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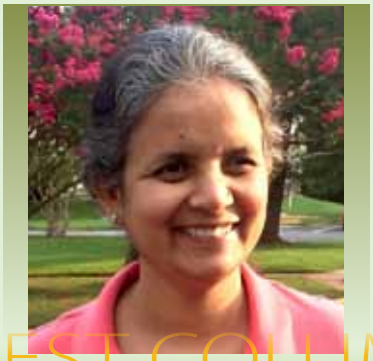
Cotton Exchange Building, 2nd Floor, Cotton Green, Mumbai - 400 033
Phone: 3006 3400 Fax: 2370 0337 Email: cai@caionline.in
www.caionline.in

Forty Years of Cotton Crop Protection in India

(Contd. from Issue No. 18, dated 1st August, 2017)

Dr. Sandhya Kranthi, Ph.D, Entomology, IARI, New Delhi, is the Head I/c, Crop Protection Division at the Central Institute for Cotton Research (CICR) Nagpur, She has more than 25 years of experience in cotton crop protection.



GUEST COLUMN

Dr. Sandhya Kranthi
Head (i/c), Division of Crop Protection, CICR

The decade of IPM (1990 to 2000):

Hybrid cotton area increased from 36.0% in 1990 to 44.0% by the year 2000. There was no substantial increase in the area under irrigation. Yields were almost stagnant at 264 to 330 kg lint per hectare. Bollworm damage intensified with the increase in area under American cotton hybrids and also because of the insecticide resistant bollworms that resulted from excessive use of synthetic pyrethroids. This decade was most challenging for cotton pest management. Not only were insecticides rendered ineffective, cotton farmers experienced emotional and financial crisis. Reports of cotton farmer suicides were viewed seriously at the political level. Researchers addressed issues of pest outbreak in a fire-fighting mode while grappling with the concepts of pest management.

Cotton production was being rendered uneconomic in many regions of the country. By the mid 1990s Indian cotton farmers were spending >43% of the variable costs of cotton production on insecticides, around 80% of that being for bollworm control and in particular *Helicoverpa* control (ICAC 1998a, b). It was the decade where labour, seed and fertilizer costs were much lower than their costs today. The reasons for the very rapid increase in the importance of *H. armigera* as a cotton pest are unknown, but by the end of the decade it was the major cotton pest. In 1998-99, 14.6% of Indian cotton production was lost to insect (mainly bollworm) damage. The excessive use of insecticides, especially synthetic pyrethroids, led to further problems of insecticide resistance in *H. armigera* and *Spodoptera litura*, which in turn necessitated the repeated application of insecticides. The first few reports related to high levels of *H. armigera* resistance to pyrethroids and DDT. Mehrotra and Phokela 1992; Armes et al. 1992, 1996; Sekhar *et al.* (1996), reported high levels of pyrethroid resistance in several cotton and pulse growing regions of the country. Subsequent studies (Armes *et al.*, 1992, 1996; Kranthi *et al.*, 2001a, 2001b, 2002a and 2002b) showed that resistance to pyrethroids was widespread and resistance in *H. armigera* to conventional insecticides such as methomyl, endosulfan and quinalphos was increasing in

India. A temporal and spatial variation in the levels of insecticide resistance in *H. armigera* was recorded. Not only did resistance vary across *H.armigera* populations collected on different crops across the country, resistance levels also varied within a cotton growing season. Resistance to some insecticides like endosulfan was low in populations of the bollworm that occurred early in the season as compared to resistance in populations that occurred later in the season. Due to unsatisfactory insect control on account of insecticide resistance, farmers were forced to spray repeatedly, most often with mixtures. By 1992, *H.armigera* resistance to insecticides had emerged as a great challenge to cotton pest management in Asia and Australia. Similar problems were being experienced in the US with other heliothine species. Subsequently, a number of Integrated Pest Management (IPM) programmes were initiated across the world in cotton growing countries to ensure effective bollworm management. This was also the period where emphasis was laid on breeding pest resistant varieties and hybrids of cotton. Multiple disease resistant lines, reported tolerant to *H. zea/ armigera* were imported for research.

