

MM 1.4 : Qualitative and quantitative improvement of cotton seed oil

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Target and achievements

Target /activity	Achievement
Identification of new genetic sources for high oil content	<ul style="list-style-type: none">• Among a total of 168 <i>G. hirsutum</i> lines evaluated, seed oil content ranged from 15.4 - 26.0 %. A number of lines viz. CISV 4, CMS F 846, CMS 39 Jhorar, CMS 55 LRA 5166, CMS 101 -Jhorar, CMS 101- SH 2379, CMS 16, CMS 114-CB 9, CMS 144 -CB 9, CMS 148- PIL 8, CMS 27- Jhorar, CMS 18, CMS 23-16, CMS 19-CB 25 and CMS 24 -Jhorar were found to contain more than 26 % seed cotton oil content.• Among <i>G. arboreum</i> lines, the seed oil content ranged
Improve oil content of cottonseed through appropriate selection and breeding	<ul style="list-style-type: none">• At CICR, Nagpur, 24 cultures were identified for good oil content and other economic characters. Among these, some of the promising cultures 3K, 24K, 9DC SP₂, 40 EP recorded seed oil content > 25.0 % (NIR Estimation). Cultures 25K, 16 DC SP₁ and 26DC-SP₁ cultures showed the good fibre length (approx. 26.0 mm), fineness as well as good fibre strength (16 DC SP 1 22.0 g/tex).• In AICCIP Trial, a culture CNHO 12 has been promoted to Br o3 (a) in South zone, Central zone and North Zone for 2005-06. Similarly, CNHO 3 has been promoted in Br o3 (b) in South zone, for 2005-06.
Evaluation of fatty acid profiles for improvement of quality of cottonseed oil.	<ul style="list-style-type: none">• At CICR, Nagpur, a number of <i>G. hirsutum</i> genetic material comprising of germplasm lines, F₃ families and advance cultures were evaluated for their fatty acid profile.• Highest amount of linoleic acid (55.13 %) was recorded in DHY 286 followed by MCU 5 VT (51.99 %) and Deviraj (51.76 %). Oleic acid content ranged from 20.59 % to 27.80 % being highest in G 67 followed by MCU 5 (26.82

<p>Evaluation of Advanced cultures of <i>G. hirsutum</i></p> <p>Evaluation of Germplasm of <i>G. hirsutum</i></p>	<ul style="list-style-type: none"> • Among 17 entries evaluated, seed cotton yield ranged from 9.33 - 15.81 q/ha. Highest mean seed cotton yield was recorded in F 1982 (15.81 q/ha) followed by CSH -1 (15.25 q/ha). Check LRK 516 recorded the mean seed cotton yield of 12.50 q/ha. Seed oil content varied from 20.17 - 22.95 %. Culture CSH 4105 recorded the highest seed oil content (22.95 %) followed by LH 1556 (22.74 %) and 10 ES (22.17%). Culture F 776 recorded highest fibre length (27.21 mm) and also showed the highest fibre strength (22.05 g/tex). • Seed cotton yield ranged from 4.83-15.53 q/ha). Germplasm CS-61 recorded the highest seed cotton yield (15.53 q/ha) followed by CSH-18 (14.29 q/ha) and CSH-17 (12.60 q/ha). Check LRK 516 recorded the mean yield per hectare 10.75 q/ha. The seed oil content in varied from 20.38 – 22.97%. Highest seed oil content of 22.97 % was
<p>Evaluation of advanced cultures of <i>G. arboreum</i>.</p> <p>Evaluation of Germplasm of <i>G. arboreum</i></p>	<ul style="list-style-type: none"> • Among the 8 advanced cultures of <i>G. arboreum</i> evaluated at four different locations, the mean seed cotton yield ranged from 9.27-13.23 q/ha. Culture LD 778 recorded the highest mean seed cotton yield of 13.23 q/ha followed by LD 794 (12.08 q/ha). Check AKH-4 recorded a mean seed cotton yield of 9.27 q/ha. Seed oil content ranged in between 17.98 - 20.04%. Highest seed oil content was recorded in LD 838 (20.04 %) followed by LD 694 (19.64 %). Highest span length of 26.00 mm as well and fibre strength of 20.65 (g/tex) was recorded in CINA 306. • Among the 11 germplasm lines evaluated, highest seed cotton yield of 15.65 q/ha was recorded in 6743 followed by 12.45 q/ha in 6686. Check AKH-4 recorded comparatively a mean seed cotton yield of 9.67 q/ha. The seed oil content of <i>G. arboreum</i> germplasm varied from 16.90 - 20.31 %. Highest seed oil of 20.31% were

Progress of Work

❖ Multilocation Evaluation of Various Breeding Materials in *G.hirsutum* *G. hirsutum* Advanced Cultures

17 entries received from various centers were sown in this trial. Seed cotton yield ranged from 9.33 - 15.81 q/ha. Highest mean seed cotton yield was recorded in F 1982 (15.81 q/ha) followed by CSH -1 (15.25 q/ha). Check LRK 516 recorded the mean seed cotton yield of 12.50 q/ha.

Seed oil content varied from 20.17 - 22.95 %. Culture CSH 4105 recorded the highest seed oil content (22.95 %) followed by LH 1556 (22.74 %) and 10 ES (22.17%). Check LRK 516 recorded their seed oil content of 21.60 %. (Table 1.4.1). Culture F 776 recorded highest fibre length (27.21 mm) and also showed the highest fibre strength (22.05 g/tex). The highest uniformity ratio was recorded in the culture 1 HS (53.0 %) (Table 1.4.2).

