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The Incredible and Inevitable Technologies that Unlocked the Milestones in Indian Cotton Production

Contd. from Issue No. 35, dated 9th February, 2021

GUEST COLUMN

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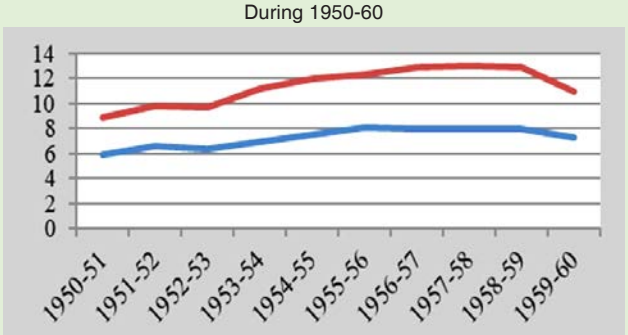
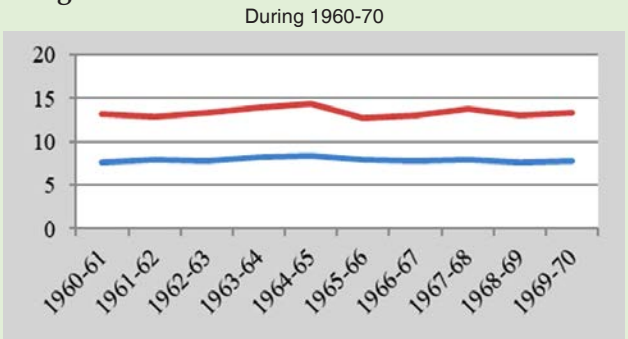
Dr. (Mrs.) Usha Rani is currently Principal Scientist at ICAR- Central Institute for Cotton Research, Regional Station, Coimbatore. She earned her B.Sc (Agri), M.Sc (Agri) and Ph.d in Agricultural Extension from Tamil Nadu Agricultural University. Her current research activities are dedicated to find out innovations in Transfer of Cotton Technology so that through support of appropriate, tailor made and translated technological information; yield and income of cotton growers can be enhanced. She has been dedicating since 2000 to the issue of Technology Transfer in Cotton through conducting nationwide demonstrations and has been involved in studies on usage of Information and Communication tools viz., web portal, mobile phone, social media etc., in dissemination of agricultural technologies and gender mainstreaming in cotton sector.

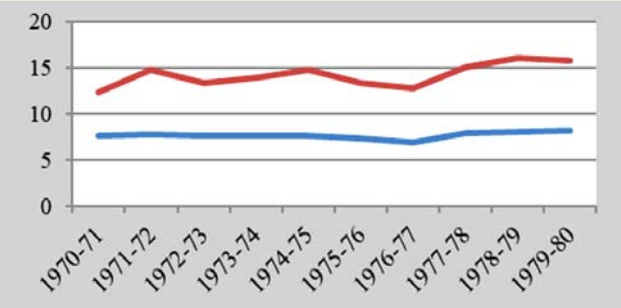
In general, Desi cotton varieties were considered as the technological catalysts that changed the cotton scenario in the country during the decade 1950-60 in which the average area and production of cotton were respectively 7.27 m ha and 4.09 m bales (170kg) (Figure 2).

Figure 2 –Decade-wise Area (m ha), Production (m bales (170kg)) and Productivity (kg/ha) of Indian Cotton during 1950 to 2018

