal	Light yellow	Yellow	White
Bolls	Medium round shape, 3 to 4 lobes	Medium to big round, pointed shape	Medium round shape
	G.Cot Hy-10 (Fig 1.5.1)	BC-68-2	LRA-5166 (SB)
Leaves 12 to 20 days after sowing	Intermediate in colour	Dark red colour on leaf edge near leaf lamina juncture on the first two leaves (cotyledon)	No colour
Pollen time of anthesis	Yellow	White	Yellow
Bolls	Oval shape pointed 4 to 5 locules No colour	Medium to big oval shape, pointed, 4 to 5 locules	Medium slight round, elongated and 4 locules
	G.Cot MDH-11	SRT GMS-1	GSav-1056
Nectary	Present	Absent	Present
Leaves	Light red with light vein leaves	Green leaves	Red leaves
Stem	Light red stem colour	Green stem colour	Red stem colour
Flower	Light red	White	Dark red

JNKVV, Khandwa

	Jawahar Tapti	KH 11	Reba B 50	Khandawa 2(MB)	KWA 1	Sarvottam	Vikram
Stem hairiness	Medium	Strong	Medium	Medium	Medium	Strong	Strong

Petal colour	Yellow	Yellow	Whitish yellow	Yellow	Yellow	Yellow	Yellow
Petal spot	Present	Absent	Absent	Absent	Present	Present	Absent
Pollen colour	Yellow	Buff white	Yellow	Buff	Yellow	Yellow	Yellow
Anther colour	Cream	White	yellow	Whitish yellow	yellow	yellow	yellow

PDKV, Akola

Characters	AK-32	DHY-286	PKV Rajat	AKA-5	AKA-7
Foliage	3 broad lobe, slightly hairy	3 – 5 broad lobe, complete hairy, velvet in feel	3 – 5 broad lobe, slightly hairy	5 narrow lobes, slightly hairy with longer middle lobe	5 narrow lobes, slightly hairy, middle lobe bulging
Flower					
Petal colour	Pale yellow	Whitish cream	Pale yellow	White	White
Pollen colour	Pale yellow to buff	Whitish cream	Buff, some times pale yellow	Yellow	Yellow
Petal spot	Present	Absent	Absent	Present	Present
Special character	Petal spot	Leaves dense hairy	Semi erect plant type & petal colour pale yellow without spot	Leaves slightly hairy with five narrow lobes & white	Leaves slightly hairy with five narrow lobes, middle lobe is bulging and white petals

MPKV, Rahuri

Plant parts	Varieties/ Hybrid	Female	Male
	Phule 492 (Fig 1.5.2)	RHC-003	RCH-004
Petal	Pale yellow	Cream	Pale yellow
	Phule 388(Fig 1.5.2)	RGC-006	RHCb-001

	Yellow petals, petal spot present, boll shape conical with pointed apex, pitted.	Pale yellow petals, petal spot absent, boll shape round pointed, pitted. Oblong,	Dark yellow petals, petal spot present, boll shape elongated, highly pitted
--	--	--	---

ANGRAU, LAM Guntur

Character	L 604 (Hy)	NA 1325 (F)	LK 861 (M)
Habit	Tall, open, conical plant type, indeterminate growth. Stem pinkish green and moderate hairy.	Bushy, stem hairy and green, open and indeterminate in growth.	Tall, open, conical plant type, indeterminate growth, stem pinkish green and sparsely hairy
Foliage	Leaves medium broad, slightly cup shaped, slightly pointed, dark green, glanded,	Leaves normal green, hairy leaf	Leaves medium to broad, slightly cup shaped, pointed lobby ends, green, glabrous, thick.
Flower	Corolla yellow, anther and pollen buff coloured	Corolla and anther cream in colour and pollen colour buff.	Corolla, anther and pollen are cream in colour.
Bolls	Big size bolls, round to oblong in shape, slightly pointed with 3 – 5 locules	Bolls are medium sized and oval in shape with smooth surface, opening good.	Bolls oblong to spindle shaped, 4-5 locules, pointed, smooth surface, opening good
Character	Aravinda	AB 6 (F)	M 2 (M)
Habit	Erect and tall, stem green before flowering and reddish purple at maturity. Stem less hairy	Bushy, short to medium internodes, Stem pinkish green and moderately hairy.	Medium tall, stem pinkish green and sparsely hairy
Foliage	Leaf lobbing narrow, green, deeply cut.	Leaves medium broad, pale green, slightly hairy.	Leaves medium broad, light green, slightly hairy.
Flower	Corolla are white with prominent deep red spot, pollen and anther colour yellow	Petal and anther colour cream and pollen yellow, petal spot absent	Petal cream to whitish and pollen colour cream to buff, petal spot absent
Bolls	Bolls oblong, pitted, 3-4 locules, glanded, boll tip pointed, boll weight 2.5 g	Oval to oblong, medium, slightly pitted, 3-5 locules, boll surface smooth	Medium sized, smooth surface, round to oval, 3-5 locules, boll surface smooth and glanded