The seed index varied from 7.46 – 9.30 gm. Culture F 1985 shows 9.30 gm followed by 2 HS (8.66 gm). Check LRK 516 recorded (8.23 gm). Ginning out turn varied from (30.23 - 35.22 %). Cultures 2 HS and F 1985 recorded ginning out turn 35.21% and 34.96% respectively. Lint index varied from 3.30-5.22 gm. The highest lint index recorded in culture F 1985 (5.22 gm). Check LRK 516 recorded lint index of 4.51 gm.

***G. hirsutum* germplasm**

Among the Germplasm evaluated at four different locations, seed cotton yield ranged from 4.83-15.53 q/ha). Germplasm CS-61 recorded the highest seed cotton yield (15.53 q/ha) followed by CSH-18 (14.29 q/ha) and CSH-17 (12.60 q/ha). Check LRK 516 recorded the mean yield per hectare 10.75 q/ha. Seed oil content in *G. hirsutum* germplasm lines varied from 20.38 – 22.97%. Highest seed oil content of 22.97 % and 22.77 % were recorded in germplasm lines of CSH 23 and DCI 122 respectively as compared to check LRK 516 (21.90 %) (Table 1.4.3).

Table 1.4.1: Seed Oil Content

S. No.	Names	Entry	Nagpur	Khandwa	Faridkot	Mean
1	4HS	TMOH 3	24.57	21.00	17.8	21.12
2	10ES	TMOH 4	25.33	20.68	20.5	22.17
3	F 1985	TMOH 13	24.97	20.51	20.1	21.86
4	F 1861	TMOH 22	26.70	21.58	17.5	21.92
5	F 1977	TMOH 23	24.97	17.67	18.2	20.28
6	F 2001	TMOH 24	24.80	20.39	18.8	21.33
7	F 776	TMOH 25	25.30	20.04	20.6	21.98
8	LH 1556	TMOH 27	23.77	24.37	20.1	22.74
9	2HS	TMOH 30	23.43	19.19	17.9	20.17
10	1HS	TMOH 31	23.83	18.51	19.0	20.44
11	23ES	TMOH 32	24.47	17.03	20.8	20.76
12	13HS	TMOH 33	22.73	21.42	18.7	20.95
13	CSH 7106	TMOH 34	24.07	18.38	21.3	21.25
14	CSH 4105	TMOH 35	25.23	23.84	19.8	22.95*
15	CSH 1	TMOH 36	23.17	20.97	20.3	21.48
16	F 1982	TMOH 37	23.97	18.19	19.7	20.62
17	LRK 516	TMOH 38	24.33	22.49	18.0	21.60

Table 1.4.2 : Fibre properties

S. No.	Names	Code	2.5% span length (mm)	Uniformity ration (%)	Fineness micronaire	Tenacity (g/tex
1	4HS	TMOH 3	24.84	50.5	3.95	20.10
2	10ES	TMOH 4	24.39	49.5	4.70	21.20
3	F 1985	TMOH 13	25.55	46.5	3.90	19.25
4	F 1861	TMOH 22	24.92	49.0	4.65	19.50
5	F 1977	TMOH 23	25.77	48.0	3.85	21.05
6	F 2001	TMOH 24	24.92	49.0	3.90	18.70
7	F 776	TMOH 25	27.21	48.0	3.45	22.05
8	LH 1556	TMOH 27	27.04	48.0	3.80	20.30
9	2HS	TMOH 30	23.77	52.0	4.75	18.25
10	1HS	TMOH 31	24.67	53.0	4.35	19.45
11	23ES	TMOH 32	25.76	49.5	4.10	19.85
12	13HS	TMOH 33	23.36	48.5	4.15	20.15
13	CSH 7106	TMOH 34	26.73	49.5	4.05	20.65
14	CSH 4105	TMOH 35	26.39	46.0	4.20	19.25
15	CSH 1	TMOH 36	25.96	51.0	3.90	19.75
16	F 1982	TMOH 37	26.54	49.0	3.90	19.65
17	LRK 516	TMOH 38	26.88	49.5	3.85	20.85

G. hirsutum germplasm

Among the Germplasm evaluated at four different locations, seed cotton yield ranged from 4.83-15.53 q/ha). Germplasm CS-61 recorded the highest seed cotton yield (15.53 q/ha) followed by CSH-18 (14.29 q/ha) and CSH-17 (12.60 q/ha). Check LRK 516 recorded the mean yield per hectare 10.75 q/ha.

Seed oil content in *G. hirsutum* germplasm lines varied from 20.38 – 22.97%. Highest seed oil content of 22.97 % and 22.77 % were recorded in germplasm lines of CSH 23 and DCI 122 respectively as compared to check LRK 516 (21.90 %) (Table 1.4.3).

Table 1.4.3 : Seed oil content

S. No.	Name	Code	Nagpur	Faridkot	Mean
1	B4-EMPIRE	TMGH 50	24.85	19.59	22.22
2	LH 372	TMGH 51	26.30	18.32	22.31
3	DCI 108	TMGH 52	25.30	18.52	21.91
4	SOCB 67	TMGH 53	25.40	19.20	22.30
5	PKV802	TMGH 54	24.45	16.53	20.49
6	JK 344	TMGH 55	27.05	17.10	22.07
7	DCI 122	TMGH 56	27.00	18.54	22.77
8	SOCB 92	TMGH 57	23.80	21.55	22.67
9	76-I-23	TMGH 58	24.80	20.39	22.59
10	CSH-23	TMGH 59	25.20	20.74	22.97*
11	CSH-59	TMGH 60	24.90	17.54	21.22
12	CSH-17	TMGH 61	24.60	17.40	21.00
13	CSH-53	TMGH 62	25.75	15.01	20.38
14	CSH-18	TMGH 63	25.80	17.96	21.88
15	CS-61	TMGH 64	26.40	18.96	22.68
16	LRK 516	TMGH 65	24.75	18.96	21.90

Germplasm CSH –53 recorded highest fibre length (27.15 mm) and CSH-59 showed the highest fibre strength (24.35 g/tex) also. The highest uniformity ratio was recorded in the germplasm CS-61 (52.5 %) followed by SOCB 92 (51.5%) (Table 1.4.4).

