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Research Article

K 12 (TKA 9102/3) - A high yielding superior medium staple *Gossypium arboreum* cotton variety suited for rainfed vertisol tracts of Tamil Nadu

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Abstract

TKA 9102/3 is a high yielding superior medium staple *G.arboreum* cotton culture developed at Agricultural Research Station, Kovilpatti in the year 2017 for winter rainfed vertisol tracts of Tamil Nadu. It is also suitable for low rainfall zone (<250 mm rainfall during cropping season), marginal fertility areas of coastal belt and black cotton soil tracts of Tamil Nadu. TKA 9102/3 is a hybrid derivative of the cross between K 11 and K 9. It has recorded an average seed cotton yield of 193 kg/ha as against the existing variety K 11 (1066 kg/ha). The yield of TKA 9102/3 is 11.9 per cent higher than K 11. TKA 9102/3 recorded moderate boll weight (2.7 g) and superior medium staple fibre quality of 27.7 mm 2.5 % span length and bundle strength of 22.1 g/tex than check K 11 (24.0 mm and 21.4 g/tex). TKA 9102/3 is resistant to leaf hopper and moderately resistant to thrips. It is also tolerant to drought and has recorded the maximum yield potential of 2365 kg kapas per hectare under rainfed condition. Hence, the culture TKA 9102/3 was released as K 12 for the coastal rainfed and black cotton soil areas of Tamil Nadu during 2017 from Agricultural Research Station, Kovilpatti.

Keywords

K 12, Desi cotton, seed cotton yield, fibre quality, superior medium staple, bundle strength, rainfed.

INTRODUCTION

Cotton is one of the most important fibre and cash crop of India and plays a vital role in the industrial and agricultural economy of the country. It provides the basic raw material (cotton fibre) to cotton textile industry. Cotton in India provides direct livelihood to 6 million farmers and about 40 - 50 million people who are employed in cotton trade and its processing. In Tamil Nadu, cotton consumption is increasing day by day, beyond 100 lakh bales per annum while our production remains static, *i.e*. 5 lakh bales/ annum. The area of cotton has declined from 2.5 lakh ha (2004-05) to 1.47 lakh ha (2015-16). Even though many *Bt.* cotton hybrids were released, they could not meet the current cotton requirement of Tamil Nadu. It needs location specific varieties for different situations. In Tamil Nadu more than 65% of the cotton growing area is in rainfed condition of which an area of 50000 hectare in the southern part of coastal areas in Tuticorin and Ramanathapuram districts are suffered by salinity/ alkalinity problem and low rainfall zones of Tirunelveli, Virudhunagar, Madurai and Perambalur districts suffered with low rainfall of <250 mm during crop growth period (due to uncertainty of North East monsoon). The *Bt.* cotton cultivation was failed in these areas where it was originally cultivated with Desi cotton (*G. arboreum* - Karunganni). The Karunganni cotton area has reduced to a great extent and might be due to low price for the short to medium staple and non - availability of seeds. But the Desi cotton has great demand in India particularly in making fabrics like denim, bandage and upholstery and this requirement was fulfilled by importing 8-10 lakh bales

of lint from Pakistan and Bangladesh (Ravinder Raju *et al.* 2015). Hence, it is necessary to develop a superior quality Karunganni cotton to fulfill the requirements of rainfed vertisol tracts of Tamil Nadu.

