



**Title: Development and Promotion of medium and long linted diploid cottons**  
(*G.arboreum* and *G.herbaceum*)

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**INTRODUCTION**

Development of productive tetraploid cotton as well as Bt cotton lead to the significant decline in desi cotton cultivated area. Being drought tolerant and pest resistant it is essential to promote cultivation of desi varieties. To achieve this we need to evolve desi cotton varieties with superior fibre quality and yield. This will be eventually helpful for marginal and poor farmers. Few desi lines with medium long lint were already developed during xth plan TMC MM1 programme which need to be evaluated for further promotion.

**OBJECTIVES**

1. Development of medium and long linted diploid *G.arboreum* and *G.herbaceum* cottons.
2. Breeding desi cotton genotypes with low gossypol, naked seeded and high oil content.
3. Promotion of medium and long linted staple *G.arboreum* / *G.herbaceum* genotypes.

**ACTIVITIES**

- Evaluation of newly developed medium to long linted genotypes of *G.arboreum*.

- Evaluation of medium to long linted genotypes of *G. herbaceum*.
- Evaluation and identification of high yielding superior medium genotypes from early generation.
- Evaluation and demonstration of newly identified, medium to long linted, early maturing *G. arboreum* and *G. herbaceum* genotypes on farmers' field for promotion

**EXECUTIVE SUMMARY**

More than 124 newly developed strains were tested for their yield potential and fibre traits in comparison to *hirsutum* and *arboreum* checks over fourteen centres. Among *G. arboreum* strains tested over North, Central and South zones, the strains, JLA 2300, RG 459, KWA 227, PAIG 8/3 and PAIG 8/1 were found promising with good seed cotton yield combined with better ginning out turn and good fibre quality (2.5% span length above 26mm and strength around 20 g/tex). The strain RAC 024, Dela 25 and PA 531, superior in quality (30mm staple length, 22g/tex strength and micronaire 4.0) has performed better consistently over the locations. More than 30 selections from interspecific and wide crosses including different races have been done for quality and seed cotton yield at various



centers among which, PAIG 39 and PAIG 62 look promising. Twelve medium to long linted *G. herbaceum* genotypes have been evaluated among which GBhv 229 gave significantly higher seed cotton yield than the common check G.Cot.23 at Bharuch as well as Banswara. The halo length ranged from 22.6 mm (RBOV 24 at Bharuch) to 32 mm (RBOV 21 at Banswara). The strength ranged from 17.1 g/tex (GBhv 255 at Bharuch) to 22.8 g/tex (RBOV 24 at Oharwad). The variety PA 405 gave higher seed cotton yield (1394 kg/ha) than hirsutum check PH 348 (1126 kg/ha), and arboreum checks, PA 255 (1148 kg/ha) and PA402 (1212 kg/ha) at farmers field. Fourteen strains, viz. OLSA 1004, OLSA 1005, RG 441, CINA 348, PA 528, RG 526, CISA 294, HO 459, LO 937, CINA 1003, CISA 10405, RG 514, PAIG 247, CINA 347 from various centres were sponsored during 2007-08 out of which, ten strains viz. were promoted to respective zonal trials **CISA 284, CISA 405, RG 526, RG 441, HO 459, CINA 347, PA 528, OLSA 1004, OLSA 1005 and CINA 1003**. Technology for MM II: PA 405, MOL 2617, OLSA 17, CISA 310.

#### SALIENT FINDINGS:

#### **Evaluation of newly developed medium to long linted genotypes of *G. arboreum*:**

The objective of this activity is to evaluate the performance of quality *arboreum* derived from breeding materials and germ plasm in comparison with *hirsutum* and released quality *arboreum* varieties in multi-location trials. Accordingly, 26 genotypes sponsored by different centres were evaluated along with common *arboreum* check, PA 255, local *arboreum* check as well as *hirsutum* checks of respective centres at 14 locations.

