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Sustainable Practices in Small-Scale Cotton Production System

EXPERT's Column

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With a M.Tech. from IIT, Kharagpur and Ph.D. from VNIT, Nagpur, Dr. P.G. Patil has professional experience of more than 25 years in R&D and Research Management in different areas of cotton processing and value addition. He has made significant contribution in modernisation of cotton ginning industry in India. He has been the Director of ICAR-CIRCOT, Mumbai since May 2014. He has handled about 20 National and International projects including project funded by Common Fund for Commodities, The Netherlands. He has developed and commercialised 17 novel technologies on processing of cotton, by-product utilisation and nano-cellulose production technology. He has a patent on DR Gin improvements to his credit. He has vast international exposure and has actively contributed to the development of the cotton sector in many African countries. He was instrumental in establishing Ginning Knowledge Cluster in Benin under Cotton TAP for Africa Programme of Govt. of India. He is Chairman, Asian Cotton Research and Development Network (ACRDN). He has published more than 110 research papers in reputed national and international journals, 4 books and over 75 bulletins, articles, book chapters, training course materials, etc. He has many awards and recognitions to his credit.

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Dr. Pradeep Kumar Mandhyan is Ph.D (Textiile Physics) from the Mumbai University, Mumbai. Presently he is working as he is working as Senior Scientist (Technical Textiles) and Head Quality Evaluation and Improvement Division, ICAR-Central Institute for Research on Cotton Technology, Mumbai. With more than 35 years of experience in evaluation of textile fibres, yarns and fabrics and development of various value-added products from various natural fibres; he has to his credit more than 40 research articles in national and international journals, popular articles, training manuals, reports, etc. He is is Associate of Textile Association and also the Principal Investigator (Quality Research) of All India Co-ordinated Research Project on Cotton of Ministry of Agriculture and Farmer's welfare. He is member of Central Variety Identification Committee for cotton. He is member of Board of Studies of DKTE Institute of Engineering and Textiles, Ichalkarnji and member of various Sectional Committees of Bureau of Indian Standards. He has done consultancy projects for private industries and also completed 20 projects funded by ICAR and other government/private bodies.

Cotton is a commercial crop with great economic importance across the world, including India, where there are 8 million to 10 million cotton farms. This article deals with case studies from India that demonstrate profitable implementation of sustainable practices in small-scale cotton farms and good practices for hand-picking, ginning, spinning, dyeing, weaving

and by-product utilization. India has an array of production practices that range from completely organic to chemical-intensive. All Indian cotton is hand-picked and is generally clean, with less than 5% trash and very little contamination. However, some contaminants — including human hair, pebbles, dust, jute, or plastic threads from the transport material — could make their way into the hand-picked cotton depending on the practices followed during picking and transportation.

Seed cotton enters into the value chain through the process of ginning, in which lint is obtained and used to produce yarn, which is then used to make fabric and garments. Over the past few years, environmental awareness has prompted the adoption of many sustainable crop production practices. Some of these production systems, both on-farm and off-farm, are more sustainable than others. The first and crucial unit of operation involved in the off-farm value chain is ginning — the conversion of seed cotton into lint. This is still considered to be one of the weakest links in many developing countries because it is characterised by excessive use of energy, low productivity, the absence of facilities for proper lint cleaning and lint quality assessment. Although the spinning industry in India is considered to be modern, with standards that are comparable to the rest of the progressive countries, the same probably cannot be said about the weaving/knitting sector. Further, a few factors that need immediate attention are related to downstream processing, including preparatory chemical treatments like scouring and bleaching of yarn or fabrics, eco-friendliness, energy efficiency and the generation and treatment of effluent.

Cotton by-products such as seedcake, short fibres, comber noil and cotton stalks are either wasted or underutilised. We highlight case studies in which extra-long-staple (ELS) cotton was produced on small farms using environmentally compatible and sustainable practices, and then tracked the fibre throughout the value chain — from ginning, spinning, weaving and dyeing — using eco-friendly technologies. Short fibres were used for absorbent cotton or for the production of nanocellulose. Cotton stalks were used for the production of mushrooms, particle-boards, briquettes, pellets, compost and power generation.

