

Colour cotton

The renewed interest in research on colour cotton is an off-shoot of the growing consumer driven movement. There is worldwide concern about the growing health hazard associated with the use of textiles dyed with the use of textiles dyed with the azo-group and other synthetic dyes. Manmade fibres have substituted cotton consumption substantially the world over. In India, cotton still happens to be the major textile used and will continue to be in the near future. There may be an increase in organic substitutes or partners by way of blending-jute, pineapple, and the like. A new trend has emerged in the cotton market scenario as the natural coloured cotton has caught the fancy of crop scientists. The renewed interest in research on colour cotton is an off-shoot of the growing consumer driven movement. It is an Eco-friendly alternative to dye-based textiles. Earlier the interest was slim in this due to low economic spin-off and inferior quality of cotton, but researchers now have come up with commercial varieties by incorporating desirable strains through breeding techniques. The coloured cotton was commercially grown in India during the first half of the century, there was a market decline in its cultivation due to low yields and weak fibres. The natural coloured cotton is much more favorable and desirable as compared to the chemically dyed cotton as its colour fades when treated with detergents. ICAR had recently identified in "*Gossypium arboreum*", an indigenous cotton plant, and four brown-coloured varieties that possessed medium staple length and good strength. Various shades of brown and green have also been identified in "*Gossypium Hirsutum*" and "*Gossypium Barbardense*".

Various genetic varieties will be available in the country with a rich depository of coloured wild cotton species in various shades of brown, tan gray and cream. Besides the germ plasm accessions, wild species are a rich repository of colour linted cotton.

Profit of Colour Linted Germplasm		
Species	No. of accessions	Lint colour range
<i>G.hirsutum</i>	40	Brown (different shades)and green
<i>G.arboreum</i>	6	Brown, red brown, Kakhi and Almond.
<i>G.barbadense</i>	2	Brown
Wild species	17	Brown, brownish tan, gray, cream

In India, brown linted varieties of Asiatic cotton, Coconada-1, Coconada-2, and Red Northerns were commercially grown during the first half of this century. A brown linted variety KC 92-2 has been released for commercial cultivation in Madhya Pradesh and other variety DDCC-1 is being released for cultivation Karnataka.

Cotton breeding is considered to be a complex as the expression of colour is linked to several genes and not to a single gene. Environmental factors also influence the colour in plants.

THE ORIGINS OF COLOURED COTTON

Contrary to what some U.S. fashion experts and popular magazine writers may believe, natural coloured cotton varieties were not invented in California in the 1980s. All coloured commercial cotton varieties

descended, in large part, from Central American and Mexican parental stocks created by indigenous peoples of the Americas.(4)

Even more importantly, these cotton varieties are not the product of "primitive" farming communities, but continue to be grown today by thousands of indigenous farmers in the Americas.

The estimated 15,000 peasants and indigenous farmers who still routinely cultivate native, pigmented cotton varieties in Peru constitute by far the largest single group of naturally coloured lint producers worldwide. Brown cotton, called coyote or coyuche, continues to be spun by Nahua Indian women in Mexico. Brown cotton called Ixcoco is still spun in several communities in highland Guatemala.

"COTTON MONOPOLIES"

Sally V. Fox, an entomologist and cotton breeder from California, is best known for her entrepreneurial efforts to promote commercial-scale production of natural and organic coloured cottons. Her company, Natural Cotton Colours of Arizona is the largest seller of coloured cotton in the United States. Fox is widely recognized as a pioneer in California's sustainable agriculture movement because of her success in developing both natural and organic coloured cotton for commercial markets.

In 1990, Sally Fox received plant patents (under the U.S. Plant Variety Protection Act) for two varieties of natural coloured cotton, "COYOTE" (a brown coloured variety) and "GREEN." As the legal "owner" of two coloured cotton varieties, Fox's patent-like protection gives her the legal right to exclude others from selling her varieties, or reproducing, importing or exporting them without permission until the year 2008.