#### NORTH ZONE

At Ludhiana, none of the genotypes could out yield the *hirsutum* check F 1861 (1827 kg/ha) and local *arboreum* check LO 694 (1604 kg/ha). However, they out yielded the common check PA 255 (556 kg/ha). Five genotypes namely PAIG 8/1, PA 08, JLA 1600, RAC 024 and PA 255 possessed fibre length of above 28mm, maximum being recorded by PAIG 8/1 (29.7 mm). Fifteen genotypes possessed fibre strength values exceeding 20 g/tex. Among the North zone entries, LO 909 and HO 463 possessed 2.5% span length of at least 25 mm and strength around 19 g/tex with relatively higher yields.

At Sirsa, none of the genotypes out yielded the *hirsutum* check, RS 2013 (2255.8 kg/ha) and local *arboreum* check, HO 123 (2514.9 kg/ha). The highest mean halo length was recorded by RAC 024 and GBAV 108 (26.2 mm each). Highest strength was recorded by AKA 0101 (21.1 g/tex) followed by KWA 228 (20.7 g/tex). Maximum GOT was

recorded by MOL 2643 (38.5%).

At Hisar, due to less plant stand the yield data was not recorded. The genotypes namely Oela 3, RAC 024, AKA 0101 and PA 531 had very good fibre quality parameters (2.5% span length: more than 20 mm; fibre strength: more than 22.5 g/tex; micronaire value below 5).

At Sriganaganagar, none of the genotypes could out yield the *hirsutum* check. Only one genotype RG 459 (1914 kg/ha) could give significantly higher yield than local *arboreum* check RG 18 (1708 kg/ha). The 2.5% span length was maximum for MOL 2443 (26.3 mm).

#### CENTRAL ZONE

At Parbhani, genotype PA 08 recorded the highest seed cotton yield (1800 kg/ha). The strain KWA 25 recorded highest ginning out turn (43.76%) followed by RG 459 (41.94%) and AKA 8 (40.67%). Strain PA 405 recorded highest staple length (28.70 mm) followed by Oela 6 (28.30 mm) and PAIG 8/1 (27.25 mm). In general, performance of the strains PA 08 and PA 405 was excellent for seed cotton yield (above 17 qtls/ha) with better combination of ginning out turn (around 38%) and staple length (above 26 mm).

At Khandwa, the genotypes LO 929 (1135.2 kg/ha) and AKA 8 (1018.5 kg/ha) significantly out yielded all the checks viz., PA 255 (500 kg/ha), J. Tapti (Local Check) (679.6 kg/ha) and JK-4 (Local *hirsutum* check) (638.9 kg/ha). The entry KWA 25 recorded maximum ginning percentage (38.50%). Maximum halo length of 27.0 mm was recorded by PAIG 8/1 closely followed by GBAV 106 (26.0 mm) and KWA 25 (25.67 mm).

At Nagpur, three genotypes KWA 227 (828 kg/ha), RG 459 (740 kg/ha) and LO 909 (1474 kg/ha) were significantly superior over common check, PA 255 (478 kg/ha) and had a ginning outturn in the range of 30.8% (CINA 343) to 36.5% (RG 459). Two genotypes KWA, 227 and LO 909 were significantly superior over *hirsutum* check, LRK 516 (510 kg/ha).

At Akola and Jalgaon, none of the genotypes could surpass the *hirsutum* checks AKH 8828 (1715 kg/ha) and LRA 5166 (1645 kg/ha).

At Jalgaon, the highest halo length was recorded by Oela 25 (28.93 mm) followed by Oela 6 (28.73mm).

At Banswara, none of the genotypes could out yield the *hirsutum* check LRA 5166 (504.6 kg/ha). However, the genotypes PAIG 29 (369.3 kg/ha), GBAV 109 (362.9 kg/ha) and TKA 8801/6 (359.3 kg/ha) gave higher yield than *arboreum* checks, PA 255 (277.8 kg/ha), RG 8 (178.2 kg/ha) and RG 18 (199.5 kg/ha). The halo length was observed 29mm in culture OELA 25.