TNAU, Coimbatore

TCHB 213 (HY)

Character	TCH 1218 (Female)	TCB 209 (Male)
Stem	Sympodial type	Normal sympodial type
Leaves	Green, light hairy, 5 lobed	Green, glabrous, 5 lobed

	(mostly)	
Corolla	Cream	Yellow
Anther	Buff	Deep yellow

PAU, Abohar

Hybrid	LHH144	PIL43 (female)	PIL8 (male)
	Dark green semi okra leaves with deep lobes, big oval shape bolls and large seed size.	Dark green deeply lobed narrow okra leaves, big bolls and large seed size	Short compact plant, medium size green normal leaves, elliptic shape bolls
Variety	LH1556 Medium light green normal leaves, cream flowers and anthers, round bolls		
Variety	LD-694 Red pigmented plants, deeply lobbed narrow okra leaves, round pigmented bolls, pink flowers and presence of red spot at the base of petals		

MAU, Nanded

	NHH-44 (Hyb)	BN-1 (Female)	AC-738 (Male)
	Yellow petal and yellow anther	Creamy petal and yellow anther	Yellow petal and cream anther
Variety	NH-452	Pale yellow petal and pale yellow anther	
	PA-255	Yellow petal with petal spot, deeply serrated leaves with 2-3 lobes	

CCSHAU, Sirsa

	AAH-1 (Hybrid)	DS5 (Female)	HD266 (Male)
	Red plant body, creamy flower with petal spot	White flower with dark red petal spot, green plant body, yellow anther	Red plant body, creamy flower and absence of petal spot.
Variety	HS-6	2-3 upright monopods, light green leaves, bigger and round bolls.	
Variety	HD-123	Green plant and leaves, narrow leaf with deep cuts, intermediate lobes, hairy surface and small flower.	

UAS, Dharwad

Character	DHH 11 (Hy)	CPD 423 Female	CPD 420 Male
leaf colour	Parrot green	Light green	Dark green
Leaf size	Medium	Medium	Medium
Leaf lamina	Cup shaped	Flat	Cup shaped
Petal colour	Yellow	Cream	Yellow
Anther colour	Yellow	Cream	Yellow
Boll shape and size	Round big,	Oval, pointed, medium	Round big

CICR, Coimbatore

Character	Sumangla	LRA-5166
Density of foliage	Dense	Medium
Leaf nectaries	Present	Present
Petal colour	Cream	Cream
Petal spot	Absent	Absent
Anther colour	Yellow	Yellow
Boll size	Medium, oval & smooth	Medium, oval & Pitted smooth

RAU, Sriganaganagar

Character	RG 8	RG 18
Growth habit	Spreading	Semi compact
Pubescence on stem	Sparsely hairy	Sparsely hairy
Nectary	Present	Present
Petal colour	Creamy	White with pinkish margin
Petal spot	Large	Large
Anther colour	Buff	Creamy
Boll shape	Oblong with pitted surface	Oval

CICR, Sirsa

Hybrid Om Shankar	Female SH 2379	Male K 34007
Semi-compact, sympodial type with fluffy opening. Flowers with creamy petals and produce bolls with semi-naked seed	Plant medium sized light green with 3-5 lobed leaf, naked seed, 4 -5 monopodia, corolla cream	Plant with moderately hairy and medium green leaf, cream anther, white fuzzy seed and sympodial plant type

Hybrid CSHH 198	CSH 19(F)	CSH-8 (M)
Green broad & hairy leaves with cream petal, cream pollen and oval shaped big bolls, boll weight with blunt tip. Maturity period 162 days	4-6 monopodia big green broad leaves with hairy surface cream petal, cream pollen boll oval shaped with tip, boll weight 4.1 gm, seed index 10.5 to 11.0 gm , maturity period 172-180 days	Sympodial compact type with 0-1 monopodia, small green leaves with hairy surface, petal cream ,pollen cream, boll oval shaped with blunt tip, boll weight 3.6 gm , seed index 9.5-10 gm, maturity period 140-150days

❖ **Genetic marker using molecular technique**

During seed multiplication and distribution several factors such as cross pollination, mechanical admixture, incorrect labeling etc. can alter the genetic integrity of the original breeder seed. Testing of hybrids and their parents on the basis of morphological distinct characters are time consuming as one has to wait 60 to 70 days i.e., till the flower appears. Therefore keeping these problems in view, few preliminary studies were carried out to develop a rapid, simple and inexpensive method to identify the hybrids and their parents.

