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Agro-ecology Based Technology Targeting for Sustainable Cotton Production

EXPERT's Column

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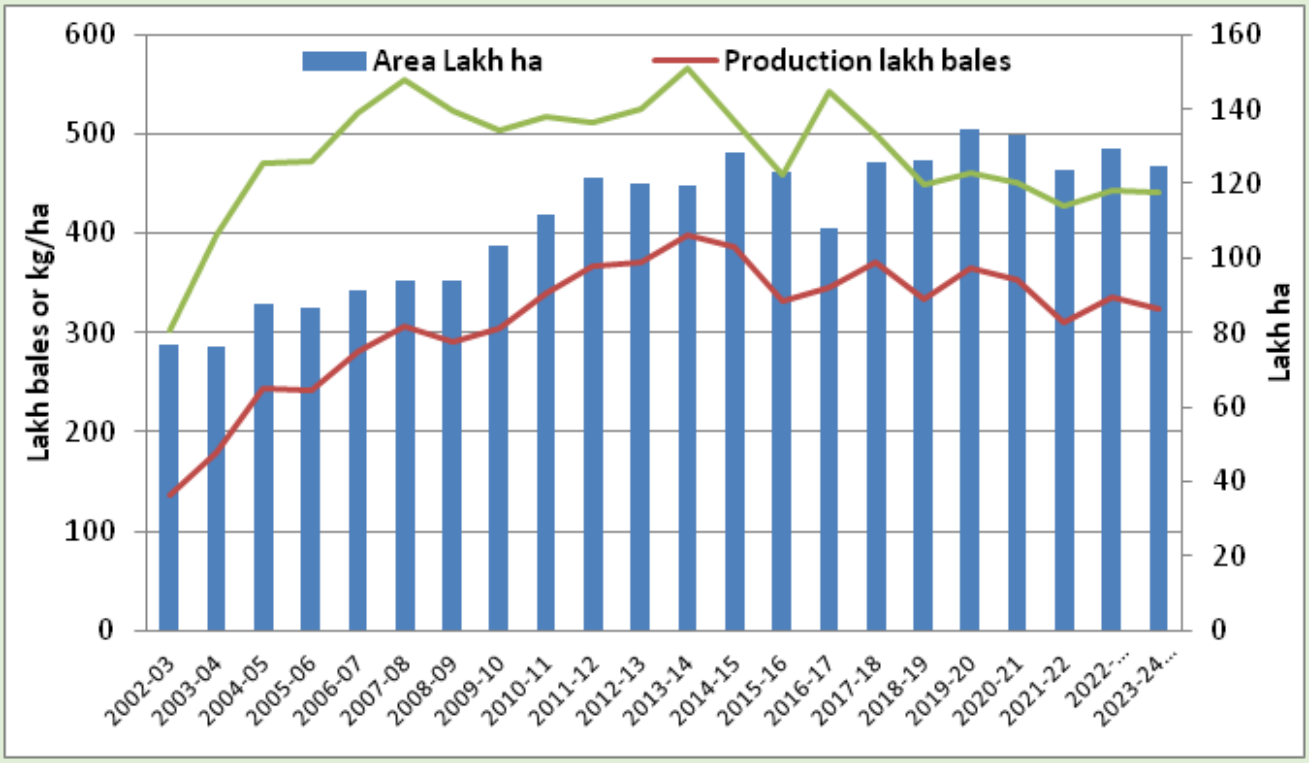
Cotton Scenario in the Post Bt era

Post-independence, the Indian cotton sector witnessed regular technological breakthroughs that resulted in quantum jumps in the productivity and production of cotton. However, the introduction of genetically modified Bt cotton hybrids in 2002 can be considered as a disruptive technology that transformed the entire landscape of cotton production. In a span of 12 years, the national cotton production trebled from 136 lakh bales in 2002-03 to 398 lakh bales in 2013-14 (Figure 1). During the same period, the productivity increased 1.87 times, from 302 kg lint/ha to 566 kg lint/ha. Consequently, farm profits from cotton production increased, cotton consumption and exports rose and the import of raw cotton declined.

Another spinoff of this technology was a steady increase in the area under cotton from 77 lakh hectare in 2002-03 to 122 lakh hectare in 2011-12 and further to 135 lakh ha in 2019-20. The major increase in the area under cotton was in the states of Maharashtra, Gujarat, Telangana, Andhra Pradesh and Rajasthan (Southern and Central). Cotton hybrids also made inroads into soil/sites, not ideally suited for its cultivation, particularly shallow soils, gravely, red soils and into chronic drought prone areas.