The seed index of 16 germplasm lines evaluated ranged from 6.43 – 8.74 g. Highest seed index was recorded in CSH-59 (8.74 g) as compared to check LRK 516 (8.20 g). Lint index varied from 2.95 – 5.05 Lint index of 5.00 were recorded in CSH-53 followed by 4.72 g in SOCB – 92. CSH 53 (39.88 %) followed by PKV 802 (37.68 %) indicated a high ginning out turn as compared to check LRK 516 (37.46%).

Table 1.4.4 : Fibre properties

S. No.	NAME	Code	2.5% span length (mm)	Uniformity ration (%)	Fineness micronaire	Tenacity (g/tex)
1	B4-EMPIRE	TMGH 50	25.02	48.5	4.10	20.05
2	LH 372	TMGH 51	25.36	49.0	4.40	21.50
3	DCI 108	TMGH 52	23.32	48.0	4.35	18.30
4	SOCB 67	TMGH 53	25.60	48.5	4.45	18.40
5	PKV802	TMGH 54	22.85	49.0	5.05	17.95
6	JK 344	TMGH 55	25.31	49.0	4.15	19.30
7	DCI 122	TMGH 56	24.92	52.0	4.85	18.45
8	SOCB 92	TMGH 57	24.77	51.5	3.95	19.35
9	76-I-23	TMGH 58	24.85	48.5	3.95	18.00
10	CSH-23	TMGH 59	26.82	49.0	4.05	21.60
11	CSH-59	TMGH 60	26.05	48.5	4.10	24.35
12	CSH-17	TMGH 61	27.00	45.5	3.75	23.80
13	CSH-53	TMGH 62	27.15	46.5	3.80	19.70
14	CSH-18	TMGH 63	24.70	49.5	3.85	18.85
15	CS-61	TMGH 64	27.02	52.5	3.75	19.85
16	LRK 516	TMGH 65	26.88	49.0	3.75	19.60

❖ **Multilocation evaluation of various breeding material in *G.arboreum***

***G. arboreum* Advance Culture**

Among the 8 advanced cultures of *G. arboreum* evaluated at four different locations, the mean seed cotton yield ranged from 9.27-13.23 q/ha. Culture LD 778 recorded the highest mean seed cotton yield of 13.23 q/ha followed by LD 794 (12.08 q/ha). Check AKH-4 recorded a mean seed cotton yield of 9.27 q/ha.

Seed oil content ranged between 17.98 - 20.04% . Among these 8 cultures, highest seed oil content was recorded in LD 838 (20.04 %) followed by LD 694 (19.64 %) as compared to check AKH 4 (17.78 %) Table 1.4.5.

Table 1.4.5 : Seed oil content

S.NO.	Name	Code	Nagpur	Khandwa	Faridkot	Mean
1	CINA 306	TMOA 1	21.27	19.13	18.3	19.56
2	CINA 329	TMOA 3	19.10	17.15	17.7	17.98
3	AKH4	TMOA 5	20.40	19.92	17.8	19.37
4	CINA 323A	TMOA 7	20.03	19.42	17.7	19.05
5	LD 838	TMOA 9	21.57	19.66	18.9	20.04*
6	LD 694	TMOA 10	21.93	17.40	19.6	19.64
7	LD 778	TMOA 13	20.90	17.09	18.4	18.79
8	LD 794	TMOA 14	20.53	15.11	17.7	17.78

Highest span length of 26.00 mm as well and fibre strength of 20.65 (g/tex) was recorded in CINA 306. (Table 1.4.6).

Table 1.4.6 : Fibre Properties

S. No.	Name	Code	2.5% span length (mm)	Uniformity ration (%)	Fineness micronaire	Tenacity (g/tex)
1	CINA 306	TMOA 1	26.00	57.0	4.85	20.65
2	CINA 329	TMOA 3	25.28	50.0	5.25	20.15
3	AKH4	TMOA 5	25.31	50.0	5.10	20.70
4	CINA 323A	TMOA 7	25.51	50.0	5.15	19.10
5	LD 838	TMOA 9	18.66	53.0	6.95	15.85
6	LD 694	TMOA 10	18.38	53.0	7.10	14.95
7	LD 778	TMOA 13	18.71	52.5	3.25	15.35
8	LD 794	TMOA 14	17.68	53.5	7.35	14.40

The seed index of total 8 *G. arboreum* cultures ranged from 4.48 – 5.90 g. Highest seed index was recorded in CINA 323A (5.90 g) as compared to check AKH 4 (5.32 g). Lint index varied from 1.87 – 3.49 g. Highest lint index of 3.49 g were recorded in CINA 306 followed by 3.37 g in LD 694. Highest ginning out turn was observed in advanced culture of *G. arboreum*, LD 694 (41.34%) followed by LD 838 (41.08%) as compared to check AKH-4 (31.01%).

***G. arboreum* germplasm**

In this trial, 11 germplasm lines were evaluated at four different locations. Highest seed cotton yield of 15.65 q/ha was recorded in 6743 followed by 12.45 q/ha in 6686. Check AKH-4 recorded comparatively a mean seed cotton yield of 9.67 q/ha. The seed oil content of *G. arboreum* germplasm varied from 16.90 - 20.31 %. Highest seed oil of 20.31% were recorded in germplasm lines of 6743 as compared to check AKH-4 (18.89%) (Table 1.4.7).