India too initiated integrated pest management programmes in cotton during this period. Season long training programs were carried out with funding from both National and International organisations. Identification of natural enemies was recognised as an important step towards pest management. Protocols for mass multiplication of natural enemies, particularly the egg parasitoids were developed. Inundative release of natural enemies like the egg parasitoids were advocated as being effective for bollworm control. Use of botanical insecticides in newer formulations or as the conventional neem seed kernel extract was promoted. However integrated pest management with the emphasis on biological control had its own drawbacks. To a certain extent the biological interventions were found useful in many situations in many countries. But, despite enormous governmental support and intensive scientific effort, cultivators did not adopt IPM methods wholeheartedly. Some of the major reasons were poor efficacy, non-availability and high costs of the non-insecticidal alternative components. IPM models were developed and demonstrated in farmers' fields. The Astha model of integrated pest management started in 1997 in 10 locations was one of the first endeavors of cotton entomologists to showcase the technology of IPM. Importance of area wide ecosystem management was highlighted with emphasis being laid on timely sowing of a limited number of varieties/hybrids across the village. Use of nuclear polyhedrosis virus mass produced, locally, in the village was encouraged. The social component of IPM was also highlighted.

Lady bird beetle – natural enemy of cotton pests

Entomopathogenic nematode Heterorhabditis indica infected American bollworm larvae

Resistance research being carried out at CICR, Nagpur attracted international funding through the NRI ICAR CICR IRM project, then led from ICRISAT. The training programme imparted by ICRISAT laid the foundation for resistance research and it involved preliminary protocols for the collection of H. armigera larvae and eggs from the field, its rearing on semi-synthetic diet and maintenance of healthy cultures over several generations. IPM evolved into IRM- insect pest management program was developed and fine tuned based on robust resistance data including monitoring insecticide resistance in geographic populations and the biochemical and molecular mechanisms mediating resistance in the cotton bollworms. Together, it led to the development of implementable IRM strategies. The AP Cess fund project funded by ICAR on Insecticide Resistance Management involved the demonstration and dissemination of strategies for pest management to farmers in farmers' fields of Wardha.

Soon, the International Cotton Advisory Committee at Washington funded a mega project on Area wide pest management in small scale cotton production systems that was led from Natural Resources Institute, UK and involved cotton scientists from Pakistan, India and China. Facilities for basic research were stepped up in the form of equipment and project staff and landmark papers on insecticide resistance were published from the country.

IRM (Insecticide Resistance Management) strategies were incorporated into IPM programmes and implemented in area-wide farmer participatory projects across the country. The emphasis was on adopting the cultivars tolerant to sucking pests, spraying of eco-friendly molecules, if necessary early in the season, avoidance of synthetic pyrethroids up to the first 90 DAS. The idea focused on conserving the native natural enemies occurring in the ecosystem through the use of ecologically friendly pest management strategies built over the use of host plant resistance. The IRM program that began on a small scale in 1996 at Wardha, Maharashtra, spread across the country with enormous and sustained funding by the Government of India. The project ended when it had covered 12 states, with the number of villages ranging between 88-662, across an area ranging between 5009 acres to 91118 acres, with the cost of cultivation ranging from Rs.19,817 to 38,743 per hectare in IRM villages and Rs. 23,308 to 40.934 per hectare in the non IRM village. Thus, IPM/IRM strategies were successful in reducing insecticide applications, saving on costs and ensuring sustainable eco-friendly cotton pest management, Because of the extensive efforts of the Government; IPM/IRM became commonly recognised terms for cotton cultivators not only in India but also globally.

Having learnt from the mistakes made at the time of introduction of pyrethroids, the insecticide resistance group at CICR initiated studies on Bt toxins, at a time when the Indian Government was contemplating introduction of GM cotton. Cry 1Ac toxin was sourced and evaluated against, both, the target and non target pests of cotton. Bioassay protocols were developed and evaluated under laboratory conditions.

(To be continued)

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

Monthly Average Cotlook A Index from 2011-12 onwards

(in US Cents per lb.)

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
August	114.10	84.40	92.71	74.00	71.82	80.26
September	116.86	84.15	90.09	73.38	68.74	77.86
October	110.61	82.00	89.35	70.34	69.03	78.52
November	104.68	80.87	84.65	67.53	69.22	78.92
December	95.45	83.37	87.49	68.30	70.39	79.50
January	101.11	85.51	90.96	67.35	68.75	82.33
February	100.75	89.71	94.05	69.84	66.57	85.15
March	99.50	94.45	96.95	69.35	68.73	86.78
April	99.94	92.68	94.20	71.70	69.28	87.04
May	88.53	92.70	92.71	72.89	70.28	88.64
June	82.18	93.08	90.90	72.35	74.10	
July	83.97	92.62	83.84	72.35	81.06	