Fig 1. Trend In the Area, Production and Productivity Of Cotton In The Last Two Decades



*Source: Meeting of Committee on Cotton Production and Consumption (COCPC) held on 14.03.2024,
Data Source: https://cotcorp.org.in/statistics.aspx

Post 2013-14, the cotton production and productivity are declining. During 2022-23, the cotton production was 336.6 lakh bales (of 170 kg each), from an area of 129,3 lakh ha resulting in a productivity of 443 kg lint/ha. Some of this could be du to technology fatigue, while other reasons include- the breakdown in resistance to cry toxins present in Bt Cotton by the pink bollworm, climate change inducedspatial and temporal variability in rainfall pattern, recurrenceof white fly and cotton leaf curl virus disease, emergence of new pests like stem weevil, T mosquito bug, trips and diseases like boll rot and tobacco streak virus; and above all a gradual deterioration in the soil health.

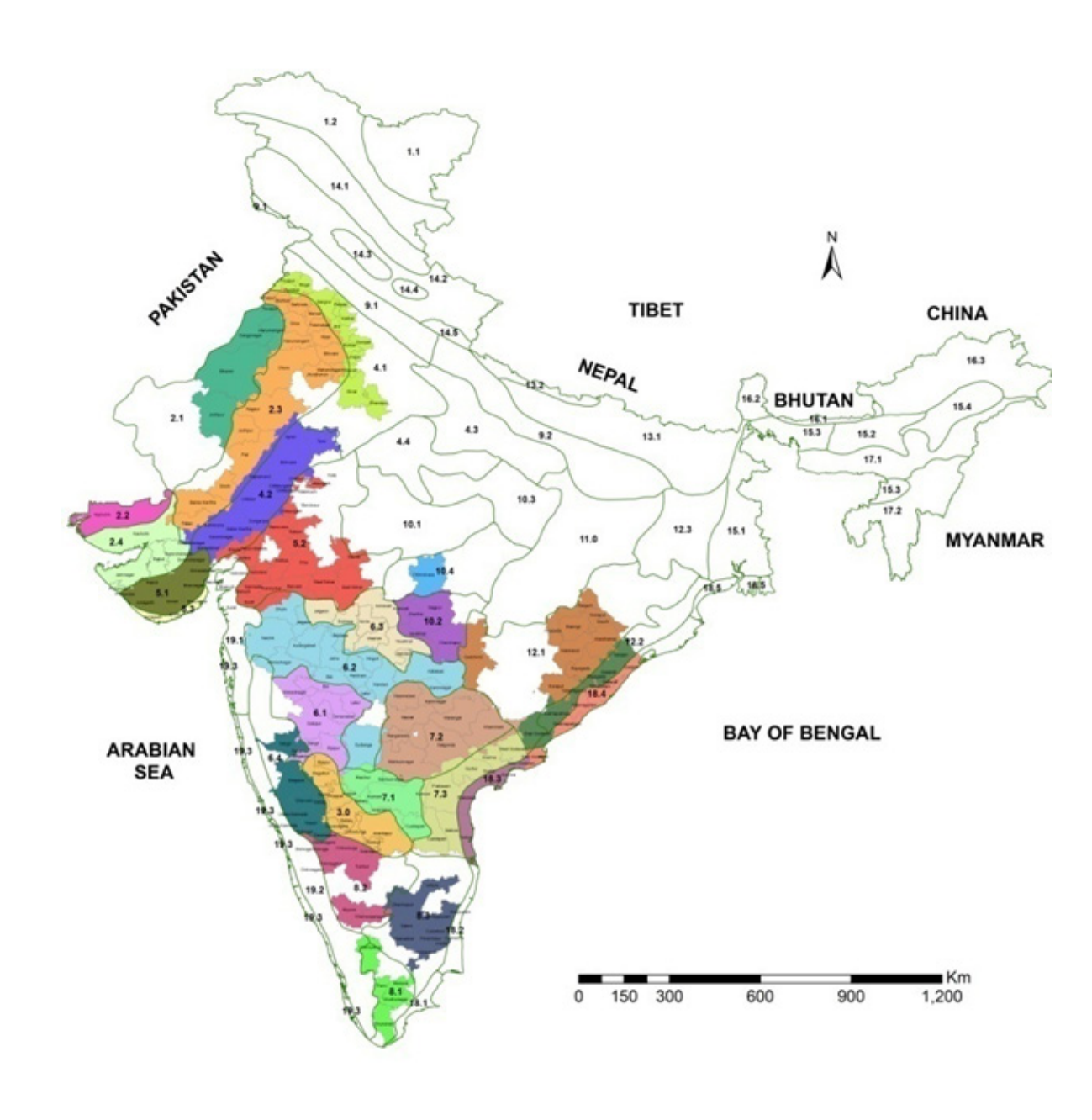
Today, the industry, scientific community, policy makers and most importantly, cotton farmers are seeking sustainable and scalable solutions to reverse the declining trend in cotton productivity. Before embarking upon technological solutions, it is necessary to understand the Agro ecological diversity of our cotton growing regions so that appropriate, location specific technologies can be targeted.

