



TMC MM I 1.3: Identification of *G.hirsutum* genotypes suitable for machine picking and development of agronomic package

INTRODUCTION

Cost of cotton cultivation for various operations especially manual pickings has increased manifold. Moreover, the availability of labour for clean picking is also a serious constraint. About 30% of world cotton production in Australia, Israel and USA is machine picked. Machine picking is a viable alternative to manual picking which will not only minimize cost of cultivation but also reduce the dependency on labour. However, the prerequisite for machine picking is the identification of cotton genotype having short stature (~100.0 cm height), earliness, compactness, sympodial growth habit and synchronous boll opening. In view of this, research project on this aspect was initiated to identify varieties/genotypes suitable for machine picking, to find out appropriate spacing and fertilizer dose and time of application of defoliant to cause leaf shedding to synchronize boll opening.

OBJECTIVES

- Identification of *G.hirsutum* genotypes suitable for machine picking
- Development of compact and synchronous flowering in *G.hirsutum*
- Introgression of useful genes from wild species for development of plant type suitable for machine picking

- Development of agronomic practices for cultivation of genotypes suitable for machine picking
- Promotion of superior genotypes suitable for machine picking

SALIENT FINDING

Activity 1: Evaluation of released/pre-released genotypes suitable for machine picking

Under this activity twelve genotypes viz. F 2380, F 2381, F 2383, CCH 28 I, CCH 724, NISC 50, KC 3, TCH 1608, MCU 12, P 13-2, P 23-1 and P 1750 were evaluated against local varietal check and Bt Hybrid RCH 134 check at Faridkot, New Delhi, Nagpur and Coimbatore centres. On the basis of mean seed cotton yield, the highest seed cotton yield of 2065 Kg/ha was recorded in KC 3 followed by P 1750 (1992 kg/ha), F 2383 (1811 kg/ha) and NISC 50 (1758 kg/ha) as compared to 1774 kg/ha in local checks and 2126 kg/ha in Bt hybrid check (Table 1.3.1). Besides high yielding, these genotypes possess suitable characters for machine picking. These okra leaf entries also recorded relatively less plant width of 52.8 cm. (F 2380), 54.9 cm. (F 2381) and 52.4 cm. (F 2383) RS 875 F has recorded least width 42.3 cm amongst all the entries tested. All these entries had medium to fluffy kapas attachment. Besides high yielding, these genotypes possess suitable characters for machine picking.



Fig 1.3.1 : Okra leaf genotypes showing early maturity

Table 1.3.1 : Mean performance of different genotypes in common trial during 2009-10

S. no.	Entry	SCY (kg/ha)				Height of 1st boll.			
		ND	FD	NGP	COM	ND	FD	NGP	COM
1	P 13-2	2549	1778	1919	822	57.3	57.5	17.2	27.0
2	P 23-1	2264	1660	2437	1005	50.0	86.7	17.2	25.0
3	P 1750	2707	1938	1994	1330	53.7	43.3	23.4	27.0
4	NISC 50	1447	1583	2409	1593	59.0	39.2	15.1	21.0
5	CCH 724	1763	1264	1335	1837	49.7	42.5	20.6	21.0
6	CCH 281	1718	1451	2314	1430	44.0	35.8	15.8	23.0
7	F 2380	2540	1257	1746	1474	40.7	40.8	20.1	20.0
8	F 2381	2147	972	2025	1120	46.3	22.5	15.2	23.0
9	F 2383	2603	1542	1475	1624	41.3	35.0	20.8	22.0
10	RS 875 F	2196	542	-	-	44.0	14.2	-	-
11	KC 3	2463	1771	2723	1301	56.7	37.5	19.7	22.0
12	TCH 1608	1157	868	2158	1796	66.3	42.5	20.3	22.0
13	MCU12	360	333	1513	1296	67.7	60.8	21.6	21.0
14	Local check	2451	2285	1301	1059	55.3	39.2	11.4	24.0
15	Btcheck	2776	2299	1521	1907	61.0	41.7	19.0	27.0
	CD at 5 %	170	170.2	755	236.78	-	-	6.20	5.18