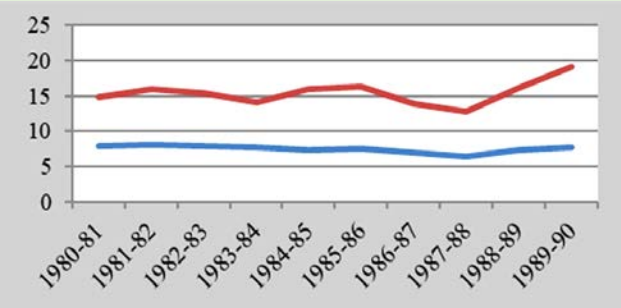




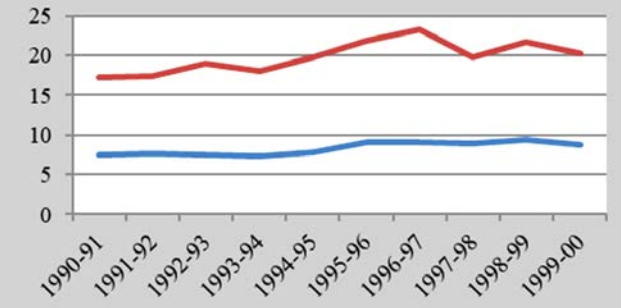
During 1970-80



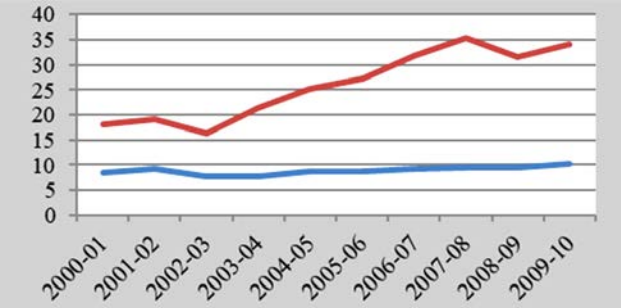
During 1980-90



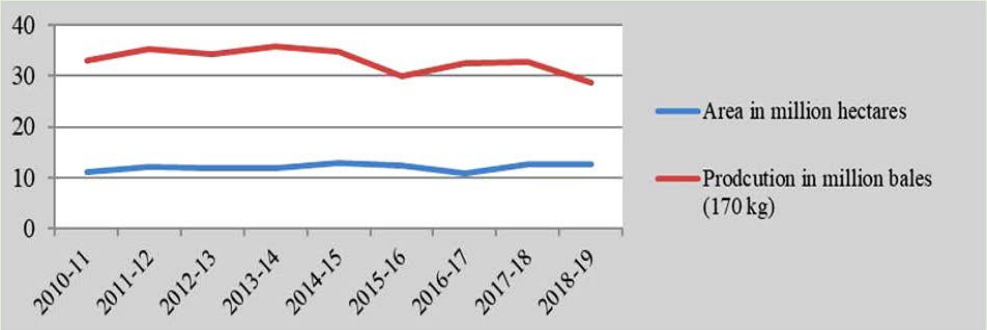
During 1990-2000



During 2000-2010



During 2010-2018



(Source: Agricultural Statistics at a Glance, 2019, Directorate of Economics and Statistics, DACAFW)

Improved and Indomitable Cotton Varieties Developed During 60s to 70s and Thereafter

The varietal improvement work in cotton started as early as in 1904, when Agricultural Departments were established in various states. It was further strengthened in 1923 when Indian Central Cotton Committee (ICCC) was constituted. The varietal improvement work got momentum with the inception of All India Coordinated Cotton Improvement Project (AICCIP) in April, 1967. After inception of AICCIP, cotton breeders started developing many varieties and hybrids with superior fibre quality for commercial cultivation in different states of India. The number of cotton varieties released from 1969 during various plan periods is presented below in Table 1.

Table 1
List of cotton variety / hybrid released during different plan period by the AICCIP

Plan period	Number of variety / hybrid developed
IV (1969-74)	22
V (1974-79)	26
VI (1980-85)	52
VII (1985-90)	30
VIII (1992-97)	57
IX (1997-02)	35
X (2002-07)	39
XI (2007-12)	32
XII (2012-17)	Notified = 13; Identified = 25

Among the varieties, there were a few varieties which transformed the way cotton had been cultivated in India like LRA 5166 (drought and water logging tolerant variety) which once occupied almost one fifth of the country's cotton area, Bikaneri Narma (a well adopted variety in North and Central India), Sujatha (can be spun up to 100s), Suvin (Extra Long Staple variety), MCU 5 (Long Staple quality variety), Anjali (Compact variety for rainfed areas and Rice Fallow Cotton production system), MCU 5 VT (*Verticillum* wilt tolerant variety), Surabhi (preferred by summer irrigated and organic cotton sector), F 414 and H777 (for cotton-wheat rotation in North Zone), LH 900 (early duration (150-155 days medium staple variety), RS 810, RS 2023, F1867, LH1556 and H1098 (Leaf Curl Virus resistant varieties) and Khandwa-2 (Jassid resistant medium staple variety) are just a few varieties to name.