ANGRAU, Lam Guntur

Particulars	Female	Male	Hybrid
Pedigree (Genotype)	L 235	L 555	L 235 x L 555
Molecular marker applied	RAPD	RAPD	RAPD
No. of Primers tried (RAPD)	20	20	20
Number of Polymorphic primers identified	One	One	One
No. of primers strong enough to provide repeatable results to differentiate female and hybrid	One	One	One
Material used for analysis (seed/leaf)	Seed	Seed	Seed
Suggestions	The extra loci on male can be better utilized for assessing the genetic purity of the hybrid NSPHH 7.		

TNAU, Coimbatore

Hybrid confirmation through RAPD analysis

A molecular marker study was carried out for the development of molecular marker based seed identification of cotton hybrids. Three hybrids viz., TCHB 213 from TNAU, Coimbatore, one hybrid from Lam, Guntur and G. cot.Hy.10 from GAU, Gujarat were screened along with their parents. Of the 35 random primers screened so far for polymorphism male specific markers were obtained for the hybrid TCHB 213 through primers OPF 02, OPF 03 and OPF 09 and the primer OPF 03 showed for the hybrid G.cot Hy. 10. Study is in progress to get more polymorphic markers for these hybrids.

Genetic divergence using Mahalanobis D² analysis : The genetic divergence in the 150 genotypes was estimated by subjecting them to distance analysis, using Mahalanobis D² statistics. Based on D² values the 67 robust genotypes were grouped into thirteen clusters. Among the thirteen, cluster I had fifty-four genotypes and was the largest. Cluster XIII had two genotypes and all other clusters had only one genotype each. In a similar way the 66 semi compact genotypes were grouped into twenty clusters. Cluster I comprised the maximum number of 14 genotypes followed by cluster II (13), cluster III (11), cluster VII (4), cluster IX and 12 (3), cluster XIII, 15 and 20 (2). All the clusters had only one genotype. For grouping the 17 compact genotypes, a special procedure involving stepwise elimination of characters in the order of least importance was followed as the number of characters chosen was very high as compared to the number of genotypes. Finally, successful grouping could be done using 12 characters. The 17 compact genotypes were grouped into five clusters. Cluster I included the maximum number of genotypes (9) followed by cluster II (5). The clusters III, IV and V had only one genotype.

CCSHAU, Sirsa

RAPD markers that were found to be polymorphic between the parents of hybrid AAH-1, which are also useful for seed purity determination, have been listed below :

Hybrid	RAPD
AAH-1	OPA-07, OPA-10, OPC-19

UAS, Dharwad

i) For hybrid DHH-11

Out of 120 primers, 12 primers viz, OPA-02, OPA-11, OPC-7, OPC-11, OPC-17, OPY-04, OPY-15, OPY-18, OPZ-05 and OPZ-10 showed polymorphism between the female and male parents of DHH-11. An extra amplified product in male parent of intra hirsutum hybrid DHH-11 for the primers viz., OPC-17, OPY-15, OPY-18 and OPZ-05 is confirmed. Among these OPC-17 produced additional 700bp locus (RAPD band) in both male and hybrid. OPC-17 was tested repeatedly to confirm the stable amplicon of the locus. This will be used to find out parallelism between field GOT and RAPD analysis.

ii) For varieties:

Eighty Operon Primers viz., OPZ 1-20, OPP1-20, OPC1-20 and OPA1-20 are tested for polymorphism in the varieties viz., Sahana, DLSa-17 and Jayadhar. Among these OPZ primers kit showed stable and highly polymorphic banding patterns. The amplicon present at 750bp for OPZ-1 and OPZ-18 in DLSa-17, is absent in Jayadhar and Sahana. Polymorphic band at 500bp for OPZ-4, OPZ-7 is observed in Jayadhar but absent in DLSa-17. Similarly for OPZ-6, OPZ-8 and OPZ-20 at 1000bp. Thus these primers could be used in identifying the genotypes and helps in developing genotype specific fingerprinting data.