At Bharuch, the genotypes GBAV 110 (1650 kg/ha), GBAV 109 (1376 kg/ha), RG 459 and GBav 106 (1272 kg/ha) out yielded all the checks, PA255 (1109 kg/ha), G. Got-19 (929 kg/ha) and G. Got-16 (1044 kg/ha).

Amongst higher yielding strains having good combination of yield and strength, the strain MOL 2643 (34.5%) had higher ginning out turn followed by OELA 25 and PAIG 29 (both 33.0%). The strains OELA 25 (28.6 mm) and OELA 6 recorded longest staple length (28.5 mm) followed by PAIG 8/3 (27.1 mm).

In general, performance of OELA 25 (623 kg/ha), MOL 2463 (646 kg/ha) and PAIG 29 (679 kg/ha) were promising for seed cotton yield and fibre properties

#### SOUTH ZONE

At Mudhol, the genotype MOL 2617 gave the highest yield (1056 kg/ha) followed by PAIG 8/1 (1055 kg/ha) which were significantly superior to all the three checks i.e. PA 255, common check (954 kg/ha), Narasimha, the hirsutum check (857 kg/ha) and Veena, the local arboreum check (771 kg/ha). PAIG 8/1 had good fibre properties i.e. 2.5% span length of 26.8mm, micronaire of 4.58 and fibre strength of 22.1 g/tex.

At Oharwad, none of the tested *G. arboreum* genotypes were on par with hirsutum check, Sahana (3332 kg/ha), while two genotypes JLA 2300 (2538 kg/ha) and PAIG-8/3 (2435 kg/ha) had numerically superior yield to both the *arboreum* checks i.e. PA 255 (2414 kg/ha) and OLSA 17 (2333 kg/ha).

**Table 1: Five top ranking strains for seed cotton yield (Kg/ha) at various locations**

Locations	I	II	III	IV	V
Parbhani	PA 08	PA 405	JLA 1600	JLA 2300	KWA 227
	1800	1720	1700	1647	1547
Nagpur	LO 909	KWA 227	RG 459	PAIG 29	LO 955
	1269	828	740	679	653
Akola	AKA 8	JLA 2300	RAG 024	RG 459	Oela 25
	1483	1358	1327	1194	1111
Mudhol	MOL 2617	PAIG 8/1	PAIG 29	AH 1	RG459
	1056	1055	937	927	912
Oharwad	JLA 2300	PAIG 8/3	PAIG 8/1	Oela 6	MOL 2643
	2538	2435	2414	2340	2281
Kovilpatti	Oela 25	Oela 6	TKA 8801/6	PAIG 8/3	PA 255
	1353	1248	963	948	893
Bharuch	GBAV110	GBAV109	RG 459	GBAV 106	LO 909
	1650	1376	1327	1272	1207
Banswara	LO 909	PAIG 29	GBAV 109	TKA 8801/6	PAIG 8/3
	396	369	363	359	338
Khandwa	LO 929	AKA 8	Oela 25	JLA 1600	HO 463
	1135	1019	972	907	954
Sirsa	RG 277	HO 123	GBAV109	RAG 024	RG 2013
	2530	2515	2423	2362	2256
Sriganganagar	RS 2013	RG 459	RS 284	HO 264	RG 18
	2016	1914	1790	1757	1708
Jalgaon	Oela 25	Oela 6	JLA 2300	JLA 1600	PA 08
	1777	1745	1723	1708	1634
Ludhiana	LO 929	HO 464	LO 955	HO 463	LO 909
	1460	1391	1313	1258	1251
<b>MEAN*</b>	<b>JLA 2300</b>	<b>RG 459</b>	<b>KWA 227</b>	<b>PAIG 8/3</b>	<b>PAIG 8/1</b>
	<b>1134</b>	<b>1002</b>	<b>929</b>	<b>914</b>	<b>903</b>

\*Only those strains which were tested on minimum nine locations covering Central, South and North Zones were considered for mean ranking.