S. no.	Entry	Plant width (cm)				Kapas attachment			
		ND	FD	NGP	COM	ND	FD	NGP	COM
1	P 13-2	55.7	89.2	65.4	83.9	Fluffy	Fluffy	Medium	Clasp
2	P 23-1	46.7	112.5	67.8	89.7	Fluffy	Fluffy	Medium	Flared
3	P 1750	42.3	82.5	71.3	89.7	Fluffy	Flared	Medium	Flared
4	NISC50	56.7	95.0	67.8	80.8	Medium	Flared	Low	Medium
5	CCH724	44.0	109.2	54.4	74.0	Medium	Flared	Medium	Fluffy
6	CCH281	41.3	111.7	63.6	87.7	Fluffy	Fluffy	Medium	Fluffy
7	F2380	36.3	57.5	51.4	65.9	Medium	Fluffy	Medium	Medium
8	F 2381	46.0	70.8	40.6	62.1	Medium	Fluffy	Medium	Fluffy
9	F2383	49.3	54.2	41.8	64.2	Medium	Fluffy	Medium	Medium
10	RS875F	49.7	35.0	-	-	Fluffy	Flared	Medium	Medium
11	KC3	43.3	71.7	61.7	65.7	Medium	Fluffy	Medium	Medium
12	TCH 1608	56.7	107.5	56.3	67.7	Medium	Flared	Medium	Medium
13	MCU 12	47.3	108.3	61.7	95.3	Medium	Flared	Medium	Medium
14	Local check	56.0	70.0	61.6	94.9	Fluffy	Fluffy	Medium	Medium
15	Btcheck	60.0	94.2	49.0	76.9	Fluffy	Fluffy	Medium	Flared
	CDat5%	-	-	6.32	17.43	-	-	-	-

Check	IARI New Delhi	PAU, Faridkol	CICR, Nagpur	TANU, Coimbatore
Local check	P8-6	F 1861	LRA5166	MCU13
Bt check	RCH 134 BI	RCH 134 Bt	Bunny BI	Bunny BI

Activity 2 : Identification of synchronous flowering and boll bursting plant type

The identification of compact and synchronous plant type in *G.hirsutum*, in station trial at Faridkot involving 64 genotypes was conducted. Genotypes namely F2441, F2293 and F2389 recorded seed cotton yield of 2694kg/ha, 2333kg/ha and 2306kg/ha, respectively against 2014 kg/ha of F1861 local check and 2528 kg/ha of Bt hybrid check. These entries recorded ginning outturn (34.5 - 38.2 %), plant height (131-136 cm), plant spread (50 - 60 cm), boll wt. (3.29-3.87g), height of 1st sympod (25-27cm), height of lowest 1st boll (32-39 cm), monopods (0-1) and sympods (18-24), suitable characters for machine picking.

At New Delhi centre 24 genotypes and two checks were evaluated for seed cotton yield and fibre properties. Genotype P 45-1 recorded seed cotton yield of 2744 kg/ha followed by P 34-1 (2697 kg/ha) and P 58-1 (2697 kg/ha). P45-1 and P34-1 have other suitable characters for machine picking e.g. ginning outturn (34.0 - 35.5 %), plant height (131-144cm), plant spread (44.7- 53.0 cm), boll wt. (3.8 - 4.4g), mono pods (0.5-0.8), sympods (19-24). Eight genotypes showed above 28 mm and 9 between 27 to 28 mm 2.5% span lengths, five genotypes showed 23g/tex and above fibre strength. Four genotypes P45-1 (90.5%), P32-2(91%), P58-1 (91.3%) and P 34-1 (91.6%) recorded above 90% picking after 150 days. Genotypes CH 102 (2434 kg/ha), C 1068 (2424 kg/ha) recorded significantly higher seed cotton yield than the checks LRA5166 (1084 Kg/ha) and Bunny Bt (818 kg/ha), respectively at CICR, Nagpur centre. These genotypes had shown suitable characters like ginning outturn (34.0 % , 37.9 %), plant height (83.0 cm, 108 cm), plant spread (53 cm, 61 cm), boll wt. (3.5g, 4.4g), height of first sympod (18.6 cm, 22.5cm), monopods (1.6, 1.8) and sympods (18, 24) for machine picking.

Twenty six entries including two checks were raised in a station trial at Coimbatore. The entries TCH 1743 (2011kg/ha) and TCH1656 (1937kg/ha) were high yielding among the cultures. These genotypes recorded plant height (117- 140 cm), boll wt. (3.7- 4.8g), height of 1st sympod (20 - 24.7cm), height of lowest 1st boll (22-26cm), monopods (1.0-1.2), sympods (20-24) suitable characters for machine picking.

Activity 3: Evaluation of introgressed material for improvement of *G. hirsutum*

Six introgressed lines received from Nagpur (NISC 40, NISC 43, NISC 44) and Coimbatore (TCH 1648, TCH 1649, TCH 1652) centers were evaluated at all the four centers (Table 1.3.2) namely IARI, New Delhi; PAU, Faridkot; CICR, Nagpur and TNAU, Coimbatore.

IARI New Delhi

Seed cotton yield varied from 196 Kg/ha in TCH 1652 to 1719 Kg/ha in NISC 44 in comparison to 2307 kg/ha of local check P 8-6 2037 kg/ha and 2669 Kg/ha of RCH 134 Bt.