Table 1.4.7 : Seed Oil

S. No.	NAME	CODE	Nagpur	Khandwa	Faridkot	Mean
1	6760	TMGA 1	21.10	17.31	16.6	16.60
2	6707	TMGA 2	22.55	18.87	16.9	16.90
3	6755	TMGA 3	20.25	19.38	17.7	19.11
4	6704	TMGA 5	21.75	16.37	18.0	18.70
5	6688	TMGA 6	21.40	17.51	18.3	19.07
6	6686	TMGA 7	20.95	19.90	17.2	19.35
7	6743	TMGA 8	21.95	19.89	19.1	20.31

8	6694	TMGA 9	20.55	18.44	18.9	19.29
9	6763	TMGA 10	20.55	19.53	19.0	19.69
10	LD 790	TMGA 12	21.35	19.11	18.2	19.55
11	AKH4	TMGA 15	20.45	17.44	18.8	18.89

Among the germplasm lines evaluated, line 6704 recorded the highest fibre length of 23.90 mm and line 6707 recorded the highest fibre strength of 20.35 (g/tex) (Table 1.4.8).

Table 1.4. 8 : Fibre Properties

S. No.	Name	Code	2.5% span length (mm)	Uniformity ratio (%)	Fineness micronaire	Tenacity (g/tex)
1	6760	TMGA 1	22.45	48.50	5.2	18.75
2	6707	TMGA 2	23.85	49.00	5.3	20.35
3	6755	TMGA 3	22.25	48.00	5.4	19.05
4	6704	TMGA 5	23.90	48.50	5.2	19.25
5	6688	TMGA 6	22.05	49.00	5.9	18.00
6	6686	TMGA 7	20.30	49.00	6.3	17.45
7	6743	TMGA 8	19.20	52.00	7.0	15.95
8	6694	TMGA 9	23.05	51.50	5.9	18.10
9	6763	TMGA 10	21.55	48.50	6.2	18.25
10	LD 790	TMGA 12	22.10	49.00	6.4	18.00
11	AKH4	TMGA 15	20.20	48.50	5.8	16.05

The seed index of 11 germplasm lines of *G.arboreum* ranged from 4.88 -5.73 g. Highest seed index was recorded in 6766 (5.73 g) as compared to check AKH – 4 (5.39 g). Lint index varied from 1.00 - 3.85 g. LD 790 (38.75%) recorded a high ginning out turn.

***G. hirsutum* Segregating Lines -**

Among the 16 segregating lines of *G. hirsutum*, seed oil content ranged from 14.29 - 22.89 %. Highest seed oil content was recorded in 39 R (22.89%) followed by CSHH 243 (22.76%) and CSHH 4311 (22.51%). Check LRK 516 recorded seed oil content of 20.95% (Table 1.4.9).

Table 1.4.9 Seed oil content

S. No.	Name	Code	Nagpur	Khandwa	Faridkot	Mean
1	CSHH 431	TMSGH 30	27.3	15.58	-	14.29
2	CSHH 258	TMSGH 31	27.3	15.74	19.6	20.88
3	CSHH 825	TMSGH 32	25.6	17.84	20.3	21.91
4	CSHH 4311	TMSGH 33	24.3	20.74	20.5	22.51

5	CSHH 4345	TMSGH 34	25.5	19.64	19.2	21.88
6	CSHH 243	TMSGH 35	25.3	21.78	18.1	22.76
7	62R	TMSGH 36	26.3	21.90	17.8	22.00
8	13R	TMSGH 37	24.3	15.90	19.1	19.40
9	44R	TMSGH 38	25.2	14.52	-	19.61
10	25R	TMSGH 39	23.7	17.10	18.5	13.60
11	117R	TMSGH 40	26.3	13.16	20.3	19.32
12	58R	TMSGH 41	27.1	13.54	19.0	20.31
13	41R	TMSGH 42	26.9	18.80	19.4	21.57
14	105R	TMSGH 43	26.1	21.36	20.8	22.29
15	39R	TMSGH 44	26.7	21.16	20.1	22.89*
16	LRK 516 (C)	TMSGH 45	26.5	16.26	19.2	20.95

CSHH 431 recorded the highest seed cotton yield (28.06 q/ha), followed by 13 R (26.60 q/ha), CSHH 258 (23.28 q/ha), CSHH 4311 (22.92 q/ha) and CSHH 825 (20.98 q/ha). The highest 2.5% span length 28.2 mm was recorded by CSH 825, 44 R (28.1 mm), CSHH 258 (27.8 mm) and 105 R (27.6 mm). CSHH 258 had the highest strength (24.2 g/tex). Check LRK 516 recorded fibre strength 24.0 g/tex). The uniformity ratio was recorded by 58 R (53%). The highest ginning outturn (35.0%), seed index (12.13 g) and lint index (5.56 g) was recorded by 58 R, CS 4345, 44 R respectively. (Table 1.4.10)