But Sally Fox did not invent coloured cotton. She got her seeds from a collection held by the U.S. Department of Agriculture (USDA) in California. The coloured cotton germplasm was originally collected by a USDA plant collector, Dr. Gus Hyer, in Mexico or some other part of Central America (exact origin is not known).(5)

To develop coloured cotton varieties, Fox did what farmers have been doing for centuries--she selected seeds for certain characteristics over a number of growing seasons. Her breeding work, though labour intensive and time consuming, was not especially difficult because she began with seeds that had been improved by others. Fox began with a single plant selection of the brown-coloured seed in 1982. These seeds were saved and re-planted. Subsequent generations were picked in bulk, eventually allowing for the multiplication of coloured cotton seed. Specifically, Fox selected seeds for lint colour and for fibre quality. The primary objective was to breed a coloured cotton with a lint suitable for mechanized spinning.(6)

Under the U.S. Plant Variety Protection Act (the U.S. system of plant breeders' rights), Fox received patents for breeding distinct, uniform and stable varieties of coloured cotton. Nevertheless, there are questions and considerable controversy about the right of plant breeders to obtain legal "ownership" of new varieties that are based on germplasm collected from farmers and indigenous peoples of the Third World.

Commenting on the distinctiveness of Fox's protected cotton varieties, Dr. Philip Wakelyn of the National Cotton Council in Washington, D.C. remarks, "What I've seen of her varieties has a long way to go, it doesn't look any different from the USDA collections I saw 25-30 years ago. All she really shows is flower changes...it makes one wonder how much change she has really made."(7)

Fox's coloured cottons are, in fact, still lacking in length and strength compared to white cotton. In 1993, for example, the green cotton was too short and weak to be spun alone, so manufacturers blended it with the longest staple white cotton available.(8)

BC Cotton Inc. of Bakersfield, California, founded in 1992, is now competing with Sally Fox in the development of coloured cottons for commercial sale. According to company spokesperson, Raymond Bird, BC Cotton has developed red, brown, ivory and green coloured cotton varieties.

BC Cotton developed their cotton varieties the same way that Sally Fox did: they obtained seed samples from germplasm collections held by university and government gene bank collections, including Texas A&M University, University of California at Berkeley, and USDA's Shafter Research Station. Free samples of 25 seeds are made available to breeders who request them. Bird says that their seed samples probably originated in Central and South America, although he is not aware of the precise origin. "There is coloured cotton available in all the gene banks, it has been around for years," explains Bird.

In 1991, Sally Fox filed a lawsuit against Raymond Bird claiming that his company's coloured cottons infringed upon her plant patent claim. But recently, Fox voluntarily dismissed the suit.

In 1993, BC Cotton Inc. grew approximately 2,000 acres of coloured cotton in California, Arizona and Texas. Their markets are in the U.S., Japan and Europe. Unlike Sally Fox's company, BC Cotton does not have an emphasis on organic cotton production. The company does not plan to apply for breeder's rights on their coloured cottons.

In the meantime, Sally Fox is developing new cotton colours--including a mocha brown, and yellow-green. She is working with germplasm samples obtained from Texas A&M University, seeds originally

collected in Peru. Fox expects to seek breeder's rights on new coloured cotton varieties in the near future. Ironically, if Peruvian or Central American farmers wrote to Texas A&M University and requested that the seed bank send them samples of Sally Fox's patented seeds, the gene bank would be unable to comply. Dr. Edward Percival, curator for cotton germplasm at Texas A&M University explains: "Even if I had samples of Sally Fox's seeds, I would be unable to send them because of the varietal protection."(9)

NATIVE COLOURED COTTONS OF PERU

Ancient Andean societies domesticated and improved two of the world's finest textile fibres, and also developed "one of the greatest textile traditions in universal history."(10) Fabrics made by Andean weavers five millennia ago used two distinct colours: light brown and chocolate brown. Fisher folk of northern Peru used the darker fibres to make sturdy fishing nets and lines. The darker colours were carefully selected because they were less visible than lighter ones to fish swimming near the water's surface. In the mid-to-late 1800s, naturally pigmented cotton lint was still widely cultivated and spun by Indian artisans in coastal villages of northern Peru.