CICR, Coimbatore

The method described by Krishna and Jawali (1997) was followed to isolate the DNA from single seed of hybrid Savita and its parents T7 (female) and M12 (male). The isolated DNA was verified for size intactness, homogeneity and purity by electrophoretic method .

❖ Molecular characterization of released cotton varieties and hybrids

CICR, Nagpur

Total number of samples received – **49 (Varieties – 10)**

Samples evaluated – **33**

Molecular markers applied : **RAPD and ISSR**

No. of primers tried : **RAPD – 40, ISSR – 16**

No. of primers worked : **RAPD – 37, ISSR – 15**

Cost of analysis per sample (after standardization): Rs. 500/- (approx)

40 RAPD primers were used for the identification of the F1 hybrids and their parents of NSPHH 7, G.Cot.Hy-8, NHH-44 and AAH-1.

For NSPHH 7 : Out of 40 primers used only OPA 18, OPA 19, OPB 2, OPB 3, OPB 4, OPB 7, OPB 11, OPB 12 and OPB 18 were found to be polymorphic. 300 bp band of OPA 18, 300 bp and 1000bp band of OPB 2, 200 bp band of OPB 4, 1000 bp and 1500 bp band of OPB 11, 1100 bp band of OPB 12, 600 bp, 1100bp and 1000 bp band of OPB18 are found to be specific for hybrid and female but absent in male parent. 200 bp, 1000 bp, 1600 bp band of OPB 7 is only present in Male and Hybrid but absent in Female parent. **OPA 19** was found to be the perfect marker of **NSPHH 7** in which 1100 bp band present in Hybrid and Male but absent in Female. 600 bp band of same primer present in Female and Hybrid but absent in Male (Fig.1.5.3). Similarly, **OPB 3** is also the found to the perfect marker, where 500 bp band is only present in Male and Hybrid, while 300 bp band present in Female and Hybrid using the same primer.

For G.Cot.Hy-8 : 1500 bp band of OPA 11, 1200 bp band of OPA 13 is specific for hybrid and female but absent in male parent. Similarly, 500 bp band and 1100 bp band of OPA 17, 400 bp and 500 bp band of OPB 1, 800 bp band and 1100 bp band of OPB 11, 450 bp band and 800 bp band of OPB 16, 400 bp band and 1100 bp band of OPB 19 is specific for hybrid and male but absent in female parent.

For NHH-44: 1700 bp band of OPA 9, 1200 bp band of OPA 15, 1100 bp band of OPA 16, 1000 bp and 1100 bp band of OPA 17, 500 bp band of OPA 19, 1600 bp band of OPB 7, 450 bp and 1900 bp band of OPB 16, 600 bp band of OPB 17, are only present in BN-1 and Hybrid NHH 44 but absent in AC 738 . Similarly, 400 bp band of OPB 12 is only present in AC 738 and Hybrid NHH 44 but absent in BN-1 . **OPB 1** was found to be the perfect marker of **NHH-44** in which 400 bp band present in Hybrid and AC 738 but absent in BN-1. 1300 bp band of same primer is present in BN-1 and Hybrid but absent in AC 738.

For AAH-1: 500 bp band of OPA 8, 1200 bp band of OPA 9, 1000 bp band of OPA 10, 1500 bp band of OPA 11, 2000 bp band of OPA 13, 400 bp band of OPA 16, 800 bp band and 3000 bp band of OPB 1, 1500 bp band of OPB 3, 350 bp band and 1700 bp band of OPB 7, 550 bp band and 900 bp band of OPB 11 are only present in Male and Hybrid, but absent in Female parent.

The RAPD polymorphic primer OPA 19 and OPB 3 led to the conformation of hybridity of **NSPHH 7** while OPB 1 for **NHH-44** and hence can be used as a discriminating marker for testing. The ISSR primer IS 7 led to the conformation of hybridity of **G.Cot.Hy-8** while IS 4 for **NHH-44** (Fig.1.5.4) and hence can be used as a discriminating marker for testing.

Thus, the perfect discriminating markers were detected for the three seeds i.e. **NSPHH 7, NHH-44** and **G.Cot.Hy-8**.

NRCDF, New Delhi

During the year under report 12 cotton hybrids were included in the study. Bulk DNA sample of at least 20 individuals of these hybrid and their respective parents was extracted following CTAB method. The extracted DNA was further purified and quantified. Dilutions were prepared for further molecular work.