MATERIALS AND METHODS

Introduction of high yielding long linted *G.arboreum* cotton cultures from various centres of India *viz.,* Parbhani and Dharwad did not yield desired result. Therefore concerted effort was taken at Agricultural Research Station, Kovilpatti to evolve a high yielding long linted *G.arboreum* cotton cultures through recombination breeding. Evaluation of breeding lines led to the identification of a culture TKA 9102/3 from a derivative of the cross K 11 x K 9. Crossing was effected during 1991 and the subsequent generations *viz.,* F_1, F_2 and F_3 were evaluated during 1992, 1993 and 1994 respectively. In the F_3 population a superior segregant was selected and nomenclatured as TKA 9102/3 and were further evaluated up to F_7 generation to attain homozygosity under rainfed condition during 1998. Then it was tested in the station trials at Agricultural Research Station, Kovilpatti from the year 2004-2014 along with check K 11. The cotton culture TKA 9102/3 was promoted for large scale testing and forwarded to Multilocation trials during 2008-10 at different Research Stations of Tamil Nadu Agricultural University. The Adaptive Research Trials were conducted in the farmer's field during winter rainfed season of 2010 to 2014 and on farm trials were conducted in the farmer's field during winter rainfed season of 2012 and 2013. It was also tested across the country under All India Co-ordinated Research Project on cotton along with 31 test entries from various Co-ordinated Centres in Br. 22 b during 2009-10. Screening was done against important pests during Rabi 2009-2014 and for diseases during Rabi 2011- 2014.

Karunganni cotton TKA 9102/3 is suitable for Rabi season and high density planting with a spacing of 45 x 15 cm. It also suitable for low rainfall zone (<250 mm rainfall during cropping season) and marginal fertility areas of coastal and black cotton soil tracts of Tamil Nadu. Nipping the apical bud is essential from 75 DAS to avoid the formation of monopodial branches in the terminal axis. A minimum of 50 meters isolation distance should be maintained for a quality seed production.

RESULTS AND DISCUSSION

The culture TKA 9102/3 was tested at Agricultural Research Station, Kovilpatti during the year 2004 to 2014. The station trial was conducted over ten years revealed the consistency and superiority of the culture over the check K 11. It has recorded a mean seed cotton yield of 836 kg/ha as against the check K 11 (692 kg/ha) with yield increase of 20.8 per cent over K 11 (**Table 1**).

Table 1. Performance of cotton culture TKA 9102/3 at ARS, Kovilpatti (2004 -2014)

S. No.	Year	Seed cotton yield (kg/ha)		% increase over K11
		TKA 9102/3	K11	
1.	2004-2005	517	408	26.7
2.	2005-2006	1195	1010	18.3
3.	2006-2007	594	424	40.0
4.	2007-2008	617	519	18.8
5.	2008-2009	1104	1046	5.5
6.	2009-2010	537	423	26.9
7.	2010-2011	782	531	47.2
8.	2011-2012	938	1006	-
9.	2012-2013	871	641	35.9
10.	2013-2014	1202	915	31.4
	Mean	**836**	**692**	**20.8**

Table 2. Performance of cotton culture TKA 9102/3 in Multilocation trial (2008-2010)

S. No	Entries	Seed cotton yield (kg/ha) 2008-09			Seed cotton yield (kg/ha) 2009-10			Mean	%	GOT (%)	2.5% S.L.	Mic	Tenacity (g/t)
		ARS KPT	RRS APK	AC&RI KKM	ARS KPT	RRS APK	AC&RI KKM						
1.	TKA 9102/3	1262	898	405	630	887	299	730	16.0	37	29.2	5.3	23.0
2.	K 11	1141	699	460	532	715	241	632	-	37	26.7	5.6	20.5
3.	DLSa 17	1010	834	534	565	880	367	698	-	33.5	27.5	6.0	20.0
4.	PA 255	1015	752	480	537	798	270	642	-	34.0	28.2	5.1	20.4

Based on the superiority of the culture TKA 9102/3, it was nominated to test in MLT during 2008-2010. It has recorded an average seed cotton yield of 730 kg/ha, which was 16.0 per cent increase over the existing check K 11 (632 t/ha) (Table 2).

In All India Coordinated Cotton Improvement Project (AICCIP) trails, the cotton culture TKA 9102/3 was evaluated along with 31 cultures proposed from various Co-ordinated Centres in Br. 22a/b during 2009-10. Out of 32 entries TKA 9102/3 recorded an average seed cotton yield of 1214 kg/ha which is 9.1% increased yield over the zonal check (DLSa 17). (Table 3).