In this century, outside observers frequently assumed that naturally pigmented cotton varieties developed by indigenous cultures were all but extinct. Valuable gene pools of natural coloured cotton in Peru were severely eroded during the last half century, due primarily to the introduction of white, commercial cotton varieties, together with government policies to eradicate native cotton.

Beginning in the 1930s, federal laws and decrees in Peru obliged farmers to cut down and destroy perennial, and especially pigmented, forms of native cotton at the end of each growing season. (11) The concern was that cross-pollination between pigmented and commercial cotton would "contaminate" the white varieties, or introduce harmful insect and diseases to the commercial crop. Although these laws

are rarely enforced today, in some areas native perennial cotton is still systematically destroyed by government phytosanitary workers.(12)

Despite the powerful forces working to extinguish native cotton varieties, indigenous and peasant farmers in isolated areas of northern Peru continued to cultivate their "illicit" coloured cottons, preserving a 4,500 year-old farming and textile tradition.

CONSERVATION AND USE OF NATIVE COLOURED COTTON FOR DEVELOPMENT

Today, a Peruvian NGO, Sociedad de InvestigaciÛn de la Ciencia, Cultura y Arte NorteÒo (SICAN), is working for the revival, conservation and use of native coloured cottons as a rural development strategy to support indigenous farmers and traditional artisans. The Native Cotton Project, sponsored by SICAN since 1984, estimates that as many as 15,000 traditional farmers still cultivate coloured cotton varieties, while over 50,000 women still spin and weave native cotton fibres. Virtually all native coloured cotton is produced without synthetic fertilizers or pesticides, employing traditional, pre-Colombian systems of pest control. Most coloured cotton grows in the form of a perennial shrub. In areas where sub-surface water is available, it can grow up to 5 meters high, with annual yields of over 10 kilograms per plant. It is remarkably pest and disease resistant, and thrives in marginal soils with little or no rainfall.

In 1991 SICAN spearheaded a regional movement to have native cottons legally declared as "national plant patrimony" by regional governments.¹³ According to James Vreeland of SICAN, "Its cultivation and use by traditional and Indian communities are now officially protected, making it illegal to export germplasm without the express consent of the regional native cotton peasant farmer organizations."(14)

The Native Cotton Project of Peru also provides support for collection, conservation and sustainable use of coloured cotton germplasm. Six principal colour lines have been recovered and stabilized from traditional farmer varieties (landraces): cream, tan, medium brown, reddish brown, chocolate brown and mauve. The Project maintains 75 different landraces of white and naturally pigmented fiber lines, grown experimentally and commercially in dozens of small plots throughout northern Peru. SICAN staff member James Vreeland writes:

All bolls are hand picked, exposed to sunlight to intensify and make more uniform the color of the pigment throughout the fiber's lumen. Much of the lint is destined for craft production and domestic consumption within the rural villages where it is harvested, but a significant amount is widely circulated in popular urban markets where it is sold not only as an artisan textile fiber, but also as a medical remedy for over fifty different somatic and psychosomatic disorders.(15)

In 1992, with assistance from the Native Cotton Project, about 300 metric tonnes of coloured organic cotton was produced for the Peruvian textile industry, which exported most of its production to the United States, Europe and Japan. Ironically, native coloured cottons of Peru will have to compete in the international marketplace with proprietary varieties that are ultimately of Third World origin.

FUTURE TRENDS: COTTON WITH BLUE GENES?