Agro-ecological Diversity Of Cotton Growing Regions

Cotton is cultivated across diverse agro-ecological conditions in India. Different combinations of soils- black soils (calcareous and non-calcareous), varying in depth from < 30 cm to > 150 cm, red soils (with or without gravels) mix red and black soils, laterite soil, desert soil, alluvial soils, climate- arid, semi-arid dry, semi-arid moist, sub-humid moist, sub-humid dry, elevation, slope, physiography, water availability (rainfed, fully irrigated, partially irrigated) are some diverseagro-ecological conditions where cotton is grown. Additionally, cotton is grown as the double crop (cotton-wheat, cotton- rice), mono crop or as a rotation crop after soybean/ pigeon pea/ sorghum or is intercropped with pulses, oilseeds and vegetables.

This enormous diversity creates a wide spatial disparity in cotton productivity. The diverse agro-ecological conditions also modify the way a variety/ hybrid behave in a year or the response to a management intervention. For instance, a calcareous black soil may need a unique nutrient management that is different from a non-calcareous black soil. Similarly, a deep black soil may support a good cotton crop in a semi-arid region (<800 mm annual rainfall) but may not be ideal in a sub-humid region (1000 mm) annual rainfall), unless there is a provision for drainage.

Fig 2: Cotton Growing Agro-Eco Sub-Regions



Based on agro-ecological variability, the country is divided into 20 Agro Eco Regions (AER) and further into 60 Agro-Eco-Sub-Regions (AESR). We grouped the 153 cotton growing districts (each with >5000 ha area) into 26 AESR across 11AERs (Figure 2). We hypothesize that regions of an AESR hassimilar agro-climatic features and would therefore respond similarly to technological interventions. Thus, based on the opportunities and constraints at AER or AESR level, appropriate variety/ hybrids can be promoted and technologies can be targeted to maximise productivity in a sustainable manner.

Production Technologies for Specific Agro-Ecologies

Since there is a strong influence of the growing environment on the growth, productivity and quality of cotton, the best management practices have to be developed to specific agro-ecologies.

1. High density planting system (HDPS): The HDPS technology using dwarf compact, early maturing varieties/ hybrids planted at 90 cm x 15 cm spacing perform best on shallow/ marginal soils of AESR 5.2, 6.2, 6.1, 6.3, 7.1 and 7.2 where

Table 1: Appropriate Soil Moisture Conservation Strategies for Cotton In Different AESRs of Maharashtra

Agro-Climatic Zone (NARP)/ Agro–eco Sub Region (AESR)	Bio-climate	Soil depth (across Soil orders)		
		Shallow	Medium Deep	Deep to very deep
Western Vidarbha Zone in Maharashtra (6.3)	Semiarid (Hot moist)	Conservation furrow, Mulching	Broad bed and furrow,Deep Ploughing, Mulching	Broad bed and furrow,Deep Ploughing, Mulching
Scarcity zone in Maharashtra (6.1)	Semiarid (Hot dry)	Ridge and furrow, Mulching	Conservation furrow, Ridge and furrow Compartment bunding	Ridge and furrow, Conservation furrow
Central Maharashtra Plateau Zone in Maharashtra (6.2)	Semiarid (Hot moist)	Conservation furrow, Broad bed and furrow, Mulching	Conservation furrow; Broad bed and furrow, Sub-soiling (alternate year), Mulching	Conservation furrow; Broad bed and furrow, Sub-soiling (alternate year)

the cotton yields are low and the cultivation is rainfed.

2. Closer spacing: On medium deep soils of semi arid (moist) and dry sub humid eco-regions, closer planting at 90 x 30 cm can be adopted. Application of a growth retardant like Mepiquat chloride may be required on such soils. Wherever supplemental irrigation facility is available, a second crop of gram/ mustard/ linseed/ lentil can be taken after terminating cotton at 150- 160 days.