Table 3. Performance of cotton culture TKA 9102/3 in AICCIP trial (2009- 2010)

Sl. No.	Centres	Seed Cotton Yield (kg/ha)		% increase over the zonal check DLSa 17	2.5% Span length	Mic	Bundle Strength
		TKA 9102/3	DLSa 17 (ZC)				
1.	Kandwa	1113	1142	-	27.1	4.9	21.2
2.	Bharuch	1631	1193	36.7	27.8	5.1	22.9
3.	Amreali	1089	1151	-	-	-	-
4.	Akola	1088	1174	-	-	6.3	-
5.	Parbhani	1296	1405	-	-	-	-
6.	Jalgon	1000	976	2.5	26.6	5.2	22.0
7.	Nagpur	2038	1370	48.8	27.6	5.1	23.0
8.	Dharwad	973	843	15.4	27.6	4.8	22.9
9.	Mudhol	947	1109	-	28.5	-	-
10.	Kovilpatti	966	765	26.3	28.5	4.6	22.8
	Mean	**1214**	**1113**	**9.1**	**27.7**	**5.1**	**22.5**

In Adaptive Research Trial was conducted from 2010 to 2014 over 83 locations of 4 districts. The result revealed that the cotton culture TKA 9102/3 recorded an average seed cotton yield of 1299 kg/ha which is 10.9% increase over K 11 (1171 kg/ha). (Table 4).

Table 4. Performance of TKA 9102/3 in Adaptive Research Trial (2010-2014)

Locations	ART 2010-11		% increase over K 11
	TKA 9102/3	K 11	
Madurai	1185	1176	1.0
Tirunelveli	458	412	11.1
Tuticorin	795	759	4.7
Virudhunagar	2309	1993	15.9
Overall mean(Locations)	**1187**	**1085**	**15.9**
	ART 2011-12		
Madurai	1219	1197	1.8
Tirunelveli	1369	1296	5.6
Tuticorin	946	840	12.6
Virudhunagar	2080	1849	12.5
Overall mean(Locations)	**1403**	**1296**	8.1
	ART 2012-13		
Madurai	595	521	14.2
Tirunelveli	1454	1321	10.1
Tuticorin	1202	862	39.4
Virudhunagar	1030	834	23.5
Ramnathapuram	600	550	9.1
Overall mean(Locations)	**976**	**818**	**19.2**
	ART 2013-14		
Madurai	1129	1055	7.0
Tirunelveli	1183	1066	11.0
Tuticorin	1293	874	4.1
Virudhunagar	2457	2360	48.0
Ramnathapuram	865	953	-
Overall mean	**1385**	**1262**	**17.5**
Grand mean (Locations)	**1299**	**1171**	10.9

Over all performance of a variety and its adaptability to different agro-climatic regions of the state are the basic criterion for the identification and release as a new variety in a state. The overall performance revealed that the cotton culture TKA 9102/3 has recorded an average seed cotton yield of 1193 kg/ha over 111 locations from the different yield trials *viz.,* Station trials, Multilocation trials, ART, OFT and All India Co-ordinated trials. The yield increase of seed cotton yield is 16.0 per cent over the check K 11 (1066 kg/ ha) (Table 5).

Table 5. Overall performance of TKA 9102/3 in different yield trials (2004 - 2014)

Sl. No.	Name of the trial	No. of locations	Higher Yield in		Seed cotton yield (kg/ha)		% increase over K 11
			TKA 9102/3	K 11	TKA 9102/3	K 11	
1.	Station Trial 2004-2014	10	9	1	836	692	20.8
2.	TNAU Research Station Trials (MLT) 2008 - 2010	6	6	-	730	632	16.0
3.	AICCIP Trials (2009 -10)	10	5	5	1214	1113	9.1
4.	Adaptive Research Trial (2010 - 2014)	78	67	11	1299	1171	10.9
5.	OFT (2012 - 2013)	7	7	-	883	729	21.0
Overall Mean		111	94	17	1193	1066	11.9

TKA 9102/3 is a superior medium staple cotton with 2.5% span length of 27.7 mm and fibre strength of 22.1 g/tex. According to recent CIRCOT norms, the strength length ratio (SL ratio) should be 0.8 and above for the modern spinning units. TKA 9102/3 matches the recent CIRCOT norms with SL ratio of 0.82. The existing desi cotton K 11 (Check) is not matching the recent CIRCOT norms, since it has the SL ratio of 0.78. (Table 5a and 5b)