The cotton breeders have taken up the enormous task of maintaining the purity of all released superior cotton varieties and ensured the production of quality breeder seeds (Prakash et al., 2016). These improved varieties enhanced productivity for different cotton growing tracts of the country during 1960s and thereafter.

Invincible Hybrid Cotton Emerged in 1970s

The "Father of hybrid cotton" – Dr. C. T. Patel, successfully developed the first intra-*hirsutum* cotton hybrid "Hybrid-4 (H-4)" in the year 1970 from main Cotton Research Station, Surat, of Gujarat Agricultural University. This was a turning point in Indian cotton scenario.

This was followed by the development of world's first inter-specific hybrid Varalaxmi in 1972 from University of Agricultural Sciences, Dharwad, by Dr. B. H. Katarki. Thereafter, development of hybrids got a momentum in India and both the public and private research wings started developing numerous location specific cotton hybrids (Usha Rani, 2020).

Development of hybrids thus created a strong base for the future introduction of Bt cotton in the country. This invincible technological development had a sharp impact on country's cotton production. There was significant increase in the production from 4.76 m bales in 1970-71 to 7.65 m bales at the end of the decade (1979-80).

Predominant Pesticides Prevail During 1980s

Literature say that indeterminate growth characteristics of the cotton crop attracts nearly 130 species of insect pests viz., sucking pests, bollworms, foliage feeders, root and stem feeders and strainers. Early attempt of managing these insect pests in cotton using chemicals started with commercial availability of DDT in 1940. Its high residual toxicities and arrival of new organophosphorus and carbomate group of insecticides during late 1960s changed their usage.

Late in 1980s, registration of synthetic pyrethroids during 1984-85 and their usage in cotton crop opened up a new horizon of pest control by chemicals in cotton. This technological development and its wider adoption had increased the cotton production from 7.01 million Indian bales in 1980-81 to 11.42 in 1989-90.

Integrated Protection and Production Technologies Practiced during 1990s Integrated Pest Management

The resistance to pyrethroids in *Helicoverpa armigera* was first recorded in 1987 in Andhra Pradesh followed by out breaks at Punjab, Gujarat and Madhya Pradesh. Also, the indiscriminate use of chemicals used to manage *Helicoverpa armigera* lead to a resurgence of Jassids in cotton crop. Similarly, the loss of natural enemies due to excessive use of chemicals facilitated the native pest Pink Bollworm to cause tremendous damage to the cotton crop in later stages.

To overcome all these problems due to usage of insecticides, a sustainable approach called Integrated Pest Management was disseminated in the eighties through participatory mode with farmers. The various components of IPM in cotton production include natural control, host plant resistance, cultural control, mechanical control, biological control, use of botanicals, behavioral control and Economic Threshold Level (ETL) based chemical control.

These IPM strategies proved effective and gained momentum during the eighties in India

and had a significant impact on the area and production of cotton. The adoption of IPM is not an easy task since its effects vary across regions, time and growth of the crop. Many development programs like Lab to Land program, Front Line Demonstrations and Institute Village Linkage Program supported the spread of this wonderful technology. Even now cotton growers adopt few of the components of IPM technology on their own.

IPM in consolidation with other integrated technologies like Integrated Nutrient Management, Integrated Water Management, Integrated Weed Management and Integrated Disease Management enabled the country to increase the acreage under cotton to 8.71 m ha and production to 11.53 m bales at the end of 90s.

Insecticides Resistance Management (IRM) Monitored During 1990s

As a part of the IPM approach, IRM programs with three basic components: monitoring pest complexes in the field for changes in population density, focusing on economic injury levels and integrating multiple control strategies have been implemented in the country in the 90s. IRM was more relevant to the management of crisis caused by insect resistance to insecticides.