Table 1.4.10 : Fibre Properties

S. No.	NAME	Code	Seed Cotton yield	2.5% span length (mm)	Uniformity ratio (%)	Fineness micronaire	Tenacity (g/tex)
1	CSHH 431	TMSGH 30	28.06	27.5	49	4.9	21.9
2	CSHH 258	TMSGH 31	23.28	27.8	45	4.1	24.2
3	CSHH 825	TMSGH 32	20.98	28.2	45	4.2	23.0
4	CSHH 4311	TMSGH 33	22.92	25.4	51	5.1	22.1
5	CSHH 4345	TMSGH 34	19.55	26.0	50	4.3	21.7
6	CSHH 243	TMSGH 35	20.62	25.8	48	5.3	19.7
7	62R	TMSGH 36	17.16	22.8	50	4.8	20.0
8	13R	TMSGH 37	26.60	25.4	52	4.0	21.7
9	44R	TMSGH 38	4.09	28.1	52	4.4	21.5
10	25R	TMSGH 39	10.07	26.2	49	4.1	20.9
11	117R	TMSGH 40	14.98	26.4	50	4.5	21.1
12	58R	TMSGH 41	6.68	24.5	53	4.8	20.7
13	41R	TMSGH 42	9.55	25.1	48	4.2	21.2
14	105R	TMSGH 43	2.92	27.6	47	4.3	21.1
15	39R	TMSGH 44	6.66	24.5	51	5.1	20.8
16	LRK 516 (C)	TMSGH 45	20.41	28.1	49	3.6	24.0

❖ **Screening of available gene pool and breeding material for high oil content**

PAU Regional Station, Faridkot

BREEDING MATERIALS : In diallel cross (6 × 6), F 1988 × B. Lint CSA (20.5%), F 1977 × Taskant 3 (20.2%), May Acala × Taskant 3 (20.2%), F 1945 × F 1977 (21.4%), Taskant 3 × F 1977 (20.6%), Taskant 3 × May Acala (21.5%) and B. Lint CSA × Taskant 3 (20.5%) exhibited higher oil content than the best parent F 1945 (20.1%)
Thirty three F2 plants, 25 F3 and 25 F4 single plant selected on visual basis for seed cotton yield and other traits were also analysed for oil content .

FATTY ACID CONTENT : Thirty two genotypes/single plants of *Gossypium hirsutum* and 18 genotypes of *G. arboreum*, selected on the basis of higher oil content were analysed for fatty acid content and the results are presented in (Table 1.4.11).

IMPROVEMENT OF SEED OIL CONTENT : To ameliorate the percentage oil content in future breeding materials, the entries with high oil content were crossed with well adaptive and promising genotypes using different mating designs.

Table 1.4.11 : Fatty acid content of some selected genotypes/crosses at Faridkot

Genotype/cross	Palmitic acid (16:0)	Stearic acid (18:0)	Oleic acid (18:1)	Linoleic acid (18:2)
<i>hirsutum</i> cotton				
HAG 1055	29.15	-	18.52	51.34
F 2020	27.27	2.62	21.48	47.55
CSH 4299	24.86	2.50	22.06	48.71
DHH 361	26.66	2.35	21.55	48.42
RAHH 16	27.51	2.56	22.14	45.24
Atal	27.98	1.95	19.26	48.59
NCHH 55	27.18	3.07	18.76	48.79
KHH 121	25.75	2.92	22.46	48.17
ARBHH 364	22.66	2.85	22.74	46.98
MRC 670	26.47	2.64	21.48	48.20
LAMCH 6	28.64	1.37	18.56	50.40
PCHH 104	26.62	2.51	20.91	48.91
LMSH 50	25.15	1.82	19.35	52.94
RAJHHG 9	24.93	2.43	19.90	50.51

TMOH 4	26.03	2.17	19.10	51.54
TMOH 34	27.24	2.34	19.51	49.93
TMOH 25	26.87	2.38	18.49	51.10
TMSGH 33	26.60	2.02	22.60	47.97
TMSGH 40	27.93	2.42	16.78	51.39
TMSGH 43	27.68	2.00	18.14	51.24
F 1988X B.Lint CSA	26.17	2.31	19.47	50.97
F 1945X F 1977	26.48	2.16	17.95	50.55
Taskant 3 X F 1977	22.96	2.41	19.39	54.50
Taskant 3 X May Acala	26.14	1.52	19.26	52.24
CSH 2572	25.39	2.71	16.79	53.81
<i>hirsutum</i> cotton				
TMOH 27	26.51	2.18	18.00	52.38
Diallel 30	28.97	2.49	21.05	47.12
B.Lint CSA X Taskant 3	27.96	2.32	19.39	49.39
F 2138	26.78	2.56	21.91	47.31
ARB 904	27.05	2.40	20.72	49.05
F 2139	28.30	2.54	20.50	46.94
F 1861	27.20	1.96	20.33	49.64
F 2151	26.10	2.23	21.31	47.51
F 2152	29.23	2.82	22.20	44.15
F 2156	28.07	2.18	20.68	48.63
OC-2-1	22.53	2.56	22.05	51.98
OC-2-4	29.53	2.80	20.82	45.86
OC-2-7	26.30	2.41	25.68	44.64
OC-2-36	28.19	2.04	21.45	48.30
F3 Sandocot 708(3002)	29.43	1.61	22.38	45.85
F3 F1946XRCH138 (3043)	25.84	2.49	21.48	49.40
F4 F 1946X(F1914 X AKH081)(4091)	26.88	2.42	21.37	49.32
<i>arboreum</i> cotton				
JLA 2199	26.36	2.57	23.71	46.30
LD 866	27.16	2.38	25.32	44.03
LD 694	27.09	1.70	28.02	42.73
CISA 614	27.48	2.27	27.11	42.14
TMOA 10	27.62	2.59	26.98	42.78
TMOA 9	27.44	2.55	28.08	40.49