Table 5a. Mean performance of TKA 9102/3 for Fibre and Spinning test (2009-2013)

S. No.	Particulars	CIRCOT, Coimbatore 2009-10	CIRCOT, Coimbatore 2010-11	CIRCOT, Mumbai Full scale spinning test 2011-12	CIRCOT Coimbatore 2012-13	CIRCOT, Coimbatore 2013-14	Aver-age
1.	2.5% span length (mm)	27.8	29.4	26.5	27.2	27.5	27.7
2.	Uniformity ratio	50.0	51.1	47.0	51.1	51.1	50.1
3.	Fineness (Micronaire value)	5.3	5.9	4.8	5.6	5.4	5.4
4.	Bundle strength (g/tex)	21.6	24.5	21.6	19.0	23.6	22.1
5.	Elongation percent	4.6	5.6	5.6	5.6	4.1	5.1
Strength / length ratio:0.8							

Table 5b Comparative fibre and spinning trait of TKA 9102/3 with K 11

S.No.	Particulars	TKA 9102/3	K 11
1.	2.5% span length (mm)	27.7	24.5
2.	Uniformity ratio	50.1	50.8
3.	Fineness (Micronaire value)	5.4	5.5
4.	Bundle strength (g/tex)	22.1	19.0
5.	Elongation percent	5.1	6.5
6.	Strength / length ratio	0.82	0.77
7.	Ginning outturn (%)	35.7	34.1
8.	Lint yield (kg/ha)	456	369
9.	Seed index (g)	8.3	7.3
10.	Lint index (g)	4.5	3.7

Table 5c. Fibre quality report of CIRCOT, Mumbai (Large scale spinning test)

Culture	ICC Mode				HVI Mode			Count	Neps/ km	CSP
	2.5% S.L.	UR	MIC	Tenacity (g/tex)	UHNL	UI	Tenacity (g/tex)			
TKA 9102/3	26.5	47	4.8	21.6	27.2	83	30.5	30s 40s	293 575	**2208** 1988
Check K11	25.3	50	5.6	19.7	25.0	81	27.6	20s 30s	118 526	*2040* 1791

Standard CSP for 20s count: *2024*
Standard CSP for 30s count: 2116 S/L ratio : 0.82
Standard CSP for 40s count: 2208

Besides its high yield, TKA 9102/3 had a high lint yield of 456 kg/ha as compared to the check K 11 (369 kg/ ha). TKA 9102/3 had a larger boll size with an average weight of 2.7 g than K 11 (2.3 g) (Table 10) TKA 9102/3 possess a high ginning outturn of 35.7% than the check K 11 (34.1%). This culture comes under the superior medium staple category with 2.5% span length of 27.7 mm, fibre strength of 22.1 g/tex and micronaire value of 5.4. It can spin to 30s - 40s count (Meena, *et al.* 2016) (Table 5a, b and c). Since the requirement of Karunganni cotton had a higher demand for bandage, surgical cotton and other upholstery fabrics (Denim), fetches equal price as *Bt.* cotton (Kranthi, 2015).. TKA 9102/3 is resistant to leafhopper under both field as well as in controlled condition (Table 6a,b,c&d). The culture TKA 9102/3 was found to be moderately resistant to Bacterial Leaf Blight and Alternaria

Table 6(a). Reaction of cotton TKA 9102/3 to major pests under field condition at Agricultural Research Station, Kovilpatti over the past five years (2009-2014)