Source: Cotton Outlook

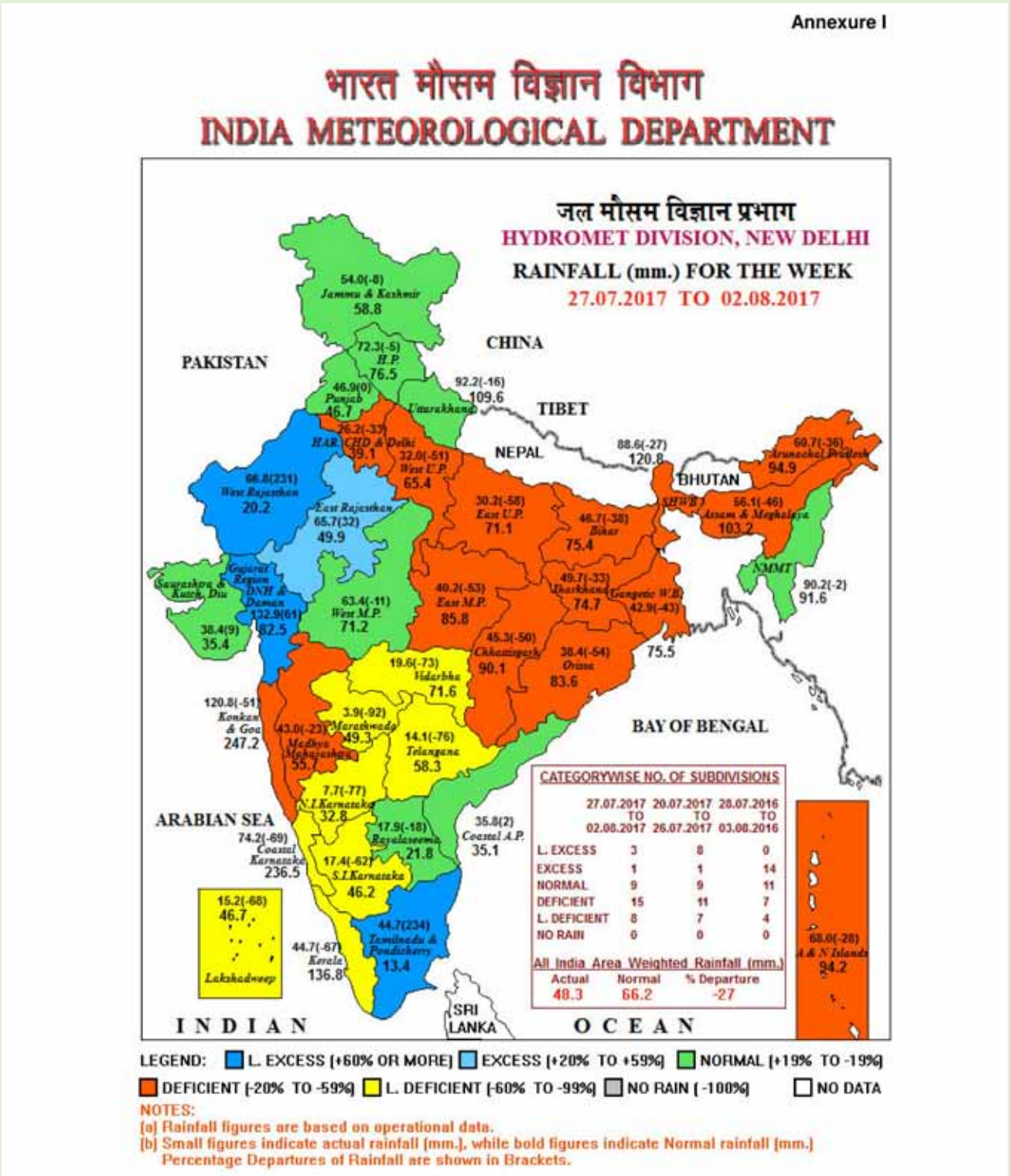
Excerpts from India Meteorological Department's Weather Report of August 3, 2017

Forecast for next two week

Rainfall/snowfall:

- Due to north-south trough from Sub-Himalayan West Bengal to northeast Bay of Bengal at lower levels and likely formation of upper air cyclonic circulation over north Bay of Bengal & its west-northwestwards movement, Fairly widespread to widespread rainfall activity likely to occur over Northeast & East