In essence, all IRM strategies aim at optimising the use of insecticides in a manner that maximises their efficacy, minimises intensity of selection pressure, and mitigates the adverse effect on ecosystems and the environment. The tactics of enhancing efficacy include transient measures such as either the use of mixtures or use of least resisted conventional insecticides or targeting vulnerable stages of the pest.

Strategies to minimise selection pressure include either rotation of insecticide groups over space and or time, or use of alternative options such as bio-pesticides or ecosystem management or biological control or reduce application frequency (Kranthi, 2007).

These efficient strategies implemented through project mode under Technology Mission on Cotton Mini Mission II effectively monitored and managed insecticide resistance in cotton during 1990s and thereafter.

Even now, there are special programs for IRM- Pink Bollworm functioning with the financial support of Government of India.

Yield Enhancing Production Technologies

Technologies and recommendations pertaining to seed rate, spacing, crop geometry, planting methods, time of planting, nutrient management, weed management, crop rotation, cropping systems, mulching, intercropping, water management, etc., were able to increase productivity, reduce input costs and enhance profits from cotton production system in India during this decade and the trailed decades.

All these crop production and protection technologies had an impact on area and production of cotton in India. The area under cotton in 1990-91 (7.44 m ha) reached a new height of 8.71 during the end of the decade. Similarly, the production which was 9.84 m Indian bales in the early years of the decade reached 11.53 m bales during the latter part of the decade.

Inevitable Bt Cotton Since 2002

In 2002, as a milestone in the history of Indian cotton improvement and pest management, Bt cotton, a transgenic crop was permitted by the Genetic Engineering Advisory Committee for commercial cultivation. The introduction of this new genetically engineered crop has provided cotton growers with a new technology for managing bollworms in cotton. Reduced pesticides use, reduced production cost, improved yield and profit were listed by many scholars as among the numerous benefits of this novel technology.

The phenomenal achievements made through the adoption of this technology have brought production gains in the scenario of country's cotton sector during the first and second decades of 21st century.

In the same period, apart from the introduction of Cry toxins in the form of transgenic Bt-cotton technology, literature explained that some of the novel eco-friendly insecticides ensured effective control of *Helicoverpa armigera,* but less toxic to beneficial insects in the cotton ecosystem.

Additionally, few more insecticides and insect growth regulators, which are selectively more effective on the sucking pests and less toxic to beneficial insects as compared to all the conventional insecticides added to sustainable pest management (Kranthi, 2016). These effective crop protection chemicals along with transgenic Bt cotton hybrids, efficient production technologies, effective extension mechanisms and effectual development programs like Technology Mission on Cotton were the contributors for the remarkable increase in the country's cotton production from 8.62 million bales in 2002-03 to 28.71 in 2018-19.

Futuristic Technologies Needed for Indian Cotton Sector

A cutting-edge technology highly awaited for setting a milestone in the Indian cotton scenario, is a well-designed and field-tested cotton picker or harvester suitable to Indian conditions along with plant types and crop management strategies to permit mechanical picking.

According to cotton scientists, the other technologies that will bring about major changes include, high density planting system with short duration, compact Bt cotton varieties, early maturing, long-linted Desi cotton especially suited for rainfed and dry land areas of Central India, using efficient legume based cropping systems with cotton, partial mechanisation of sowing and harvesting cotton, convergence of INM, IWM, IPM, IRM strategies into an ecology based production system to reduce input costs and greater use of ICT based technologies to enable farmers to make informed choices (Venugopalan, 2018).

Conclusion

Indian cotton has set many milestones in its journey in terms of progress in quantitative and qualitative accomplishments. Analysis on decade-wise technological advancements after independence of the country reveals that the doughty Desi cotton in the earliest decade, improved and indomitable cotton varieties developed during 60s to 70s and thereafter, invincible hybrid cotton technology that emerged in 1970s and subsequently, predominate pyrethroids prevailed during 80s, integrated protection and production technologies practiced during 1990s and afterwards, inevitable Bt cotton technology during the first and second decades of the 21st century along with new molecules and moderately adopted machineries; were the incredible and inevitable technologies which unlocked these milestones in Indian cotton sector.