TMGA 9	28.62	1.62	29.45	40.48
TMGA 10	27.62	2.59	26.98	42.78
TMGA 12	26.85	2.54	26.52	42.57
AAH-1	26.73	2.35	26.13	44.78
Moti	27.47	1.76	27.20	42.99
662	26.31	2.35	26.30	44.31
FMDH 4	27.04	2.23	29.10	41.21
RAJDH 183	26.63	1.86	26.68	44.42
AAH 20	26.33	2.38	26.77	43.73
ARDH 99	27.77	2.29	24.85	45.10
PA 565	27.96	1.75	27.58	42.27
AAH 18	27.96	1.75	27.58	42.27

CICR Regional Station, Sirsa

❖ Evaluation of segregating materials of *G. hirsutum*

In this trial 16 entries were evaluated and 31 single plants with desirable traits were selected. The highest mean single plant seed cotton yield 229.7 g was recorded by P2 plant of TMGH 42 followed by 205.0 g in P1 plant of TMGH 33. These single plant selections will be sown in the next crop season for further studies. The single plant selected from entry P6 plant of TMGH 40 recorded the highest ginning outturn of 38.2 % followed by 37.4 % in P1 plant of TMGH 30 and 37.0 % in P2 plant of TMGH 33.

❖ Screening of available gene pool and breeding material for high oil content

Eight germplasm lines, 55 CMS, 11 GMS and 13 Restorer lines of *G. hirsutum* were evaluated for estimation of oil content, Seventeen entries viz. CISV 4, SPC 11 x CIR 9-1-1, CMS LRA 5166, CMS F 846, CMS 39 Jhorar, CMS 55 LRA 5166, CMS 101 - Jhorar, CMS 101- SH 2379, CMS 16, CMS 114- CB 9, CMS 144 -CB 9, CMS 148- PIL 8, CMS 27- Jhorar, CMS 18, CMS 23-16, CMS 19-CB 25 and CMS 24 -Jhorar were found to contain more than 26 % seed cotton oil content. (Table 1.4.12).

Table 1.4.12 : Estimation of oil content in different entries of *G. hirsutum*

S. No.	Germplasm lines	% OIL	S. No.	CMS Lines	% OIL
1	CISV -1	24.3	11	CMS K 34007	21.9
2	CISV -2	22.7	12	CMS F 846	26.3
3	CISV -3	23.4	13	CMS 27 CB 9	23.6

4	CISV -4	26.5	14	CMS 30 PIL 8	25.0
5	SPC 62	22.4	15	CMS 37 PIL 8	25.1
6	RST 9	22.9	16	CMS 47 PIL 8	23.9
7	LSS	21.7	17	CMS 25 CB 21	25.3
8	BN	24.7	18	CMS 39 JHORAR	26.2
GMS lines			19	CMS 42 PIL 8	25.4
1	CSHG 13	25.1	20	CMS 55 LRA 5166	26.5
2	CSHG 14	25.2	21	CMS 57 JHORAR	25.2
3	CSHG 15	25.2	22	CMS RST 9	24.2
4	CSHG 16	25.0	23	CMS 74	23.8
5	CSHG 16 A	23.7	24	CMS 66	25.6
6	CSHG 12509	25.4	25	CMS 82	25.0
7	CSHG12519	25.2	26	CMS LAXMI	24.6
8	CSHG 185812	24.0	27	CMS 101 CB 2	25.0
9	CSHG 185814	23.8	28	CMS 101 CB 9	23.0
10	CSHG-185816	23.0	29	CMS 101 JHORAR	26.1
11	CSHG 185817	23.0	30	CMS 101 SH 2379	25.7
Restorer lines			31	CMS 101 LRA 5166	25.3
1	CIR 6	24.6	32	CMS 105 PIL 43	25.8
2	CIR 40	22.8	33	CMS 16	26.6
3	CIR 46	24.4	34	CMS 114 CB 9	26.4
4	CIR 49	25.8	35	CMS LSS 1	23.5
5	CIR 61	25.1	36	CMS LSS 1	24.3
6	CIR -73	23.6	37	CMS 125 CB 9	23.1
7	SPC 11 x CIR 9- 1-1	26.5	38	CMS 126 CB 6	25.3
8	SPC 9 x CIR 26- 2-5	23.4	39	CMS 133 LRA 5166	25.2
9	SPC 9 x CIR 20-1-1	23.1	40	CMS 139 LSS-1	23.0
10	SPC 11 x CIR 9-1-8	23.1	41	CMS 141 CB 9	24.1
11	SPC 9 x CIR 7- 3-2	23.3	42	CMS 141 CB 9	25.1
12	SPC 9 x CIR 26- 3-1	23.6	43	CMS 142 PIL 8	25.2
13	SPC 9 x CIR 7 1-3	24.9	44	CMS 144 CB 9	26.9
CMS lines			45	CMS 145 PIL 8	23.2
1	CMS LRA 5166	27.2	46	CMS 148 PIL 8	26.1
2	CMS Jhorar	23.3	47	CMS 25 JHORAR	25.2
3	CMS Pusa 31	23.9	48	CMS 27 JHORAR	26.1
4	CMS LH 1134	24.3	49	CMS 12	23.0
5	CMS K34007	25.2	50	CMS 18	27.8
6	CMS H 777	23.9	51	CMS 8	24.9
7	CMS NZP-562	25.1	52	CMS 23 -16	27.4
8	CMS Bikaneri Narma	25.1	53	CMS 25 CB 3	24.9
9	CMS F 1183	23.9	54	CMS 19 CB 25	26.7
10	CMS SH 2379	21.8	55	CMS 24 JHORAR	26.4

CICR, Nagpur

Cultures Developed : 24 cultures were identified for high oil content and other economic characters. Some of the promising cultures observed were 3K, 24K, 9DC SP₂, 40 EP. (Table 1.4.13).