A project was undertaken in ICAR-CIRCOT, India, funded by the World Bank under the National Agricultural Innovation Project (NAIP). Entitled, "A Value Chain for Cotton Fibres, Seed and Stalk: An Innovation for Higher Economic Returns to Farmers and Allied Stake Holders".

The main objectives were:

- To cultivate cotton in adopted villages using sustainable, integrated production-technology practices;
- To reduce the level of contaminants in cotton by adopting appropriate on-farm and off-farm management practices,
- To tag and label cotton bales with fibre attributes after appropriate ginning, and
- To prepare yarn, fabrics and garments in a modern mill to manufacture eco-friendly textiles in the handloom sector by deploying the Institute's proprietary technology for bio-scouring and colouring with natural dyes.

Cotton was harvested from the project farmers' fields using hand-picking practices to obtain clean cotton. Seed cotton was ginned in modern ginneries, pressed into bales, tagged with fibre parameters, and spun into yarn based on segregation of bales, and then woven into fabric. The project demonstrated that the cost of producing shirts from cotton fibres grown in a sustainable environment was much less than that the shirts of comparable quality in the marketplace. Technologies developed at CIRCOT were used to add value to by-products such as short-fibres, cotton seed cake and cotton stalks.

Case Study: Sustainable Production of Fibre to Fabric

(i) Production of quality cotton using sustainable cotton production practices

A new, low-cost drip system with 150-micron polytubes was used, instead of the standard Linear Low Density Polyethylene (LLDPE). The poly-tube drip systems were 57.8% cheaper than the drip system commonly used today. Poly-tube drip systems were used in selected villages. It provided water savings of as much as 36% and a yield increase of 25.4%. The results showed that by adopting integrated cotton production technologies (ICPT), farmers could achieve higher yields and profits. This led to an expansion in the project area, from 6 acres to 352

Figure 1. Tarpaulin sheets to place hand-picked cotton

acres, of ELS cotton cultivation over a four-year period in the village cluster near Coimbatore in South India. Adopting ICPT led to a mean productivity increase of 42% in seed-cotton yield with project farmers. In addition to higher yields, higher market prices for seed cotton during the experimental period cumulatively led to a higher net return of US$502/hectare, and an improved 3.50 benefit-to-cost ratio for the project farmers. The corresponding economics of baseline per hectare was US$281 as net return, with a benefit-to cost ratio of 1.67.

(ii) Clean-cotton picking practices

Cotton in India is harvested by hand picking. Awareness workshops on clean cotton picking were conducted in the project areas in Northern, Central and Southern India. Women constitute between 80% and 90% of the labour force employed in cotton picking in India. They were provided with headgear to cover their hair, which is one of the major contaminants in seed cotton. Farmers were trained to segregate insect-damaged seed cotton from good, fully opened seed cotton. They were given cotton aprons with pouch that could hold as much as 3 to 4 kg of seed cotton at a time. Farmers were also provided with 20-foot by 20-foot tarpaulin sheets to place on the harvested seed cotton, thus minimising contamination by stones, dust, and other materials. Cotton bags that could hold as much as 90 kg of seed cotton were also provided. Using these improved methods of picking and storage, there was almost no contamination, and even the trash levels in ginned cotton dropped from 5% to about 2% for farmers in the project. The growers were encouraged to keep ELS separate and not mix it with any other kind of cotton. This helped farmers to get a better price for their production. Moisture content in seed cotton was determined using a probe to confirm that it was within the permissible limits of 7.5% to 8.5%.

Figure 2. Training on 'clean-cotton picking practices'

(iii) Transporting seed-cotton in cloth bags and ginning

Seed cotton was packed in cloth bags and transported to ginning factories. Ginning was done using best management practices to obtain good-quality lint. The use of cotton bags for transporting the cotton helped to almost completely eliminate contamination.

Figure 3. Transporting seed-cotton in cloth bags

(iv) Baling and 'bale-tagging'

The lint was pressed into individually tagged 170-kg bales; samples were drawn at the time of bale pressing and identified with the corresponding bale number. Each of these lint samples was tested on HVI – fibre testing machines for measurement of fibre attributes, namely, 2.5% staple length, % uniformity ratio, micronaire for fineness and bundle strength at 3.2 mm gauge length. The label on each bale was then updated with the corresponding fibre attributes as determined by the HVI machines.