Year	Leaf hopper			Aphids (No./ plant)	Reaction	Thrips (No./ plant)	Reaction	Stem weevil (% of infected plant)	Reaction	Boll worm damage (%)	Reaction	Locule damage (%)	Reaction
	Population (No./ plant)	Injury grade	Reaction										
2009 – 10													
TKA 9102/3	1.1	1	R	-	-	-	-	18.2	R	-	-	-	-
K 11	2.0	2	MR	-	-	-	-	20.0	R	-	-	-	-
2010 – 11													
TKA 9102/3	3.0	1	R	10.7	R	1.5	R	8.3	R	16.7	MR	20.4	MR
K 11	3.3	2	MR	11.3	R	1.9	R	25.0	MR	19.0	MR	24.5	MR
2011 – 12													
TKA 9102/3	1.1	1	R	-	-	-	-	-	-	-	-	-	-
K 11	2.0	2	MR	-	-	-	-	-	-	-	-	-	-
2012 – 13													
TKA 9102/3	2.8	1	R	-	-	-	-	-	-	-	-	-	-
K 11	3.0	2	MR	-	-	-	-	-	-	-	-	-	-
2013 – 14													
TKA 9102/3	1.2	1	R	9.8	R	-	-	-	-	17	MR	22.5	MR
K 11	1.0	2	MR	10.9	R	-	-	-	-	12	MR	20.5	MR

R-Resistant ; MR – Moderately resistant ; S – Susceptible ; HS – highly susceptible

It is also tolerant to drought under rainfed condition during the drought years 2009 - 2010, 2012- 2013 and 2013 - 2014 it recorded an average kapas yield of 870 kg/ ha and with stand long dry spell (> 45 days) in the winter rainfed vertisols condition where the Bt. cotton hybrids and upland cotton varieties were failed to (Table 8). The desi cotton culture TKA 9102/3 has recorded the highest yield potential of 2365 kg/ ha in Srivilliputtur block of Virudhunagar district during 2010. TKA 9102/3 culture perform well and with stand long dry spell under marginal fertility in rainfed situation. Hence the culture TKA 9102/3 was released as K 12 Karunganni cotton for the low rainfall (< 250 mm) coastal areas of rainfed vertisol tracts of southern districts of Tamil Nadu.

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Table 6(b). Overall rating for TKA 9102/3 to the pests over Five years (2009-2014)

Entry	Leafhopper			Aphids (No./ plant)	Reaction	Thrips	Reaction	Stem weevil (%)	Reaction	Boll worm damage (%)	Reaction	Locule damage (%)	Reaction
	Population (No./Plant)	Injury index	Reaction										
TKA 9102/3	1.84	1	R	10.3	R	1.5	R	13.3	R	16.8	MR	21.5	MR
K 11	2.26	2	MR	11.1	R	1.9	R	22.5	MR	15.5	MR	22.5	MR

(Rating scale 0 – 4; 1 – Resistant; 2 – Moderately Resistant; 3 – Susceptible; 4–Highly susceptible)

Table 6(c). Reaction of cotton TKA 9102/3 to major pests in AICCIP Trials (2009 – 2010)

Culture/ Variety	Leaf hopper			Whitefly (No./ 3 leaves)	Re-action	Aphids No./ 3 Leaves	Re action	Thrips (No./ plant)	Re action	Stem weevil (% of infected plant)	Re action	Boll worm damage (%)	Re action	Locule damage (%)	Re action
	Popul-ation (No./ plant)	Injury grade	Re action												
Faridhkot															
TKA 9102/3	1.9	0	R	0.9	R	-	-	0.9	R	-	-	-	-	-	-
K 11	1.8	0	R	0.9	R	-	-	0.9	R	-	-	-	-	-	-
Hisar															
TKA 9102/3	1.2	1	R	1.1	R	-	-	1.9	R	-	-	-	-	-	-
K 11	0.8	1	R	1.1	R	-	-	1.4	R	-	-	-	-	-	-
Sirsa															
TKA 9102/3	1.0	1	R	4.5	R	-	-	1.7	R	-	-	-	-	-	-
K 11	1.0	1	R	3.1	R	-	-	1.8	R	-	-	-	-	-	-
Khandwa															
TKA 9102/3	1.5	1	R	2.4	R	10.1	R	-	-	-	-	8.9	R	11.4	R
K 11	2.0	1	R	2.8	R	10.9	R	-	-	-	-	10.5	MR	10.5	R
Dharwad															
TKA 9102/3	0.9	1	R	-	-	-	-	-	-	-	-	2.4	R	2.4	R
K 11	1.7	1	R	-	-	-	-	-	-	-	-	4.9	R	4.9	R

R-Resistant ; MR – Moderately resistant ; S – Susceptible ; HS – highly susceptible

Leaf Spot (Table 7a, b&c)).