The boll weight ranged from 3.0 g of TCH 1649 to 3.9 g of NISC 44. These introgressed genotypes, however showed relatively better ginning outturn, which varied

from 34.7% in TCH 1649 to 38% in NISC 40. The introgressed lines NISC 40, NISC-43 and NISC-44 received from CICR, Nagpur showed lower 2.5% span length, being 24.7 mm, 25.1 mm and 26.5 mm, respectively. However, the lines received from TNAU, Coimbatore 2.5 % span length.

The height of first sympodial branch from the ground was lowest (44 cm) in NISC-43 and was highest (112.0 cm) in TCH 1652 as compared to 49.7cm in P 8-6 and 55.7 in RCH 134 Bt. Likewise, the height of first boll from ground ranged from 49.3 cm in NISC-43 to 116.0 cm in TCH-1652 as compared to 54.3 cm in P 8-6 and 62 cm in RCH 134 Bt. Five genotypes, viz. EGCNH 1020, GP 2761, IC 296856, IC 296862 and IC 296864 with plant height varying from 72 cm to 102 cm were identified.

PAU Faridkot

Seed cotton yield varied from 250 kg/ha in TCH 1652 to 1486 kg/ha in NISC 40 in comparison to 2278 kg/ha in local check F 1861 and 2125 kg/ha in RCH 134 Bt. All the genotypes recorded significantly lower seed cotton yield as compared to local check F 1861 and RCH 134 Bt. The boll weight ranged from 3.2 gin NISC 44 to 3.9 gin TCH 1652. These introgressed genotypes however showed relatively better ginning outturn, which ranged from 35.0% in TCH 1652 to 38.7% in NISC 44. Number of monopodial and sympodial branches showed good variability, from 1.7 (NISC 40) to 5.5 (TCH 1652) and 14.3 (NISC 43) to 18.8 (P 8-6). The mean plant height was lowest of 107.5 cm (NISC 43) followed by NISC 44 (118.3 cm).

The height of first sympodial branch from the ground was lowest (12.5) in TCH 1652 and was highest (23.3 cm) in TCH 1648 as compared to 20.8 cm in F 1861. Likewise, the height of first boll from ground ranged from 35.0 cm in NISC 43 to 50.8 cm in TCH 1648 as compared to 33.3 cm in F 1861 and 30.0 cm in RCH 134 Bt. Two genotypes TCH 1649 and TCH 1648 showed very high height first boll as compared to other genotypes.

CICR Nagpur

Among the 3 genotypes, NISC 40 (1831 kg/ha) recorded highest seed cotton yield followed by TCH 1648 (1769 kg/ha) and TCH 1652 (1389 kg/ha) better than the checks namely LRA 5166 (1140 kg/ha) and Bunny Bt (748 kg/ha).

TNAU Coimbatore

Among the introgressed lines tested, NISC 49 registered the highest seed cotton yield (1700 kg/ha) followed by TCH 1652 (1500 kg/ha).

The overall performance for seed cotton yield varied from 1486 kg/ha (Faridkot) -1832 kg/ha (Nagpur) in NISC 40 and 1139 kg/ha (Faridkot), 1719 kg/ha (Nagpur) in NISC 44. These entries also showed suitability for machining picking and can be used progressively in breeding programme. Relatively better ginning outturn ranging from 34.7% to 38% was observed. TCH 1648 and TCH 1649 showed 2.5% span length of 29.9 mm and 29.3 mm, respectively.

Table 1.3.2 : Mean performance of introgressed material over four locations during 2009-10

S. no.	Entry	SCY (kg/ha)				Hl. of 1st Boll (cm)				Pl. width				Ka pas attachment		
		NO	FD	NGP	COM	NO	FD	NGP	COM	NO	FD	NGP	COM	NO	NGP	COM
1	NISC 40	1570	1486	1832	1329	56.0	28.3	14	25	33.0	74.2	56.4	84.1	Fluffy	Medium	Fluffy
2	NISC 43	1637	986	1098	1417	49.3	35.0	16	23	32.0	62.5	44.9	64.6	Fluffy	Medium	Flared
3	NISC 44	1719	1139	1282	1700	55.0	36.7	18.1	20	28.7	66.7	41.8	67.9	Flared	Medium	Clasp
4	TCH 1648	589	736	1770	1433	53.0	50.8	13.6	22	35.7	89.2	53.4	81.0	Med.	Medium	Medium
5	TCH 1649	472	667	1185	1151	101.3	50.0	9.6	23	35.3	92.5	44.8	81.0	Med.	Medium	Medium
6	TCH 1652	196	250	1390	1533	116.0	39.2	14.5	23	45.7	128.3	51.4	79.8	Med.	Medium	Fluffy
7	LC	2307	2278	1141	1311	54.3	33.3	15.6	26	40.3	75.0	47.6	83.6	Fluffy	Medium	Medium
8	RCH 134	2669	2125	748	2105	61.0	30.0	19.1	20	56.0	89.2	54.1	71.2	Fluffy	Medium	Flared
	CD at5 %	154	232	326	334.31	-	-	6.41	6.72	-	-	8.65	11.70	-	-	-