Figure 4. Baling and bale-tagging

(v) Spinning after segregation of bales based on fibre properties

Pressed bales with tagged fibre attributes were transported to selected spinning mills in each region. Bales were segregated based on their fibre properties, with major emphasis on fibre fineness. Lots of 8 to 10 bales each were then spun into yarn of suitable count depending on the fibre properties. Bales of ELS cotton were converted into 80s-count yarn.

Figure 5. Spinning

(vi) Weaving and fabric properties

Samples were drawn from the yarns of different groups and used for testing. The remaining bulk was converted into fabrics and garments. Researchers studied fabrics belonging to particular groups of yarns, spun from segregated groups of bales based on fibre properties, with an emphasis on dyeing properties.

Summary

Cotton is a commercial crop of great economic importance. A well-established value chain exists in which seed cotton is converted into lint, spun into yarn and woven into fabric and finally converted into garments that cater to the demands of both internal consumption and export. Sustainability is emerging as a concern for major commercial brands in recent times. There is enhanced awareness to deploy sustainable farming practices in cotton production and use sustainable processes for the conversion of fibres into high quality fabrics and cotton by-products into high value commercial products. Value addition to cottonseed and stalks not only enhances livelihood options but also reduces vulnerability of small scale farms to the market risks and uncertainties. The globalisation of supply chains coupled with the ever increasing consumer and stakeholder preferences for sustainable and ethically sourced products, are gradually leading towards sustainability becoming recognised as a core procurement requirement.

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

CAI President Rings Bell to Launch Commodity Segment on BSE

It was a proud moment for CAI when Shri. Atul Ganatra, President CAI, was invited to ring the bell to launch the commodity segment on BSE as well as to start the trading session for the day, at the BSE International Convention Hall on October 1, 2018. Shri. S.K.Mohanty, Whole Time Member, SEBI, was the Chief Guest for the event. The august gathering also included Shri. Mohit Kamboj, National Chairman BSE Brokers Forum, Shri. Somasundram, MD & CEO, World Gold Council, Shri. B. K.Sabharwal, Former President, CPAI, Shri. Rikab Mehta, President Bombay Metal Exchange, Shri. Uttam Bagri, Chairman BSR Brokers Forum and Shri. Rajesh Baheti, President, ANMI.

Glimpses of Ganeshotsav

From 13th September to 23rd September 2018

Cottoncha Raja

Shri. S.M. Makharia and family perform the aarti

Distribution of the prasad.

CAI President Shri. Atul Ganatra and Past President Shri. Dhien N. Sheth join the grand procession for the visarjan.

Pudchya varshi lavkar ya!

UPCOUNTRY SPOT RATES

(₹\Quintal)