3. Drip- Polymulch- Fertigation Technology: In the AESRs 8.1, 8.2 and 6.4, the temperature during the boll development stage is favourable for quality cotton production. Drip-Polymulch-Fertigation can be adopted in ELS G. barbadense and HirsutumxBarbadense hybrids to maximise productivity.

4. Long linted Gossypium arboreum (desi cotton) under HDPS: In chronic drought prone areas in the AESR 6.1 and 6.2, Long linted G. arboreums under HDPS at a spacing of 60x15 cm with mechanical de-topping could be a cost effective, low risk technology.

5. Soil moisture conservation: Close to 65% of the cotton is grown under rainfed condition and the majority of the rainfed area is under semi-arid agro-climate. Cotton cultivation in Maharashtra is predominantly rainfed and soil moisture conservation is essential to sustain yield and improve water productivity. Agro ecologically appropriate, site-specific soil moisture conservation strategies are enlisted in Table1

6. Calcareous soils of AER 5, 6 and 8 suffer from S, Zn and B deficiency and high P fixation Organic manure/ vermicompost, bio fertilizers Ammonium Sulphate and Single Super Phosphate along with micronutrients (Zn and B) are essential to sustain their productivity. Cotton grown on these soils also respond to foliar fertilizer application.

Conclusion: Agro-ecologically appropriate sustainable cotton production technologies can enhance cotton yield and will have a positive impact of environmental indicators. But to promote them, a clear understanding of the soil and climatic features of the target location is a prerequisite. The AER and AESRs delineated could serve in characterising the target environment.

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

Promoting QCO & Kasturi Cotton Bharat Testing in Parbhani and Jalgaon

In order to promote QCO & Kasturi Cotton Bharat Testing in the regions of Marathwada and Khandesh, Maharashtra, Keshavraj Cotton Cluster, Selu (Parbhani) and Khandesh Gin Press, Jalgaon, organised an awareness meet on QCO & Kasturi Cotton Bharat Testing on 2nd and 3rd April, 2024 respectively.

Both the meetings began with an in depth explanation on manufacturing, packing and testing of Kasturi Cotton Bharat by Dr. Pradeep Mandhyan, CEO Consultant (Cotton Testing & Research) Cotton Association of India. He also discussed the advantage of Kasturi Cotton Bharat in the cotton value chain. He was followed by Shri. Kharat of Texprocil who spoke on the methodology of registration for Kasturi Cotton transaction.

Shri Girish Nagsee referred to the ease of doing business in Kasturi Cotton Bharat lots, while Shri. Reddy, DGM, CCI explained about the efforts taken by CCI to develop the Kasturi Cotton Bharat. Shri Sanket Shingote (Technical Officer, CAI) explained the importance of cotton testing and its quality parameters in accordance with QCO to the younger generation engaged in ginning.

The meetings were attended by 60 prominent ginners, farmers and mill representative of Jalgaon and around 25 in Parbhani respectively. The lively question and answer session that followed, was proof enough of the positive impact the awareness meetings had on the attendees.