Annexure I



Annexure IV

METEOROLOGICAL SUB-DIVISIONWISE WEEKLY RAINFALL FORECAST & Wx. WARNINGS-2017

Sr. No	MET.SUB-DIVISIONS	03 AUG	04 AUG	05 AUG	06 AUG	07 AUG	08 AUG	09 AUG
1	ANDAMAN & NICO.ISLANDS	FWS	FWS	WS	WS	FWS	FWS	SCT
2	ARUNACHAL PRADESH	FWS*	FWS	FWS	FWS*	WS*	FWS	FWS
3	ASSAM & MEGHALAYA	FWS*TS	FWS*	FWS*	WS**	WS**	FWS	FWS*
4	NAGA.MANI.MIZO.& TRIPURA	FWS*TS	FWS*	WS*	WS**	WS**	FWS	FWS
5	SUB-HIM.W. BENG. & SIKKIM	WS*	WS	WS	WS	WS*	WS*	WS*
6	GANGETIC WEST BENGAL	WS	WS	WS*	WS*	FWS	FWS	FWS
7	ODISHA	WS*	FWS	FWS	FWS*	FWS*	FWS	FWS
8	JHARKHAND	WS	WS	WS*	WS*	WS*	WS	WS
9	BIHAR	WS**	WS*	WS	WS	WS	WS	WS*
10	EAST UTTAR PRADESH	WS*	FWS*	FWS*	FWS*	WS*	WS	FWS
11	WEST UTTAR PRADESH	FWS	FWS*	FWS*	FWS	FWS*	WS	FWS
12	UTTARAKHAND	WS*	WS*	WS*	WS*	WS*	WS	FWS
13	HARYANA CHD. & DELHI	ISOL	ISOL	SCT	SCT	FWS	WS	FWS
14	PUNJAB	SCT	ISOL	ISOL	ISOL	SCT	FWS	FWS
15	HIMACHAL PRADESH	FWS	FWS	FWS	FWS	WS*	FWS	FWS
16	JAMMU & KASHMIR	FWS	SCT	SCT	ISOL	SCT	FWS	FWS
17	WEST RAJASTHAN	DRY	DRY	ISOL	ISOL	ISOL	FWS	FWS*
18	EAST RAJASTHAN	ISOL	ISOL	ISOL	ISOL	SCT	FWS*	SCT
19	WEST MADHYA PRADESH	ISOL	ISOL	ISOL	SCT*	FWS**	FWS	SCT
20	EAST MADHYA PRADESH	ISOL	ISOL	SCT	FWS*	WS**	FWS	SCT
21	GUJARAT REGION D.D. & N.H.	SCT	ISOL	ISOL	ISOL	ISOL	FWS	FWS
22	SAURASTRA KUTCH & DIU	ISOL	ISOL	ISOL	ISOL	ISOL	SCT	SCT
23	KONKAN & GOA	WS	WS	WS	WS	WS	FWS	FWS
24	MADHYA MAHARASHTRA	SCT	SCT	SCT	SCT	SCT	SCT	FWS
25	MARATHAWADA	ISOL	ISOL	ISOL	ISOL	ISOL	SCT	SCT
26	VIDARBHA	ISOL	ISOL	ISOL	SCT	SCT	SCT	SCT
27	CHHATTISGARH	SCT	SCT	SCT	WS*	WS*	FWS	FWS
28	COASTAL ANDHRA PRADESH	ISOL	ISOL	SCT	SCT	FWS	FWS	FWS
29	TELANGANA	ISOL	ISOL	SCT	SCT	SCT	FWS	FWS
30	RAYALASEEMA	ISOL	ISOL	ISOL	ISOL	ISOL	FWS	FWS
31	TAMILNADU & PUDUCHERRY	ISOL	ISOL	SCT*	SCT*	SCT	FWS	SCT
32	COASTAL KARNATAKA	WS	WS*	WS**	WS**	WS*	FWS*	FWS*
DRY	NORTH INT.KARNATAKA	SCT	SCT	SCT	SCT	SCT	SCT	FWS
34	SOUTH INT.KARNATAKA	SCT	FWS	FWS	FWS*	FWS*	FWS	FWS
35	KERALA	FWS	WS	WS*	WS*	WS*	WS*	FWS
36	LAKSHADWEEP	FWS	FWS	FWS*	FWS*	FWS*	FWS*	FWS

LEGENDS:

WS	WIDE SPREAD / MOST PLACES (76-100%)	FWS	FAIRLY WIDE SPREAD / MANY PLACES (51% to 75%)		
SCT	SCATTERED / FEW PLACES (26% to 50%)	ISOL	ISOLATED (up to 25%)	DRY	NO STATION REPORTED RAINFALL

*Heavy Rainfall (64.5-115.5 mm)	**Heavy to Very Heavy Rainfall (115.6-204.4 mm)	***Extremely Heavy Rainfall (204.5 mm or more)

FOG	*SNOWFALL	#HAILSTORM	HEAT WAVE	SEVERE HEAT WAVE
$ THUNDER SQUALL	DS/TS DUST/THUNDERSTORM		COLD WAVE	SEVERE COLD WAVE

India, Chhattisgarh, Uttar Pradesh, Uttarakhand and Himachal Pradesh during 1st week (03rd to 09th August) with heavy to very heavy falls on isolated places on many days of the 1st week.

- West coast of India is also likely to receive fairly widespread to widespread rainfall activity during 1st week with isolated heavy rainfall on many days of the week over Coastal Karnataka & Kerala during the 1st week.

- Scattered to fairly widespread rainfall activity likely to occur over Madhya Pradesh & East Rajasthan during first half of the 1st week and increase in intensity during its second half.

- Light isolated to scattered rainfall activity likely to occur over rest parts of northwest India and south Peninsula during the 1st week.

- During 2nd week (10 to 16 August), rainfall activity is likely to above normal over northeastern states, Bihar & south Peninsular India and below normal over remaining parts of the country (Annexure V).

Rainfall Distribution (01.06.2017 to 03.08.2017)

Sr. No.	State	Day 03.08.2017				Period 01.06.2017 to 03.08.2017			
		Actual (mm)	Normal (mm)	% Dep.	Cat.	Actual (mm)	Normal (mm)	% Dep.	Cat.
1	Punjab	9.7	6.7	44%	E	247.6	253.1	-2%	N
2	Haryana	4.9	5.3	-8%	N	212.6	226.5	-6%	N
3	West Rajasthan	0.0	2.1	-99%	LD	306.1	140.1	118%	LE
	East Rajasthan	1.0	7.2	-85%	LD	390.4	308.6	27%	E
4	Gujarat	1.7	6.2	-73%	LD	588.8	382.5	54%	E
	Saurashtra & Kutch	0.5	3.7	-88%	LD	453.8	286.2	59%	E
5	Maharashtra	2.6	12.1	-79%	LD	558.7	578.4	-3%	N
	Madhya Maharashtra	2.6	8.0	-67%	LD	479.7	411.2	17%	N
	Marathwada	0.3	7.1	-96%	LD	266.2	350.3	-24%	D
	Vidarbha	1.4	13.3	-89%	LD	402.1	515.7	-22%	D
6	West Madhya Pradesh	1.3	11.8	-89%	LD	418.9	428.7	-2%	N
	East Madhya Pradesh	0.9	14.8	-94%	LD	475.7	522.5	-9%	N
7	Telangana	1.6	7.2	-78%	LD	352.5	397.2	-11%	N
8	Coastal Andhra Pradesh	5.9	4.3	37%	E	318.5	277.8	15%	N
	Rayalseema	0.1	2.6	-95%	LD	145.7	170.4	-15%	N
9	Coastal Karnataka	11.7	32.8	-64%	LD	1678.3	2130.9	-21%	D
	N.I. Karnataka	0.7	4.1	-83%	LD	209.5	252.8	-17%	N
	S.I. Karnataka	1.1	6.1	-83%	LD	239.7	377.4	-36%	D
10	Tamil Nadu & Pondicherry	1.6	2.1	-23%	D	118.8	119.7	-1%	N
11	Orissa	10.7	12.2	-12%	N	585.2	587.4	0%	N

L. Excess, Excess, Normal, Deficient, L. Deficient
Source : India Meteorological Department, Hydromet Division, New Delhi

Celebrating Nariyali Poornima

Members of the Cotton Association of India performed the annual ritual of Dariya Poojan at Girgaum Chowpatty on Monday, August 7, 2017. CAI President Shri. Nayan C. Mirani and other members including Shri. Kishor Chheda, Shri. Pankaj Lakdawala, Shri. Krishnaraj Negandhi, Shri. Manoj Bangdiwala, Shri. Hemant Negandhi, Shri. Jayesh Parmar, Shri. Ram Niranjan Verma, Shri. Janardhan Verma and Shri. Jitendra Sharma performed the pooja and prayed for the all-year long prosperity of the cotton trade.