Table 1.4.13

S. No.	Name	Yield q/ha	Oil % (NIR)	Seed Index	Lint Index	Ginning percent
1	14K	8.85	23.87	6.85	3.73	34.61
2	23K	9.00	23.50	6.85	3.85	36.41
3	32K	7.17	26.17	7.02	3.52	35.17
4	3K	10.05	27.07	7.58	3.56	29.95
5	25K	9.63	25.53	7.18	4.06	36.22
6	24K	10.71	26.23	7.13	4.05	36.03
7	9DC-SP ₂	11.23	18.33	7.58	4.17	36.57
8	24DC-SP ₁	7.83	24.40	7.78	4.70	39.75
9	16DC-SP ₁	8.35	25.25	7.58	4.04	34.29
10	26B	8.82	25.60	7.73	4.29	35.78
11	34K	8.05	24.00	7.33	3.98	35.65
12	20K-SP ₁	8.46	27.60	7.10	3.51	32.63
13	10ES	9.82	25.10	7.30	3.93	32.96
14	12HS	7.90	23.90	6.77	4.02	38.83
15	26DC-SP ₁	7.51	23.60	8.63	4.54	34.58
16	23ES	9.31	25.43	7.75	4.09	34.36
17	13ES	9.94	22.93	7.68	3.95	34.91
18	12ES	9.62	25.27	6.70	3.17	32.21
19	2HS	9.52	26.45	8.88	4.39	31.95
20	40EP	11.40	24.20	7.35	4.08	35.37
21	1HS	10.78	22.80	8.20	5.04	36.36
22	10HS	10.09	22.90	8.00	4.76	40.85
23	3HS	8.497	25.60	9.10	2.85	31.32
24	LRK516	9.70	26.00	7.30	3.71	34.08

Among the developed cultures evaluated, 25K, 16 DC SP₁ and 26DC-SP showed good fibre length, fineness as well as desirable fibre strength. (Table 1.4.14).

Table 1.4.14 :

S. No.	Names	2.5% span length (mm)	Uniformity ratio (%)	micronaire	Tenacity (g/tex)
1	14K	26.3	48	3.4	19.8
2	23K	22.4	51	4.1	18.5
3	32K	25.6	51	3.5	20.1
4	3K	23.1	51	3.7	18.8
5	25K	25.8	52	3.5	20.6
6	24K	22.2	50	4.4	16.4
7	9DC-SP ₂	26.0	50	4.4	18.2
8	9DC-SP ₃	25.2	50	4.5	18.1

9	24DC-SP1	27.0	49	3.9	19.8
10	16DC-SP1	27.6	51	3.5	22.0
11	26B	24.1	51	4.1	18.3
12	34K	24.9	49	4.3	17.3
13	LRK516	26.7	49	3.2	19.2
14	10ES	22.5	52	4.8	17.9
15	12HS	22.9	52	3.9	19.4
16	26DC-SP1	28.2	48	3.9	19.4
17	23ES	23.5	50	4.3	17.1
18	13ES	23.8	51	3.8	18.1
19	12ES	24.4	51	3.7	18.9
20	2HS	22.5	51	4.9	17.6
21	40EP	24.2	49	4.2	19.5
22	1HS	23.7	51	4.9	17.2
23	10HS	22.6	53	4.1	18.5
24	3HS	23.9	51	4.2	18.2

Culture CNHO 12 has been promoted to Br 03 (a) AICCIP Trial in South zone, Central zone and North Zone and CNHO 3 has been promoted to Br 03 (b) in South zone for the season 2005-06.

Estimation of oil by extraction :

Oil content has been estimated by Soxtec analyser in the following samples with petroleum ether 60-80°C. All the seed samples were ground with uniform particle size. Detailed data have been presented in the related tables.

- ❖ **GFA series : 27 samples** (Table 1.4.17)
- ❖ **Crossed materials for fatty acid evaluation : 16 samples** (Table 1.4.16)
- ❖ The following advance cultures have shown promise for very high oil content:
 - K2 X 7949 (27.1%),
 - L147 X SP3 (26.4%),
 - BN X 481 (26.2%),
 - K3 X ORS) (K2 X SP3 7) (26.7%).
- ❖ Some of the single plant selections have also been found to contain high oil percent.
- ❖ *G. arboreum* cultures like CINA 313, CINA 305, CINA 323A, LD 694 AND LD 733 can also be promoted further for oil purpose Table 1.4.19.
- ❖ Among GFA series also, some crosses indicate high oil content.

Fatty acid determination

- ❖ Hydrolysis and esterification has been completed in 46 cottonseed oil samples of single plant selections.
- ❖ Fatty acid profile has been determined in some germplasm lines, the results of which are depicted in Table 1.4.20.

Table 1.4.16 : Oil Content Fatty Acid Cross Material In FA Series 2003 – 2004

S. No.	Cross material	Sample Name	Mean oil content (%)
1	(JK344 x HAMPI) JK344	FA – 3	16.62
2	(JK344 x HAMPI) HAMPI	FA – 4	20.73
3	(PKV802 X B-56-181) PKV802	FA – 7	21.68
4	(PKV804 X B-56-181) PKV804	FA – 9	21.51
5	(PKV804 X DCI 116) DCI 116	FA – 12	22.15
6	(B-56-181 X LH 372) LH 372	FA – 15	20.49
7	(B-56-181 X LH 372) LH 372	FA – 16	23.54
8	(DCI 10 X HAMPI) HAMPI	FA – 17	23.74
9	(B-4-EMPIRE X B-56-181) B-56-181	FA - 23	18.76
10	(B-4-EMPIRE X DCI 116) B-4-EMPIRE	FA – 25	21.17
11	(B-4-EMPIRE X DCI 116) DCI 116	FA – 26	23.89
12	(76-IH-23 X LH372) LH 372	FA – 27	22.76
13	(76-IH-23 X LH372) 76-IH-23	FA – 28	23.43
14	(DCI 116 X HAMPI) DCI 116	FA – 29	21.98
15	(DCI 116 X) HAMPI	FA – 30	22.09
16	(DCI 122 X HAMPI) HAMPI	FA – 34	22.05