Supply and Distribution of Cotton

01 April 2024

Million Metric Tonnes

	2018/19	2019/20	2020/21	2021/22	2022/23 proj.	2023/24 proj.
BEGINNING STOCKS						
WORLD TOTAL	**19.47**	**19.51**	**22.37**	**20.53**	**19.94**	**21.45**
China	9.03	8.88	9.02	9.37	8.60	8.44
USA	0.91	1.06	1.58	0.69	0.88	0.93
PRODUCTION						
WORLD TOTAL	**25.98**	**26.26**	**23.96**	**25.24**	**25.10**	**24.58**
China	6.04	5.80	5.91	5.73	5.98	5.60
India	5.66	6.20	5.99	5.29	5.72	5.49
Brazil	2.78	3.00	2.36	2.55	3.27	3.56
USA	4.00	4.34	3.18	3.82	3.15	2.63
Pakistan	1.67	1.46	0.96	1.27	0.84	1.35
Uzbekistan	0.64	0.53	0.70	0.59	0.59	0.59
Others	5.20	4.93	4.86	6.00	5.56	5.35
CONSUMPTION						
WORLD TOTAL	**26.03**	**23.05**	**25.71**	**25.84**	**23.69**	**24.66**
China	8.25	7.23	8.40	8.31	7.50	7.80
India	5.40	4.45	5.70	5.30	5.20	5.39
Pakistan	2.36	2.34	2.15	2.45	1.90	2.30
Europe & Turkey	1.82	1.60	1.79	2.01	1.82	1.82
Bangladesh	1.58	1.50	1.64	1.73	1.60	1.75
Vietnam	1.51	1.45	1.52	1.46	1.30	1.42
Brazil	0.73	0.57	0.69	0.70	0.70	0.70
USA	0.65	0.47	0.52	0.56	0.45	0.38
Others	3.73	3.44	3.30	3.32	3.23	3.10
EXPORTS						
WORLD TOTAL	**9.15**	**9.12**	**10.76**	**9.70**	**8.28**	**9.57**
USA	3.23	3.38	3.56	3.15	2.78	2.68
Brazil	1.31	1.95	2.42	1.74	1.45	2.48
Australia	0.79	0.30	0.35	0.79	1.36	1.19
CFA Zone	1.16	1.07	1.19	1.31	0.88	1.18
India	0.76	0.70	1.36	0.87	0.25	0.46
Uzbekistan	0.16	0.10	0.10	0.03	0.01	0.02
IMPORTS						
WORLD TOTAL	**9.22**	**8.78**	**10.66**	**9.61**	**8.26**	**9.57**
Bangladesh	1.54	1.50	1.69	1.70	1.40	1.71
China	2.10	1.60	2.84	1.85	1.38	2.40
Vietnam	1.51	1.41	1.55	1.36	1.35	1.47
Turkey	0.79	1.02	1.19	1.24	0.95	0.80
Indonesia	0.66	0.55	0.55	0.58	0.38	0.50
TRADE IMBALANCE †	0.07	-0.34	-0.10	-0.09	-0.02	0.00
STOCKS ADJUSTMENT ‡	0.01	0.00	0.01	0.09	0.12	0.04
ENDING STOCKS						
WORLD TOTAL	**19.51**	**22.37**	**20.53**	**19.94**	**21.45**	**21.41**
China	8.88	9.02	9.37	8.60	8.44	8.61
USA	1.06	1.58	0.69	0.88	0.93	0.54
ENDING STOCKS/MILL USE (%)						
WORLD-LESS-CHINA *	**59.75**	**84.53**	**64.50**	**64.66**	**80.35**	**75.90**
CHINA **	**107.69**	**124.82**	**111.51**	**103.46**	**112.48**	**130.00**
COTLOOK A INDEX***	**84.35**	**71.33**	**84.96**	**131.68**	**101.62**	**95.24**

Note :
Seasons begin on August 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 .*

‡ *Difference between calculated stocks and actual; amounts for forward seasons are anticipated.*

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

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

*** *U.S. Cents per pound. Average price for a given season, August 1 to July 31 or average-to-date.*

Source: ICAC Cotton This Month, 01 April 2024


COTTON ASSOCIATION OF INDIA
COTTON
ASSOCIATION
OF INDIA
Established 1921
ISO 9001:2015
A CHILD'S CHILDHOOD IS FOR LEARNING
DON'T USE THEIR CHILDHOOD FOR EARNING
SAY NO TO CHILD LABOUR

UPCOUNTRY SPOT RATES

(Rs./Qtl)