UPCOUNTRY SPOT RATES

(Rs./Qtl)

Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Strength /GPT	Spot Rate (Upcountry) 2016-17 Crop JULY – AUGUST 2017					
							31st	1st	2nd	3rd	4th	5th
1	P/H/R	ICS-101	Fine	Below 22mm	5.0-7.0	15	10151 (36100)	10151 (36100)	10039 (35700)	10151 (36100)	10151 (36100)	10095 (35900)
2	P/H/R	ICS-201	Fine	Below 22mm	5.0-7.0	15	10404 (37000)	10404 (37000)	10292 (36600)	10404 (37000)	10404 (37000)	10348 (36800)
3	GUJ	ICS-102	Fine	22mm	4.0-6.0	20	8014 (28500)	8014 (28500)	8014 (28500)	8070 (28700)	8070 (28700)	8099 (28800)
4	KAR	ICS-103	Fine	23mm	4.0-5.5	21	9336 (33200)	9336 (33200)	9336 (33200)	9392 (33400)	9392 (33400)	9420 (33500)
5	M/M	ICS-104	Fine	24mm	4.0-5.0	23	10432 (37100)	10432 (37100)	10432 (37100)	10461 (37200)	10461 (37200)	10461 (37200)
6	P/H/R	ICS-202	Fine	26mm	3.5-4.9	26	11810 (42000)	11838 (42100)	11782 (41900)	11838 (42100)	11838 (42100)	11838 (42100)
7	M/M/A	ICS-105	Fine	26mm	3.0-3.4	25	9786 (34800)	9786 (34800)	9758 (34700)	9786 (34800)	9786 (34800)	9758 (34700)
8	M/M/A	ICS-105	Fine	26mm	3.5-4.9	25	10320 (36700)	10320 (36700)	10320 (36700)	10348 (36800)	10348 (36800)	10348 (36800)
9	P/H/R	ICS-105	Fine	27mm	3.5.4.9	26	11979 (42600)	12007 (42700)	11979 (42600)	12035 (42800)	12035 (42800)	12007 (42700)
10	M/M/A	ICS-105	Fine	27mm	3.0-3.4	26	10489 (37300)	10489 (37300)	10461 (37200)	10489 (37300)	10489 (37300)	10489 (37300)
11	M/M/A	ICS-105	Fine	27mm	3.5-4.9	26	10967 (39000)	10967 (39000)	10967 (39000)	10995 (39100)	10995 (39100)	10995 (39100)
12	P/H/R	ICS-105	Fine	28mm	3.5-4.9	27	12063 (42900)	12092 (43000)	12063 (42900)	12120 (43100)	12120 (43100)	12092 (43000)
13	M/M/A	ICS-105	Fine	28mm	3.5-4.9	27	11529 (41000)	11529 (41000)	11557 (41100)	11585 (41200)	11585 (41200)	11557 (41100)
14	GUJ	ICS-105	Fine	28mm	3.5-4.9	27	11501 (40900)	11501 (40900)	11529 (41000)	11557 (41100)	11557 (41100)	11557 (41100)
15	M/M/A/K	ICS-105	Fine	29mm	3.5-4.9	28	11923 (42400)	11923 (42400)	11951 (42500)	11979 (42600)	11979 (42600)	11951 (42500)
16	GUJ	ICS-105	Fine	29mm	3.5-4.9	28	11867 (42200)	11867 (42200)	11895 (42300)	11923 (42400)	11923 (42400)	11923 (42400)
17	M/M/A/K	ICS-105	Fine	30mm	3.5-4.9	29	12120 (43100)	12120 (43100)	12120 (43100)	12120 (43100)	12120 (43100)	12148 (43200)
18	M/M/A/K/T/O	ICS-105	Fine	31mm	3.5-4.9	30	12345 (43900)	12345 (43900)	12345 (43900)	12373 (44000)	12373 (44000)	12401 (44100)
19	A/K/T/O	ICS-106	Fine	32mm	3.5-4.9	31	12879 (45800)	12879 (45800)	12879 (45800)	12879 (45800)	12879 (45800)	12879 (45800)
20	M(P)/K/T	ICS-107	Fine	34mm	3.0-3.8	33	15325 (54500)	15325 (54500)	15185 (54000)	15044 (53500)	15044 (53500)	14904 (53000)

Standard Descriptions with Basic Grade & Staple in Millimetres based on Upper Half Mean Length [By law 66 (A) (a) (4)]

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