Table 1.4.17 : Oil Content In F2 (Fatty Acid) GFA – Series 2003 – 2004

S. No.	Cross material	Mean oil content (%)
1.	JK 344 x LH 372	14.54
2.	JK 344 x HAMPI	25.55
3.	JK 344 x HAMPI	20.15
4.	JK 344 x HAMPI	19.91

5.	PKV 0802 x B - 56 -181	22.64
6	PKV 0802 x DCI 116	19.70
7.	PKV 0804 x B - 56 -181	19.78
8.	PKV 0804 x DCI 116	21.69
9.	PKV 0804 x HAMPI	14.15
10.	PKV 0804 x HAMPI	18.33
11.	PKV 0804 x HAMPI	20.23
12.	DCI 108 x HAMPI	21.23
13.	B-56-181 x LH 372	21.03
14.	LH 372 x DCI 108	16.06
15.	LH 372 x DCI 116	20.46
16.	B4 EMPIRE x B-56-181	19.13
17.	B4 EMPIRE x DCI 116	21.59
18.	76-LH-23 x LH 372	20.82
19.	DCI 116 x HAMPI	17.16
20.	DCI 122 x LH 372	22.24
21.	DCI 122 x HAMPI	23.50
22.	DHY 286 x LH 372	21.70
23.	DHY 286 x HAMPI	20.83
24.	HAMPI x PKV 0802	21.66
25.	HAMPI x B-56-181	16.78
26.	HAMPI x BEMPIRE	20.03
27.	HAMPI x 76-IH-23	21.70

Table 1.4.18 : Seed Oil Content in G.hirsutum Germplasm Lines 2003 – 2004

S.No.	Genotype	Mean oil content (%)
1	JK 344	18.80
2	PKV 0802	17.32
3	PKV 0804	21.66
4	150-3-1-1	20.37
5	B-56-181	17.19
6	DCI-108	20.14
7	LH-372	16.47
8	B4	25.26
9	76-IH-23	19.69
10	DCI-116	21.17
11	DCI-122	18.68
12	DHY-286	19.24
13	HAMPI	17.23
14	H-777	19.70
15	86-1A-1	19.29

Table 1.4.19 : Oil content in some *G. arboreum* germplasm lines (2003 – 04)

S.No	Genotype	Mean Oil Content (%)
1	CINA - 306	20.48
3	CINA - 329	18.98
4	CINA - 330	20.58
5	AKH - 4	21.03
6	CINA - 305	21.71
7	CINA - 323A	21.79
8	CINA - 323B	21.41
9	LD - 838	19.44
10	LD - 694	22.37
11	LD - 835	19.98
12	LD - 733	22.00

Table 1.4.20 : Oil Content & percent fatty acid profile in *G. hirsutum* germplasm line

Genotype	Oil content	Fatty Acid profile (% composition)			
		Palmitic	Stearic	Oleic	Linoleic
MCU 5 VT	22.15	21.33	3.18	20.59	51.99
LRA 5166	25.23	22.23	3.20	22.57	50.82
DHY-286	23.56	19.53	2.83	21.90	55.13
MCU-5	25.61	19.28	3.08	26.82	49.55
DEVIRAJ	24.82	17.81	3.20	23.43	51.76
G 67	26.22	14.04	1.73	27.80	42.68

CICR Regional Station, Coimbatore

- ❖ The single plant selections made from the F2 segregating populations were evaluated for seed oil content. Among the segregating materials, TMSGH 21-(3), TMSGH 15-(3) possessed seed oil content around 25%, whereas TMSGH 20(2), TMSGH 20 (7), TMSGH 18-(5), TMSGH 18 (7) were noticed to possess around 27%.

- ❖ Biochemical and biometrical observations were recorded at regular intervals to assess the metabolic status of the F3 generation materials from specific crosses viz., Sumangala x F776, M5KD933 x F776, CBR3 x F1861 generated from the previous year trial along with the segregating populations received from CICR, Nagpur.
- ❖ Metabolic status of the crop was monitored at regular intervals during the crop phenophase. Among the genotypes analysed, Nitrate Reductase activity ranged between 4 to 7 $\mu\text{moles/h/g}$ fr.wt. This revealed the better nitrogen assimilation during the crop growth in selected cultures. Similarly, reducing sugar, protein and peroxidase activity were found gradually increasing up to 120 days after sowing stage, which implied that the selected cultures had better metabolic status during crop growth period.
- ❖ Single plant selections were made from the F2 segregating materials that were received earlier from CICR, Nagpur. These were analyzed for seed oil content.
- ❖ Further selections were made from the F3 crop for seed oil content evaluation and these lines would be advanced to next generation for further evaluation. Among these selections, Anjali x (A x F 1861) - 3 (2), Anjali x (A x F 1861) - 3 (5) were found superior with better morphophysiological attributes.
- ❖ Seed oil content of all the cultures and genotypes were estimated using earlier standardized cold percolation method with further refinement to enable still more accuracy and low sample utility. Further, the oil samples have been subjected to methyl ester preparation and preserved for further evaluation of fatty acid profile in selected high yielding cultures.