We strongly believe that the one single miracle technology needed to reach a further milestone in the history of Indian cotton scenario, is a well-designed and field-tested cotton picker suitable for the country's fragmented cotton fields.

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(The views expressed in this column are of the author and not that of Cotton Association of India)

Supply and Distribution of Cotton

February 1, 2021

Seasons begin on August 1 — Million Metric Tons

	2015/16	2016/17	2017/18	2018/19	2019/20 Est.	2020/21 Proj.
BEGINNING STOCKS						
WORLD TOTAL	22.95	20.47	18.68	18.78	18.51	21.18
China	14.12	12.65	10.35	9.03	8.88	8.94
USA	0.79	0.83	0.60	0.82	0..83	1.31
PRODUCTION						
WORLD TOTAL	**21.64**	**23.20**	**26.80**	**25.92**	**26.21**	**24.10**
India	5.75	5.87	6.35	5.61	6.07	6.20
China	5.20	4.90	5.89	6.04	5.80	5.91
USA	2.81	3.74	4.56	4.00	4.34	3.26
Pakistan	1.54	1.66	1.80	1.67	1.32	0.89
Brazil	1.29	1.53	2.01	2.78	3.00	2.65
Uzbekistan	0.83	0.79	0.80	0.64	0.72	0.55
Others	4.23	4.71	5.40	5.18	4.97	4.64
CONSUMPTION						
WORLD TOTAL	**24.33**	**24.85**	**26.44**	**25.98**	**22.77**	**24.10**
China	7.60	8.28	8.50	8.25	7.25	8.00
India	5.30	5.15	5.42	5.40	4.45	5.13
Pakistan	2.15	2.22	2.35	2.36	2.20	1.94
Europe & Turkey	1.68	1.61	1.80	1.70	1.60	1.65
Bangladesh	1.32	1.41	1.66	1.58	1.37	1.40
Vietnam	1.01	1.17	1.51	1.51	1.45	1.48
USA	0.75	0.71	0.70	0.63	0.47	0.52
Brazil	0.66	0.69	0.68	0.73	0.61	0.61
Others	3.87	3.62	3.82	3.83	3.36	3.36
EXPORTS						
WORLD TOTAL	**7.59**	**8.31**	**9.26**	**9.26**	**9.02**	**9.33**
USA	1.99	3.33	3.64	3.37	3.38	3.32
India	1.26	0.99	1.13	0.76	0.70	1.12
CFA Zone	0.98	1.00	1.06	1.18	0.96	1.23
Brazil	0.94	0.61	0.91	1.31	1.95	1.66
Uzbekistan	0.50	0.40	0.34	0.13	0.10	0.06
Australia	0.62	0.81	0.85	0.79	0.30	0.24
IMPORTS						
WORLD TOTAL	**7.84**	**8.10**	**9.00**	**9.05**	**8.26**	**9.33**
Bangladesh	1.38	1.41	1.67	1.54	1.37	1.38
Vietnam	1.00	1.20	1.52	1.51	1.46	1.48
China	0.96	1.10	1.32	2.10	1.55	2.00
Turkey	0.98	0.84	0.96	0.79	1.02	0.96
Indonesia	0.64	0.74	0.76	0.69	0.55	0.60
TRADE IMBALANCE 1/	**0.25**	**-0.21**	**-0.26**	**-0.20**	**-0.76**	**0.00**
STOCKS ADJUSTMENT 2/	**-0.04**	**0.07**	**0.00**	**0.00**	**-0.01**	**0.00**
ENDING STOCKS						
WORLD TOTAL	**20.47**	**18.68**	**18.78**	**18.51**	**21.18**	**21.18**
China	12.65	10.35	9.03	8.88	8.94	8.80
USA	0.83	0.60	0.82	0.83	1.31	0.73
ENDING STOCKS/MILL USE (%)						
WORLD-LESS-CHINA 3/	**47**	**50**	**54**	**54**	**79**	**77**
CHINA 4/	**166**	**125**	**106**	**108**	**123**	**110**
COTLOOK INDEX A 5/	**70.39**	**82.77**	**87.98**	**84.35**	**71.33**	

1/ The inclusion of linters and waste, changes in weight during transit, differences in reporting periods and measurement error account for differences between world imports and exports.