Table 6d. Reaction of TKA 9102/3 to leafhopper under controlled condition (Summer 2014)

Entry	Leafhopper Injury Index	Reaction
TKA 9102/3	1.0	R
K 11	1.0	R
LRA 5166 (Susceptible Check)	4.0	HS

(Based on Hopper Burn Assessment (Grade 1-4) – Indian Central Cotton Committee).

Table 7a. Reaction of cotton TKA 9102/3 to major diseases at ARS, Kovilpatti over the past three years (2011-2014)

Year	Bacterial Leaf blight	Alternaria Leaf spot	Grey mildew	Rust	Root rot
2011-12					
TKA 9102/3	2 (MR)	2 (MR)	2	-	-
K 11	2 (MR)	2 (MR)	2	-	-
2012-13					
TKA 9102/3	2 (MR)	4 (S)	4	-	-
K 11	2 (MR)	4 (S)	4	-	-
2013-14					
TKA 9102/3	2 (MR)	2 (MR)	4	-	-
K 11	2 (MR)	2 (MR)	4	-	-

1 – Resistant ; 2 – Moderately Resistant
3 – Moderately susceptible ; 4 – Susceptible
* Sheoraj (1998) Grading system for cotton disease. CICR, Nagpur.

Table 7b. Reaction of cotton TKA 9102/3 to major diseases in AICCIP Trials during (2009 -2010)

Year	Bacterial Leaf blight	Alternaria Leaf spot	Grey mildew	Rust	Root rot	FFS	MLS
Dharwad							
TKA 9102/3	0 (R)	4 (S)	4	2	-	-	-
K 11	0 (R)	4(S)	4	2	-	-	-
Khandwa							
TKA 9102/3	2 (MR)	2 (MR)	1	-	-	-	2
K 11	2(MR)	2 (MR)	1	-	-	-	2
Ludhiana							
TKA 9102/3	1 (R)	-	-	-	4	1	-
K 11	1(R)	-	-	-	1	1	-
Faridhkot							
TKA 9102/3	1(R)	-	-	-	-	2	-
K 11	2(MR)	-	-	-	-	2	-
Sirsa							
TKA 9102/3	-	-	-	-	4	-	-
K 11	-	-	-	-	4	-	-

Table 7c. Reaction of TKA 9102/3 to diseases under *controlled* condition (Summer 2014)

Entry	Alternaria leaf blight		Root rot (R. solani)		Dry root rot (M.phaseolina)	
	PDI	Grade	PDI	Grade	PDI	Grade
TKA 9102/3	1.5	1 (R)	13	2 (MR)	3	1 (R)
K 11	4.0	1 (R)	12	2 (MR)	4	1 (R)
LRA 5166 (Susceptible Check)	12.5	2 (MR)	18	3 (MS)	11	2 (MR)

(0-4 scale adapted by AICCIP) (Source department of plant pathology, TNAU, Coimbatore)

Table 8. Performance of cotton TKA 9102/3 for drought parameters under stress condition 2013-14.

Sl. No.	Entry	Root length (cm)	Relative* water content (%)	Proline* content (mg/g)	Seed cotton yield (kg/ha)	% increase over K11
1.	TKA 9102/3	74.1	78.4	1107	1202	31.4
2.	K 11	69.4	76.3	1085	915	-
3.	LRA 5166	60.2	70.8	987	900	-

*RWC and Proline content – at flowering stage.