RG 459 had GOT percent, 41.41 % and *hirsutum* check had 41.14 %. Dela 25 was very good in fibre quality with 28.1 mm span length and 23.6 g/tex strength.

At Kovilpatti, the genotypes Dela 6 and Dela 25 recorded highest 2.5% span length of 29.4 and 28.8 mm respectively which is under the category of long staple, with a seed cotton yield of 1353 Kg/ha and 1248 kg/ha respectively. Among *G.arboreum* genotypes, Dela 25 and Dela 6 recorded average micronaire value of 5.2. Highest bundle strength was recorded by GBAV 109 (22.7 g/t) followed by Dela 5 (22.4 g/t). The genotype Dela 6 recorded bundle strength of 20.3 g/tex.

Five top ranking strains at various locations have been indicated in Table: 1

### **Evaluation of medium to long linted genotypes of *G.herbaceum***

At Dharwad, twelve *herbaceum* genotypes were tested with *hirsutum*, *arboreum* and *herbaceum* checks. One genotype Dela-24 (320 kg/ha) was numerically superior over the *herbaceum* check DDhc-11 (246 kg/ha) for seed cotton yield. None of the genotypes could out yield the *arboreum* check, DLSA 17 (1089 kg/ha) and *hirsutum* check, Sahana (2020 kg/ha) The genotype RBDV-24 had good fibre properties with span length of 25.3 mm and fibre strength of 22.8 g/tex.

At Banswara, the highest seed cotton yield was recorded by RBDV 23 (619.3 kg/ha) closely followed by GBhv-229 (592.6 kg/ha) and RBDV 17 (530.1 kg/ha) and were out yielding over *G. herbaceum* checks, Pratap Kapi-1 (335.4 kg/ha), G.Cot-17 (253.2 kg/ha) Only RBDV 23 was found significantly superior to *hirsutum* check LRA 5166 (509.3 kg/ha) The maximum halo length was observed in RBDV 21 (31.67 mm).

At Bharuch, genotypes GBhv 255 gave the highest seed cotton yield (1698 kg/ha) followed by GBhv 274 (1555 kg/ha) and GBhv 229 (1365 kg/ha) These genotypes also maintained their superiority for lint yield. The staple length ranged from short (22.7 mm) to medium (26.2 mm), micronaire from very coarse (5.3) to average (4.2) and bundle strength from 17.1 to 21.5 g/tex.

### **Evaluation and identification of high yielding superior medium genotypes from early generation**

#### ***G.arboreum***

##### **NORTH ZONE**

At Ludhiana, about fifty fresh F1 crosses between locally adapted genotypes and lines with superior fibre quality have been developed.

At Hisar, sixty single plants /progenies having halo length more than 23 mm were selected from the above material.. Twenty five lines with superior fibre quality and good seed cotton yield were bulked which will be tested in advance trial.

At Sirsa, the promising culture namely CISA-6-350 (2133.8 kg/ha) was also found having superior fibre quality (span length 27.5 mm & strength 22.0 g/tex).

At Sriganganagar, out of 14 strains evaluated, seven strains (RG514, RG 508, RG511, RG518, RG524, RG 520 & RG 509) were found superior in staple length (more than 25 mm).

At Banswara, 91 single plants from F5 & 16 from F3 segregants were evaluated and superior segregants were isolated.

At Mudhol, 158 single plants were selected from BC1 F3 & BC2 F3 populations

##### **SOUTH ZONE**

At Kovilpatti, a total of 316 single plants were selected in different generation for further study and 55 new crosses were attempted.