2/ Difference between calculated stocks and actual; amounts for forward seasons are anticipated.

3/ World-less-China's ending stocks divided by World-less-China's mill use, multiplied by 100.

4/ China's ending stocks divided by China's mill use, multiplied by 100.

5/ U.S. Cents per pound

Source : ICAC Cotton This Month, February 1, 2021

Revision in Testing Charges at CAI Laboratories

The following are the charges for cotton testing in the laboratories of the Cotton Association of India with effect from 1st October 2020.

Particulars	Per Sample Testing Fees in Rs.		
	Testing Fees	GST	Total
HVI Test	145	26	171
Micronaire Test	85	15	100
Colour Grade on HVI	85	15	100
Gravimetric Trash Test on HVI	85	15	100
Moisture	85	15	100
Grading (Manual Classing)	235	42	277

VOLUME BASED DISCOUNTS

Particulars	Per Sample Testing Fees in Rs.		
	Testing Fees	GST	Total
For 250 samples and above but less than 500 samples	140	25	165
For 500 samples and above but less than 750 samples	135	24	159
For 750 samples and above but less than 1000 samples	130	23	153
For 1000 samples and above but less than 2000 samples	125	23	148
For 2000 samples and above but less than 5000 samples	120	22	142
For 5000 samples and above but less than 10,000 samples	115	21	136
For 10,000 samples and above	100	18	118

The fees under the above volume based discount scheme is payable within 15 days from the receipt of the invoices to be raised on monthly basis.

We would also like to inform that the parties can avail the benefit of testing of cotton at multiple laboratories of the Associations against the CAI Credits made by them.

We earnestly request you to avail the facility of testing at the Association's laboratories.

COTTON ASSOCIATION OF INDIA
Established 1921
ISO 9001:2015

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UPCOUNTRY SPOT RATES

(Rs./Qtl)

Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Gravimetric Trash	Strength /GPT	Spot Rate (Upcountry) 2019-20 Crop February 2021 8th	9th	10th	11th	12th	13th
3	GUJ	ICS-102	Fine	22mm	4.0 – 6.0	13%	20	8436 (30000)	8492 (30200)	8492 (30200)	8464 (30100)	8492 (30200)	8492 (30200)
								Spot Rate (Upcountry) 2020-21 Crop					
1	P/H/R	ICS-101	Fine	Below 22mm	5.0 – 7.0	4%	15	10686 (38000)	10742 (38200)	10798 (38400)	10798 (38400)	10826 (38500)	10826 (38500)
2	P/H/R (SG)	ICS-201	Fine	Below 22mm	5.0 – 7.0	4.5%	15	10826 (38500)	10882 (38700)	10939 (38900)	10939 (38900)	10967 (39000)	10967 (39000)
3	GUJ	ICS-102	Fine	22mm	4.0 – 6.0	13%	20	- -	- -	- -	- -	- -	- -
4	KAR	ICS-103	Fine	23mm	4.0 – 5.5	4.5%	21	8689 (30900)	8745 (31100)	8802 (31300)	8773 (31200)	8802 (31300)	8802 (31300)
5	M/M (P)	ICS-104	Fine	24mm	4.0 – 5.5	4%	23	10714 (38100)	10770 (38300)	10826 (38500)	10798 (38400)	10826 (38500)	10826 (38500)
6	P/H/R (U) (SG)	ICS-202	Fine	27mm	3.5 – 4.9	4.5%	26	11979 (42600)	12063 (42900)	12204 (43400)	12120 (43100)	12204 (43400)	12204 (43400)
7	M/M(P)/ SA/TL	ICS-105	Fine	26mm	3.0 – 3.4	4%	25	9505 (33800)	9561 (34000)	9617 (34200)	9589 (34100)	9645 (34300)	9645 (34300)
8	P/H/R(U)	ICS-105	Fine	27mm	3.5 – 4.9	4%	26	12148 (43200)	12232 (43500)	12373 (44000)	12288 (43700)	12373 (44000)	12373 (44000)
9	M/M(P)/ SA/TL/G	ICS-105	Fine	27mm	3.0 – 3.4	4%	25	10039 (35700)	10095 (35900)	10151 (36100)	10123 (36000)	10179 (36200)	10179 (36200)
10	M/M(P)/ SA/TL	ICS-105	Fine	27mm	3.5 – 4.9	3.5%	26	10770 (38300)	10854 (38600)	10911 (38800)	10882 (38700)	10939 (38900)	10939 (38900)
11	P/H/R(U)	ICS-105	Fine	28mm	3.5 – 4.9	4%	27	12204 (43400)	12288 (43700)	12429 (44200)	12345 (43900)	12429 (44200)	12429 (44200)
12	M/M(P)	ICS-105	Fine	28mm	3.7 – 4.5	3.5%	27	12007 (42700)	12063 (42900)	12120 (43100)	12092 (43000)	12148 (43200)	12148 (43200)
13	SA/TL/K	ICS-105	Fine	28mm	3.7 – 4.5	3.5%	27	12035 (42800)	12092 (43000)	12148 (43200)	12120 (43100)	12176 (43300)	12176 (43300)
14	GUJ	ICS-105	Fine	28mm	3.7 – 4.5	3%	27	12035 (42800)	12035 (42800)	12092 (43000)	12063 (42900)	12120 (43100)	12120 (43100)
15	R(L)	ICS-105	Fine	29mm	3.7 – 4.5	3.5%	28	12148 (43200)	12232 (43500)	12373 (44000)	12317 (43800)	12401 (44100)	12401 (44100)
16	M/M(P)	ICS-105	Fine	29mm	3.7 – 4.5	3.5%	28	12317 (43800)	12373 (44000)	12429 (44200)	12401 (44100)	12457 (44300)	12457 (44300)
17	SA/TL/K	ICS-105	Fine	29mm	3.7 – 4.5	3%	28	12345 (43900)	12401 (44100)	12457 (44300)	12429 (44200)	12485 (44400)	12485 (44400)
18	GUJ	ICS-105	Fine	29mm	3.7 – 4.5	3%	28	12317 (43800)	12373 (44000)	12429 (44200)	12401 (44100)	12457 (44300)	12457 (44300)
19	M/M(P)	ICS-105	Fine	30mm	3.7 – 4.5	3.5%	29	12654 (45000)	12710 (45200)	12766 (45400)	12738 (45300)	12795 (45500)	12795 (45500)
20	SA/TL/K/O	ICS-105	Fine	30mm	3.7 – 4.5	3%	29	12626 (44900)	12682 (45100)	12738 (45300)	12710 (45200)	12766 (45400)	12766 (45400)
21	M/M(P)	ICS-105	Fine	31mm	3.7 – 4.5	3%	30	13020 (46300)	13076 (46500)	13132 (46700)	13104 (46600)	13160 (46800)	13160 (46800)
22	SA/TL/ K / TN/O	ICS-105	Fine	31mm	3.7 – 4.5	3%	30	13048 (46400)	13104 (46600)	13160 (46800)	13132 (46700)	13188 (46900)	13188 (46900)
23	SA/TL/K/ TN/O	ICS-106	Fine	32mm	3.5 – 4.2	3%	31	13216 (47000)	13273 (47200)	13329 (47400)	13301 (47300)	13357 (47500)	13357 (47500)
24	M/M(P)	ICS-107	Fine	34mm	3.0 - 3.8	4%	33	18419 (65500)	18475 (65700)	18531 (65900)	18503 (65800)	18559 (66000)	18559 (66000)
25	K/TN	ICS-107	Fine	34mm	3.0 - 3.8	3.5%	34	19122 (68000)	19178 (68200)	19234 (68400)	19206 (68300)	19262 (68500)	19262 (68500)

(Note: Figures in bracket indicate prices in Rs./Candy)