Screening of RAPD primers for useful polymorphisms for seed purity determination was carried out. A total of 35 RAPD primers were screened. Figure 1.5.5 depicts a representative RAPD profile of these 12 hybrids and their respective parents (total 36 samples) using primer OPC-16. The list of RAPD markers found useful is provided in the Table. Screening and testing of STMS markers is under way.

Seed purity determination : DNA from individual plants of the hybrids was extracted, purified and quantified. More than 90% genetic purity was observed in all the hybrids except for 'Omshankar' where in 82.5 % genetic purity was observed. Five hybrids exhibited 100 % genetic purity at the investigated loci. Figure-1.5.6 shows representative RAPD pattern at the polymorphic locus for the hybrid 'Omshankar' and its parents.

Informative polymorphic markers between the parents of cotton hybrids

Hybrid	Male parent specific markers
Savita	OPA-8 ₈₅₀ , OPB-02 ₅₁₀ , OPB-14 ₅₀ , OPC-10 ₁₅₅₀ , OPC-15 ₁₈₀₀ , OPX-06 ₃₅₀₀ , OPX-06 ₈₆₀ , OPX-20 ₇₅₀
Surya	OPC-10 ₁₅₅₀ , OPX-06 ₃₅₀₀ , OPX-06 ₈₆₀ , OPX-20 ₇₅₀
G.Cot Hy.-8	OPB-20 ₂₀₀₀
LHH-144	Nil
NHH-144	OPB-14 ₄₅₀ , OPC-10 ₁₅₅₀
NSPHH-1	Nil
Sruthi	OPA-02 ₁₄₀₀ , OPA-12 ₅₅₀ , OPC-16 ₁₅₀₀ , OPC-20, OPX-05 ₁₀₀₀ , OPX-09 ₁₀₀₀ , OPX-17 ₈₀₀ , OPX-18 ₆₀₀ , OPA-08 ₂₉₀
DCH-32	OPA-02 ₁₄₀₀ , OPA-12 ₅₅₀ , OPC-16 ₁₅₀₀ , OPC-20, OPX-05 ₁₀₀₀ , OPX-09 ₁₀₀₀ , OPA-08 ₂₉₀ , OPX-20, OPX-16 ₆₀₀

- ❖ **Large scale multiplication of seeds of the varieties and parents of hybrids during Kharif 2004 based on the above study**

Breeder seed production

Parental line/variety	Total quantity of seed obtained (in quintals)	
	Breeder seed	Nucleus seed
	2004-05	2004-05
Female line	11.2 (11*)	0.1 (1*)
Male line	5.9 (9*)	0.1 (1*)
Varieties	348.9 (54*)	1.6 (8*)

* no. of lines

- ❖ **Evaluation of progenies for heterosis, sca, fibre quality characters and resistance/ tolerance to biotic stress**

Heterotic evaluation of crosses has been attempted using male and female of hybrids with suitable mating design. The poor combining progenies were discarded. Progeny No. 26 of HS-26 at CCSHAU, Sirsa has been isolated as best progeny for fibre quality parameters. G Cot10 appeared resistant to sucking pests, bacterial blight and *Alternaria* leaf spot at Surat. Progenies of JK-4 at Khandawa have been found to be tolerant to boll worm and progenies of JKHy-1 resistant to black arm and escaping from bollworm at Indore. The progenies of MCU-12 are tolerant to Jassids at TNAU, Coimbatore. The progenies of HS-6 and H-1117 has been found to be resistant to CLCuV disease at CCSHAU, Sirsa . Similarly, at Abohar, some progenies of LH-1556, PIL-43, PIL-8 and LD-694 resistant against CLCuV were isolated. Progeny No. 8 of L-604, No. 7 of Narsimha, No.5 of Arvindha and No.4 of MCU-5 were appeared tolerant to sucking pests at Guntur. Similarly some progenies of RHC 003, RHC 004, RHC 006 and RHCB 001 were observed tolerant to sucking pests at Rahuri.