S. no.	Entry	Boll wt. (gm)				GOT %			Monopods				IARI N. Delhi			
		NO	FD	NGP	COM	NO	FD	NGP	NO	FD	NGP	COM	2.5 SL	UR	MV	FS
1	NISC 40	3.6	3.48	3.5	3.9	38.0	37.2	35.1	2.0	1.7	1.8	0.9	24.7	52.6	5.0	19.9
2	NISC 43	3.6	3.41	3.5	4.5	35.6	35.2	35.7	1.0	1.8	2.4	1.4	25.1	54.0	5.0	21.8
3	NISC44	3.9	3.22	3.6	4.4	35.5	38.7	37.0	2.5	1.7	1.7	1.4	26.5	52.3	4.8	21.5
4	TCH 1648	3.4	3.62	3.4	4.6	34.9	36.5	35.3	6.3	1.8	2.6	1.1	29.9	49.9	4.3	22.2
5	TCH 1649	3.0	3.48	3.9	4.5	34.7	37.1	35.9	5.5	3.5	1.6	1.4	29.3	48.0	3.9	22.8
6	TCH 1652	3.7	3.90	4.1	4.8	35.8	35.0	37.0	5.7	5.5	2.0	1.2	27.6	51.1	5.0	20.9
7	LC	4.6	3.37	3.6	5.0	34.6	34.5	35.8	1.3	0.5	1.5	1.0	27.4	51.3	4.5	22.3
8	Bt check	4.2	3.94	4.0	5.3	35.3	37.6	37.4	6.7	2.5	1.3	2.0	28.0	51.7	4.7	23.1
	CD at5 %	0.3	-	0.7		0.5	-	1.42	0.9	-	0.59	0.69	-	-	-	-

Check	IARI New Delhi	PAU, Faridkot	CICR, Nagpur	TANU, Coimbatore
Local check	P 8-6	P 8-6	LRA 5166	MCU13
Bt check	RCH 134 Bt	RCH 134 Bt	Bunny Bt	Bunny Bt

Activity 4: To study the use of defoliant suitable for genotype amenable for machine picking.

Under this activity defoliant "Etheral" was sprayed at 135 days and 150 days after sowing @ 5000 ppm on different varieties at all the centres of this project. 5000 ppm dose at 150 DAS of defoliant Etherel was found suitable for achieving desirable level of leaf shedding and boll opening.

IARI New Delhi

The plots sprayed with the defoliant showed about 60% to 70% leaf shedding as compared to checks. The boll opening was also better as compared to the checks. There was no effect on seed cotton yield and other traits like boll weight, ginning percentage, seed index, etc due to the application of the defoliant on P 1750 and P 13-2. Seed cotton yield of 2760 Kg/ha was recorded in P 1750 and 2575 Kg/ha in P 13-2.

PAU Faridkot

At Faridkot it was observed that Etherel @ 5000 ppm was found suitable for achieving desired level of leaf shedding (more than 95%) and boll opening on genotype F 2383.

CICRNagpur

The effect of defoliant Etherel was observed on only one genotype namely CNH 120 MB. Etherel was sprayed at 135 and 150 Days after sowing (DAS) on CNH 120 MB planted on a plot size of 10 rows x 6 m. The dose of Etherel has been standardized at 5000 ppm.

First spray of Etherel was taken up at 135 DAS on 20/11/2009 and observation on defoliation was recorded each after 5, 10 and 15 days after spraying. Second Spray of Etherel on CNH 120 MB was taken up at 150 DAS.

More than 95% of the defoliation takes place with Etherel sprayed at 5000 ppm at 150 DAS.

TNAU Coimbatore

Bunny Bt was found to be amenable for mechanical picking which showed better defoliation followed by KC 3 and MCU 12. Etheral (5000 ppm at 150 DAS) was found suitable for achieving desired level of leaf shedding and boll opening.

SPECIFIC TECHNOLOGIES/ RECOMMENDATIONS

Row to row spacing of 100 cm and plant to plant spacing of 10 cm is found to be suitable for machine picking.

More than 95% of the defoliation takes place with Etherel sprayed at 5000 ppm at 150 DAS

More than 95% of the defoliation takes place with Etherel sprayed at 5000 ppm at 150 DAS. At New Delhi centre

compact and early maturing genotypes were identified from breeding material. RILs derived from the cross 'P56-4 x RS 2013' in F₅ generation were evaluated. Several single plants were identified for compact plant type, early maturity, jassid and CLCuV resistance and high fibre strength.