At Dharwad, fifty four stable lines advanced from the segregating generations of *arboreum* crosses were evaluated, among which, 12 lines had good yield of more than 1000 kg/ha, 3 lines with high GOT (40.0%) and 19 lines with halo length more than 28 mm ..

##### **CENTRAL ZONE**

At Khandwa, nineteen cultures of *G.arboreum* were evaluated. Highest SCY was recorded by entry KWA-140 (1111.11 kg/ha) followed by entry KWA-140 (1027.78 kg/ha), Kwa-7 (1000 kg/ha), and KWA-24 (887.04 kg/ha) Maximum halo length was recorded by KWA-225 closely followed by KWA-227 (28.60 mm), and KWA-7 (27.00 mm).

At Nagpur, two hundred and nineteen progenies (F2 to F7) in early generation were grown and 2715 selections were made during 2007-2008. Ten single plants in F6 generation were having staple length 28mm and 19 single plants in F3 generation were with staple length in the range of 28.0 - 30.4 mm.

At Akola, twenty-five single plant selections were made in F2 and F4 generations based on halo length > 25.0mm from line.

At Jalgaon, three fresh crosses JLA-794 JLA-1600, JLA-794 PA-402 and Turab JLA-1202 were attempted for improving yield & fibre properties.

#### ***G.herbaceum***

At Bharuch, 24 F1 were evaluated with their ten high yielding and qualitative parents and two checks G.Cot.DH-7 &



G.Cot.DH-9. Among the hybrids, none of the hybrids significantly surpassed the high yielding check G.Cot.DH-7 (1234 kg/ha) while six hybrids were significantly superior to another check G.Cot.DH-9 (1011 kg/ha). 36 F<sub>2</sub> were evaluated 106 single plants were selected based on yield, plant type, earliness, boll weight and fibre quality. 76 F<sub>3</sub> and 16 F<sub>4</sub> were evaluated & 75 single plants were selected.

At Dharwad, thirty genotypes in advanced generations of selection from back cross populations of inter specific and inter racial crosses were evaluated. Among the tested entries 14 had good yield potential of more than 1200 kg/ha. Six entries had halo length of more than 28 mm, which will be advanced based on the strength of the fibres.

At Banswara, 62 single plants were selected from F<sub>4</sub> generation.

## INTROGRESSION

At Nagpur, the strain PAIG 563/6 (1739 kg/ha) recorded significant superiority for seed cotton yield over common check, PA255 (1049 kg/ha), local arboreum check, AK-8 (774 kg/ha) and hirsutum check, LRK 516 (1403 kg/ha). Two other strains, viz. PAIG 562/6 (1194 kg/ha) and PAIG 899/6 (1244 kg/ha) recorded significant superiority for seed cotton yield over local check, AK-8 (774 kg/ha). A range of 22.0 (CINA 316) to 26.6 mm (PAIG565/6) was observed for halo length.

At Parbhani, PAIG 39 and PAIG 62 recorded significant superiority over quality *arboreum* check; PA-255 and local *arboreum* check, PA-402, respectively, where as, ten strains significantly out yielded *hirsutum* check, PH-348 (Table 2). The ginning outturn ranged from 32.50 (PAIG-36) to 39.67 percent (PAIG-62) amongst the strains under testing. A range of 26 mm