- ❖ **Evaluation of progenies for fibre traits, biotic stress**

Varieties/ Hybrid	Progenies with fibre quality		Promising progenies for biotic stress with pests
	Good	Poor	
NAU, Surat			
G.Cot Hy-8	Male: Progeny 1	Male :2,3 - poor in strength. 3 - poor in length & 5- poor in length & strength	G.Cot 10 : All the progenies were resistant to sucking pests, bacterial blight and alternaria leaf spot

Varieties/ Hybrid	Progenies with fibre quality		Promising progenies for biotic stress with pests
	Good	Poor	
NAU, Surat			
G.Cot Hy-10	Female : Progeny 2 Male : Prog. 2,4,5 6,9,and 10	Female : Prog. 1,3 poor in strength Male :Prog. 1,3,,7,and 8 poor in srength	Nil
G.Cot MDH-11	female :medium Male: All	Female : Medium in quality Male: Poor in strength	All the progenies were found disease free against BLB
JNKVV, Khandawa			
J.Tapti	Result awaited		Resistance against sucking pest
JK 4	Result awaited		Tolerant to bollworm
Reba B 50	Result awaited		Escaping from bollworm
KH 11	Results awaited		--
Khandwa 2	Results awaited		Resistance against sucking pests
JNKVV, Indore			
JKH1	Result awaited		Resistance against black arm & sucking pest
JKH2	Result awaited		Escaping from bollworm
Vikram	Result awaited		Escaping from bollworm & synchronous busting
MPKV, Rahuri			
RHC-003	Result awaited		Twelve progenies appeared tolerant to sucking pests viz., RHC-003-17-2,57-2, 92,97,320-2, 320-7,329-4,329- 6,331,337, 356 and 359
RHC-004	Result awaited		Thirteen progenies appeared tolerant to sucking pests viz., RHC-004- 12,17,55,111, 151,363,367,375,376,377,378,380 and 381
RHC-006	Result awaited		Fourteen progenies were observed tolerant to sucking pests viz., No. 2,87,10,12,15,16,17,18, 22, 386,389,393,396 and 398
RHCb-001	Result awaited		Sixteen progenies appeared tolerant to sucking pest viz., No.5,11,17,17A,22,27,30,31,411,412,4 13,416,417,419,421 and 424

Varieties/ Hybrid	Progenies with fibre quality		Promising progenies for biotic stress with pests
	Good	Poor	
PDKV, Akola			
AK-32	14	27	23
DHY-286-1	15	17	39
PKV Rajat	7	43	60
AKA-5	23	55	129
AKA-7	9	33	64
ANGRAU, Lam Guntur			
L 604	8	9	8 – Jassids, white fly
NA 1325 (Narasimha)	11	11	7 – Jassids, White fly, Aphids
Aravinda	7	8	5 – Jassids, Aphids
MCU 5	7	8	4 – Jassids, white fly, thrips
TNAU, Coimbatore			
MCU 12	100	403	MCU 12 – 435 MCU 12 -- 491 MCU 12 – 612 showed resistance to jassids
MCU 13	37	388	---
MCU 5	50	120	---
MCU 7	25	100	---
PAU, Abohar			
LH 1556 PIL43 PIL8 LD 694	1, 2, 3, 5, 7, 10, 11,15 16 1, 5, 7, 9, 11, 14 2, 5, 6, 10, 11, 13, 14, 15, 16	6, 4, 12, 14 6, 8, 9, 12 2, 3, 4, 8, 10 3, 4, 7, 8, 12	3, 4, 5, 7, 10, 13 1, 2, 4, 7, 9, 10 2, 4, 6, 7, 8, 10, 13, 14, 15 1, 5, 8, 9, 12, 15 Promising progenies for biotic (CLCuV) and seed cotton yield
MAU, Nanded			
NH-545	3,5	--	Resistant to sucking pests (Jassid, white fly)
PA-255	4,8	--	Tolerant to boll worm (8), Escaping from boll worm(4)
BN-1	2,6	--	Resistant against white fly, Jassid(2), Resistant to Aphids, mites(6)
AC-738	1	--	Tolerant to boll worm
CCSHAU, Sirsa			
HS-6	26, 11,22, 20, 19	2, 9, 17	Progeny 26 is the over all the best for fibre quality parameters
UAS, Dharwad			
CPD-423	19	11	--
CPD-420	5	13	--
Sahana	16	14	--
DDhC-11	4	12	--

❖ **Pre and post harvest management technique for the improvement of seed health**

- Foliar applications of DAP 2% alone or in combination with either B or Zn or both appeared promising but the results are not consistent at all locations. Hence the trial with same treatments were repeated during Kharif 2004 also. However the treatment DAP + B + Zn was observed promising for seed cotton yield as well as well mature seed at some of the locations.
- No significant differences among normal irrigation and one additional irrigation after first picking was observed.

Thus, the project provided an opportunity to access the stability of present distinguishing characters and identification of some new easy distinguishable characters including molecular marker characters for easy and rapid GOT. Also better progenies for yield and other economic characters, resistant to biotic stress with desirable fibre quality were isolated for further use.