Standard Descriptions with Basic Grade & Staple in Millimetres based on Upper Half Mean Length [By law 66 (A) (a) (4)]								Spot Rate (Upcountry) 2023-24 Crop April 2024					
Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Gravimetric Trash	Strength /GPT	8th	9th	10th	11th	12th	13th
1	P/H/R	ICS-101	Fine	Below 22mm	5.0 – 7.0	4%	15	12513 (44500)		12513 (44500)	12513 (44500)	12513 (44500)	12513 (44500)
2	P/H/R (SG)	ICS-201	Fine	Below 22mm	5.0 – 7.0	4.5%	15	12682 (45100)		12682 (45100)	12682 (45100)	12682 (45100)	12682 (45100)
3	GUJ	ICS-102	Fine	22mm	4.0 – 6.0	13%	20	11164 (39700)	H	10911 (38800)	10798 (38400)	10629 (37800)	10545 (37500)
4	KAR	ICS-103	Fine	22mm	4.5 – 6.0	6%	21	13582 (48300)		13498 (48000)	13441 (47800)	13357 (47500)	12935 (46000)
5	M/M (P)	ICS-104	Fine	23mm	4.5 – 7.0	4%	22	15466 (55000)		15466 (55000)	15410 (54800)	15410 (54800)	15410 (54800)
6	P/H/R (U) (SG)	ICS-202	Fine	27mm	3.5 – 4.9	4.5%	26	15747 (56000)	O	15747 (56000)	15663 (55700)	15522 (55200)	15410 (54800)
7	M/M(P)/ SA/TL	ICS-105	Fine	26mm	3.0 – 3.4	4%	25	N.A. (N.A.)		N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)
8	P/H/R(U)	ICS-105	Fine	27mm	3.5 – 4.9	4%	26	15888 (56500)		15888 (56500)	15803 (56200)	15663 (55700)	15550 (55300)
9	M/M(P)/ SA/TL/G	ICS-105	Fine	27mm	3.0 – 3.4	4%	25	14679 (52200)		14679 (52200)	14566 (51800)	14482 (51500)	14397 (51200)
10	M/M(P)/ SA/TL	ICS-105	Fine	27mm	3.5 – 4.9	3.5%	26	15607 (55500)	L	15607 (55500)	15494 (55100)	15353 (54600)	15269 (54300)
11	P/H/R(U)	ICS-105	Fine	28mm	3.5 – 4.9	4%	27	16085 (57200)		16085 (57200)	16000 (56900)	15860 (56400)	15747 (56000)
12	M/M(P)	ICS-105	Fine	28mm	3.7 – 4.5	3.5%	27	16647 (59200)		16591 (59000)	16478 (58600)	16338 (58100)	16253 (57800)
13	SA/TL/K	ICS-105	Fine	28mm	3.7 – 4.5	3.5%	27	16703 (59400)	I	16647 (59200)	16535 (58800)	16394 (58300)	16310 (58000)
14	GUJ	ICS-105	Fine	28mm	3.7 – 4.5	3%	27	16731 (59500)		16675 (59300)	16591 (59000)	16422 (58400)	16338 (58100)
15	R(L)	ICS-105	Fine	29mm	3.7 – 4.5	3.5%	28	16619 (59100)		16591 (59000)	16506 (58700)	16450 (58500)	16366 (58200)
16	M/M(P)	ICS-105	Fine	29mm	3.7 – 4.5	3.5%	28	16984 (60400)		16928 (60200)	16816 (59800)	16675 (59300)	16591 (59000)
17	SA/TL/K	ICS-105	Fine	29mm	3.7 – 4.5	3%	28	17013 (60500)	D	16956 (60300)	16844 (59900)	16703 (59400)	16619 (59100)
18	GUJ	ICS-105	Fine	29mm	3.7 – 4.5	3%	28	17013 (60500)		16956 (60300)	16872 (60000)	16703 (59400)	16619 (59100)
19	M/M(P)	ICS-105	Fine	30mm	3.7 – 4.5	3.5%	29	17378 (61800)		17322 (61600)	17238 (61300)	17013 (60500)	16928 (60200)
20	SA/TL/K/O	ICS-105	Fine	30mm	3.7 – 4.5	3%	29	17406 (61900)	A	17350 (61700)	17266 (61400)	17041 (60600)	16956 (60300)
21	M/M(P)	ICS-105	Fine	31mm	3.7 – 4.5	3%	30	17659 (62800)		17659 (62800)	17575 (62500)	17434 (62000)	17350 (61700)
22	SA/TL/ K / TN/O	ICS-105	Fine	31mm	3.7 – 4.5	3%	30	17687 (62900)		17687 (62900)	17603 (62600)	17462 (62100)	17378 (61800)
23	SA/TL/K/ TN/O	ICS-106	Fine	32mm	3.5 – 4.2	3%	31	N.A. (N.A.)		N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)
24	M/M(P)	ICS-107	Fine	34mm	2.8 - 3.7	4%	33	22355 (79500)	Y	22355 (79500)	22355 (79500)	22355 (79500)	22355 (79500)
25	K/TN	ICS-107	Fine	34mm	2.8 - 3.7	3.5%	34	22777 (81000)		22918 (81500)	22918 (81500)	22918 (81500)	22918 (81500)
26	M/M(P)	ICS-107	Fine	35mm	2.8 - 3.7	4%	35	22777 (81000)		22777 (81000)	22777 (81000)	22777 (81000)	22777 (81000)
27	K/TN	ICS-107	Fine	35mm	2.8 - 3.7	3.5%	35	23199 (82500)		23340 (83000)	23340 (83000)	23340 (83000)	23340 (83000)

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