**Table 2: Testing of high quality arboreum developed through introgression at Parbhani**

SrNo	Entry	Yield kg/ ha	% increase over			G.O.T., (%)	S. L, (mm)
			PA-255 (a)	PA-402 (a)	PH-348 (h)		
1	PAIG-265	942	02.39	06.92	28.33	38.20	27.00
2	PAIG-298	773	-	-	05.31	35.85	26.20
3	PAIG-5	931	01.19	05.67	26.83	35.50	26.10
4	PAIG-12	1007	09.45	14.30	37.19	36.76	26.80
5	PAIG-33	942	02.39	06.92	28.33	35.26	27.20
6	PAIG-36	903	-	02.49	23.02	32.50	26.00
7	PAIG-37	942	02.39	06.92	28.33	32.63	27.40
8	PAIG-39	1489	61.84	69.01	102.86	36.24	27.80
9	PAIG-43	1016	10.43	15.32	38.41	37.44	28.00
10	PAIG-62	1280	39.13	45.28	74.38	39.67	27.80
11	PAIG-63	1011	09.89	14.75	37.73	37.09	27.00
12	PAIG-289	674	-	-	-	38.79	26.00
Checks							
13	PA-255(a)	920				36.02	27.40
14	PA-402(a)	881				36.52	26.10
15	PH-348(h)	734				40.12	27.60
	SE/ha +	53.14					
	CD/ha +	160.95					
	C.v; (%)	7.85					



(PAIG-289 to PAIG-36) to 28 mm (PAIG-43) was observed for staple length.

### Evaluation of high yielding better fibre quality, low gossypol and high oil content *G. arboreum* genotypes

At Parbhani, only one strain, PA-705 recorded significant superiority (1425 kg/ha) over check, PA-255. The strain PA-705 also had good ginning out turn (39.8%) and staple length (27.10 mm).

At Nagpur, none of the naked seeded strains were significantly superior for seed cotton yield over common check, PA 255 (540 kg/ha) and local check, AKA 8 (529 kg/ha).

### Evaluation of high yielding diploids for low gossypol and high oil content

The oil percentage in *herbaceum* genotypes ranged from 9.7 (GBhv 274) to 16.5% (MDL 2463)

### Evaluation and demonstration of newly identified, medium staple, long linted, early maturing *G. arboreum* and *G. herbaceum* genotypes on farmers' field

At Parbhani, the variety PA405 was demonstrated at farmers' field in five villages and gave higher average seed cotton yield (1394 kg/ha) than *hirsutum* check PH 348 (1126 kg/ha), *arboreum* check PA255 (1148 kg/ha) and PA402 (1212 kg/ha).

At Dharwad, a *G. arboreum* variety DLSA-17 bred for fiber quality was tested with *G. hirsutum* variety, Sahana on farmer's field in five locations. The variety DLSA-17 (9.34 q/ha.) could

not out yield Sahana (11.46 q/ha.).

At Bharuch, the *herbaceum* variety GBhv-226 was demonstrated at five locations which gave an average yield of 1443 kg/ha over the local check variety G.Got.-23 (1160 kg/ha) At Mudhol, the *arboreum* variety, Veena gave mean seed cotton yield of 10 q/ha and MDL 2617 gave 12 q/ha at farmers' field.

At Kovilpatti, the variety TKA 8801/6 (900 kg/ha) and KG 3 (890 kg/ha) gave average yield at par with variety PA 255 (890 kg/ha) at five locations.

At Akola, the *hirsutum* variety AKH-8828 (1475 kg/ha) recorded highest seed cotton yield followed by AKA-9602 (1263 kg/ha), PA-255 (1238 kg/ha) and AKA-8 (1188 kg/ha) over five locations.

At Nagpur, PA 255, PA 402, GINA 316 were promoted in Melghat region with the help of an NGO based in Angangaon Surji of Vidarbha.

### Genotypes sponsored in AICCIP Trial from TMC MM1.1 project

The genotypes improved /developed over the years using the genetic material generated / exchanged in TMG project are being sponsored in AICCIP trial. As many as 14 strains, viz. DLSA 1004, DLSA 1005, RG 441, GINA 348, PA 528, RG 526, GISA 294, HD 459, LD 937, GINA 1003, GISA 10405, RG 514, PAIG 247, GINA 347 from various centres were sponsored during 2007-08 and out of which ten strains were promoted to respective zonal trials viz. GISA 284, GISA 405, RG 526, RG 441, HD 459, GINA 347, PA 528, DLSA 1004, DLSA 1005 and GINA 1003 during 2008-09 season.



Staple length improvement in *arboreum*