September 2018

2017-18 Crop

Growth	P/H/R	P/H/R	GUJ	KAR	M/M	P/H/R	M/M/A	M/M/A	P/H/R	M/M/A	M/M/A	P/H/R	M/M/A	GUJ	M/M/A/K	GUJ	M/M/A/K	M/M/A/K/T/O	A/K/T/O	M(P)/K/T
G. Standard	ICS-101	ICS-201	ICS-102	ICS-103	ICS-104	ICS-202	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-105	ICS-106	ICS-107
Grade	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine	Fine
Staple	22 mm	22 mm	22 mm	23 mm	24 mm	26 mm	26 mm	26 mm	27 mm	27 mm	27 mm	28 mm	28 mm	28 mm	29 mm	29 mm	30 mm	31 mm	32 mm	34 mm
Micronaire	5.0-7.0	5.0-7.0	4.0-6.0	4.0-5.5	4.0-5.5	3.5-4.9	3.0-3.4	3.5-4.9	3.5-4.9	3.0-3.4	3.5-4.9	3.5-4.9	3.5-4.9	3.5-4.9	3.5-4.9	3.5-4.9	3.5-4.9	3.5-4.9	3.5-4.9	3.0-3.8
Strength/GPT	15	15	20	21	23	26	25	25	26	26	26	27	27	27	28	28	29	30	31	33
1	12457	12598	9336	10236	11135	12907	11192	11557	12963	11670	12120	13020	12935	13076	13273	13413	13357	13610	14201	16591
3			...		...		...			HOLIDAY				...			...		...	
4	12288	12429	9280	10179	11023	12738	11135	11501	12795	11614	12063	12851	12879	13020	13216	13357	13301	13610	14201	16591
5	12288	12429	9280	10179	11023	12738	11079	11445	12795	11614	12063	12851	12823	13020	13132	13357	13301	13610	14201	16591
6	12288	12429	9280	10179	10939	12738	10995	11360	12795	11529	11979	12851	12738	12963	13048	13301	13216	13526	14116	16591
7	12288	12429	9280	10179	10939	12738	10939	11360	12795	11473	11979	12851	12738	12963	13048	13301	13216	13526	14116	16591
8	12288	12429	9280	10179	10939	12738	10939	11360	12795	11473	11979	12851	12738	12963	13048	13301	13216	13526	14116	16591
10	12288	12429	9336	10236	10995	12710	10995	11417	12766	11529	12035	12823	12795	13020	13104	13357	13273	13582	14172	16647
11	12288	12429	9392	10292	11051	12766	11051	11473	12823	11585	12092	12879	12851	13076	13160	13413	13329	13638	14229	16703
12	12288	12429	9392	10292	11051	12766	10995	11417	12823	11529	12035	12879	12823	13076	13104	13413	13273	13582	14201	16675
13			...		...		...			HOLIDAY				...			...		...	
14	12288	12429	9392	10292	11051	12654	10939	11360	12710	11473	11979	12766	12766	13020	13020	13357	13188	13498	14116	16591
15	12288	12429	9392	10292	11051	12654	10911	11332	12710	11445	11951	12766	12738	12991	12991	13329	13160	13469	14088	16563
17	12288	12429	9392	10292	11051	12598	10911	11332	12654	11445	11951	12710	12738	12991	12991	13329	13160	13469	14088	16563
18	12288	12429	9392	10292	11051	12513	10854	11276	12570	11389	11895	12626	12682	12935	12935	13273	13104	13413	14032	16506
19	12288	12429	9336	10292	10995	12429	10798	11220	12485	11332	11838	12541	12598	12879	12935	13216	13104	13413	14032	16366
20	12288	12429	9336	10292	10995	12429	10798	11220	12485	11332	11838	12541	12570	12879	12879	13216	13076	13329	13976	16310
21	12288	12429	9308	10264	10967	12429	10742	11164	12485	11304	11754	12541	12457	12823	12766	13160	12963	13273	13947	16281
22	12317	12457	9364	10320	11023	12485	10770	11192	12541	11332	11782	12598	12513	12879	12823	13216	13020	13329	14004	16338
24	12317	12457	9392	10376	11079	12485	10770	11192	12541	11332	11782	12598	12513	12823	12823	13160	13020	13329	14004	16338
25	12317	12457	9392	10376	11079	12485	10770	11192	12541	11332	11782	12598	12513	12823	12823	13160	13076	13357	13947	16422
26	12317	12457	9392	10376	11079	12429	10770	11192	12485	11332	11782	12541	12513	12823	12823	13160	13076	13357	13947	16422
27	12317	12457	9336	10320	11023	12345	10770	11135	12401	11248	11698	12457	12457	12766	12766	13104	13076	13357	13891	16422
28	12317	12457	9280	10264	10967	12317	10770	11051	12373	11248	11642	12429	12457	12738	12766	13076	13020	13273	13835	16422
29	12317	12457	9280	10264	10967	12317	10770	11051	12373	11248	11642	12429	12457	12738	12766	13076	13020	13273	13835	16422
H	**12457**	**12598**	**9392**	**10376**	**11135**	**12907**	**11192**	**11557**	**12963**	**11670**	**12120**	**13020**	**12935**	**13076**	**13273**	**13413**	**13357**	**13638**	**14229**	**16703**
L	**12288**	**12429**	**9280**	**10179**	**10939**	**12317**	**10742**	**11051**	**12373**	**11248**	**11642**	**12429**	**12457**	**12738**	**12766**	**13076**	**12963**	**13273**	**13835**	**16281**
A	**12304**	**12445**	**9341**	**10272**	**11021**	**12583**	**10898**	**11296**	**12639**	**11426**	**11898**	**12696**	**12665**	**12925**	**12967**	**13263**	**13154**	**13450**	**14056**	**16502**

H = Highest L = Lowest A = Average

UPCOUNTRY SPOT RATES

(Rs./Qtl)

Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Strength /GPT	Spot Rate (Upcountry) 2017-18 Crop SEPTEMBER 2018					
							24th	25th	26th	27th	28th	29th
1	P/H/R	ICS-101	Fine	Below 22mm	5.0-7.0	15	12317 (43800)	12317 (43800)	12317 (43800)	12317 (43800)	12317 (43800)	12317 (43800)
2	P/H/R	ICS-201	Fine	Below 22mm	5.0-7.0	15	12457 (44300)	12457 (44300)	12457 (44300)	12457 (44300)	12457 (44300)	12457 (44300)
3	GUJ	ICS-102	Fine	22mm	4.0-6.0	20	9392 (33400)	9392 (33400)	9392 (33400)	9336 (33200)	9280 (33000)	9280 (33000)
4	KAR	ICS-103	Fine	23mm	4.0-5.5	21	10376 (36900)	10376 (36900)	10376 (36900)	10320 (36700)	10264 (36500)	10264 (36500)
5	M/M	ICS-104	Fine	24mm	4.0-5.0	23	11079 (39400)	11079 (39400)	11079 (39400)	11023 (39200)	10967 (39000)	10967 (39000)
6	P/H/R	ICS-202	Fine	26mm	3.5-4.9	26	12485 (44400)	12485 (44400)	12429 (44200)	12345 (43900)	12317 (43800)	12317 (43800)
7	M/M/A	ICS-105	Fine	26mm	3.0-3.4	25	10770 (38300)	10770 (38300)	10770 (38300)	10770 (38300)	10770 (38300)	10770 (38300)
8	M/M/A	ICS-105	Fine	26mm	3.5-4.9	25	11192 (39800)	11192 (39800)	11192 (39800)	11135 (39600)	11051 (39300)	11051 (39300)
9	P/H/R	ICS-105	Fine	27mm	3.5.4.9	26	12541 (44600)	12541 (44600)	12485 (44400)	12401 (44100)	12373 (44000)	12373 (44000)
10	M/M/A	ICS-105	Fine	27mm	3.0-3.4	26	11332 (40300)	11332 (40300)	11332 (40300)	11248 (40000)	11248 (40000)	11248 (40000)
11	M/M/A	ICS-105	Fine	27mm	3.5-4.9	26	11782 (41900)	11782 (41900)	11782 (41900)	11698 (41600)	11642 (41400)	11642 (41400)
12	P/H/R	ICS-105	Fine	28mm	3.5-4.9	27	12598 (44800)	12598 (44800)	12541 (44600)	12457 (44300)	12429 (44200)	12429 (44200)
13	M/M/A	ICS-105	Fine	28mm	3.5-4.9	27	12513 (44500)	12513 (44500)	12513 (44500)	12457 (44300)	12457 (44300)	12457 (44300)
14	GUJ	ICS-105	Fine	28mm	3.5-4.9	27	12823 (45600)	12823 (45600)	12823 (45600)	12766 (45400)	12738 (45300)	12738 (45300)
15	M/M/A/K	ICS-105	Fine	29mm	3.5-4.9	28	12823 (45600)	12823 (45600)	12823 (45600)	12766 (45400)	12766 (45400)	12766 (45400)
16	GUJ	ICS-105	Fine	29mm	3.5-4.9	28	13160 (46800)	13160 (46800)	13160 (46800)	13104 (46600)	13076 (46500)	13076 (46500)
17	M/M/A/K	ICS-105	Fine	30mm	3.5-4.9	29	13020 (46300)	13076 (46500)	13076 (46500)	13076 (46500)	13020 (46300)	13020 (46300)
18	M/M/A/K/T/O	ICS-105	Fine	31mm	3.5-4.9	30	13329 (47400)	13357 (47500)	13357 (47500)	13357 (47500)	13273 (47200)	13273 (47200)
19	A/K/T/O	ICS-106	Fine	32mm	3.5-4.9	31	14004 (49800)	13947 (49600)	13947 (49600)	13891 (49400)	13835 (49200)	13835 (49200)
20	M(P)/K/T	ICS-107	Fine	34mm	3.0-3.8	33	16338 (58100)	16422 (58400)	16422 (58400)	16422 (58400)	16422 (58400)	16422 (58400)

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