Table 9a. Rainfall pattern and the Performance of the culture TKA 9102/3 (2004-2014)

S. No.	Year	Seed cotton yield (kg/ha)		% increase over K11	Rainfall during Cropping Period (October to February)	
		TKA 9102/3	K11		Total	
1.	2004-2005	517	408	26.7	471.7	Normal
2.	2005-2006	1195	1010	18.3	487.6	Normal
3.	2006-2007	594	424	40.0	791.3	Above Normal
4.	2007-2008	617	519	18.8	504.2	Above Normal
5.	2008-2009	1104	1046	5.5	476.2	Normal
6.	**2009-2010**	**537**	**423**	**26.9**	**333.8**	**Below Normal**
7.	2010-2011	782	531	47.2	627.0	Above Normal
8.	2011-2012	938	1006	-	506.0	Above Normal
9.	**2012-2013**	**871**	**641**	**35.9**	**261.1**	**Below Normal**
10.	**2013-2014**	**1202**	**915**	**31.4**	**269.9**	**Below Normal**
	Mean	**836**	**692**	**20.8**	**472.88**	

Table 9b. Performance of the culture TKA 9102/3 during the drought years

S. No.	Year	Seed cotton yield (kg/ha)		% increase over K11	Rainfall during Cropping Period (October to February)	
		TKA 9102/3	K11		Total	
1.	2009-2010	537	423	26.9	333.8	Below Normal
2.	2012-2013	871	641	35.9	261.1	Below Normal
3.	2013-2014	1202	915	31.4	269.9	Below Normal
	Mean	**870**	**659.7**	**31.4**	**288.27**	

Table 10. DUS characters for TKA 9102/3

Sl. No	Characteristics	TKA 9102/3	K 11
1	Hypocotyl: Pigmentation	Present	Absent
2.	Leaf : Colour	Green	Green
3.	Leaf : Hairiness	Sparse	Sparse
4.	Leaf : Appearance	Flat	Flat
5.	Leaf : Gossypol glands	Absent	Absent
6.	Leaf : Nectaries	Absent	Absent
7.	Leaf : Petiole pigmentation	Present Light purple pigmentation in the petiole portion when exposed to sunlight	Present Light purple pigmentation in the petiole portion when exposed to sunlight
8.	Leaf : Shape	Semi-okra, 5-7 lobed, and shallow lobed.	Semi-okra, 5-7 lobed, deep lobed.
9.	Plant : Stem hairiness	Sparse	Sparse
10.	Plant : Stem pigmentation	Present Light purple pigmentation in the stem portion when exposed to sunlight	Present Light purple pigmentation in the stem portion when exposed to sunlight
11.	Plant : Height (cm)	Medium Tall (100-110 cm)	Medium Tall (95-100 cm)
12.	Plant : Growth habit	Compact with short sympodia (< 30 cm) 2-3 boll / sympodia	Compact with short sympodia (< 30 cm) 3 boll / sympodia
13.	Bract : Type	Normal with entire margin and leathery	Normal with entire margin and leathery
14.	Flower : Time of flowering	Medium	Medium
15.	Flower : Petal colour	Yellow	Yellow
16.	Flower : Petal spot	Present	Present
17.	Flower : Stigma	Exerted	Embedded
18.	Flower : Anther filament colouration	Purple	Purple
19.	Flower : Pollen colour	Yellow	Yellow
20.	Flower : Male sterility (Only for A and B lines)	-	-
21.	Boll : Bearing habit	Solitary	Solitary
22.	Boll : Colour	Green	Green
23.	Boll : Shape (Longitudinal section)	ovate	Elliptic
24.	Boll : Surface	Pitted	Pitted
25.	Boll : Prominence of tip	Pointed	Pointed
26.	Boll : Opening	Open	Open
27.	Boll : Weight of seed cotton / boll (g)	Very Small (2.7g)	Very Small (2.3g)
28.	Seed : Fuzz	Dense	Dense
29.	Seed : Fuzz colour	White	White
30.	Seed : Index (100 seed wt in gram)	Medium (7.5 g)	Small(6.7 g)
31.	Ginning (%)	High (35.7 %)	High (35.3 %)
32.	Fibre : Colour	White	White
33.	Fibre : Length (2.5 % span length) (mm)	Long (27.7 mm)	Medium (24.5 mm)
34.	Fibre : Strength (g/tex)	Medium (22.2g/tex)	Medium (21.3 g/tex)
35.	Fibre : Fineness (Micronaire value)	Coarse (5.4)	Coarse(5.5)
36.	Fibre Uniformity (%)	Excellent (50 %)	Excellent (50 %)
37	Fibre: Maturity (%)	-	-

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