Several biotechnology companies are using genetic engineering to modify cotton fibres. One of the long-term goals is to engineer cotton varieties to produce coloured fibres--especially blue, for the blue jeans manufacturing industry. If genetic engineers succeed in developing blue coloured cotton, it would obviate the need for synthetic chemical dyes. Genes from the indigo plant are one possible source for blue genes. If molecular scientists can determine the genes that code for pigmentation in natural

coloured cottons, these genes may someday provide another source of colour for genetically engineered coloured cottons.

Two U.S.-based companies, Calgene (Davis, California, USA) and Agracetus (Middleton, Wisconsin, USA), have initiated research and development on coloured cotton fibre via genetic engineering. Will it work? Ken Barton of Agracetus states unequivocally: "Of course it will work. Give a scientist enough time and money and he can do anything." (16) Scientists at Calgene are tight-lipped about their coloured cotton project, saying only that it is a brand new initiative. (17)

Meanwhile, geneticists at the Russian Academy of Technological Science and cotton-planters of Turkmenistan claim that they have already succeeded in developing "diverse colours of cotton fiber...using mutation methods based on the genetic engineering from the fine-stapled "white gold" of central Asia."¹⁸ RAFI was unable to obtain any additional information about this work.

CONCLUSION

The conflict between "Breeders' Rights" and "Farmers' Rights" is not new. Sally Fox's patent-like claim on coloured cottons is a particularly striking example of the inequities of a plant intellectual property system that rewards the contribution of a modern plant breeder, with no corresponding recognition or reward for the original innovators--anonymous farmers, both past and present, who selected, nurtured and developed coloured cottons over millennia.

Farmers and NGOs in Peru have taken important steps to protect their national plant patrimony--the invaluable cultural and economic heritage of indigenous peoples. These grassroots efforts serve as an important model for farmers and local communities who seek to control their genetic resources and recognize the contributions of the informal sector.

- (1) Not all coloured cotton is grown organically, although some people believe that natural coloured cotton varieties offer greater pest resistance.**
- (2) Personal conversation with Dr. Edward Percival, Texas A&M University, November 14, 1993. According to Dr. Purcival brown cotton sells for roughly (US) \$2/lb. and green sells for \$5/lb., this compares with white cotton at around .60 per lb.**
- (3) Nobody really knows how much coloured cotton is grown in the U.S. RAFI uses this estimate based on conversations with industry analysts and companies who are contracting directly with farmers.**
- (4) Vreeland, James M., Paper presented in the Joint Economics and Marketing Panel Discussion on "Niche Markets for Specialty Cottons: Colored and Organic Cottons," at the Beltwide Cotton Production Research Conferences, National Cotton Council of America, New Orleans, January, 1993.**
- (5) U.S. Plant Variety Protection Certificate Numbers. 8900170 and 8900169, Exhibit A, Section 14a, Breeding History, Issued 28 September 1990.**
- (6) All information on breeding history of "coyote" and "green" comes from U.S. Plant Variety Protection Certificates, 8900169 and 8900170.**
- (7) Personal communication with Dr. Philip Wakelyn, National Cotton Council, Washington, D.C. , August, 1993.**
- (8) Apodaca, Julia, "Economic Potential of Naturally Colored and Organically Grown Cotton for the Texas Natural Fibers Industry," Natural Fibers Research and Information Center, Bureau of Business Research, University of Texas at Austin, 1993, p. 14.**
- (9) Personal communication with Dr. Edward Percival, Curator for Cotton Germplasm, Texas A&M University, November, 1993.**
- (10) Vreeland, James M., Paper presented in the Joint Economics and Marketing Panel Discussion on "Niche Markets for Specialty Cottons: Colored and Organic Cottons," at the Beltwide Cotton Production**

Research Conferences, National Cotton Council of America, New Orleans, January, 1993.

(11) Government policies to eradicate perennial forms of cotton are not limited to Peru. In the United States, for example, the U.S. Department of Agriculture has waged a similar campaign against perennial relatives of cotton in Arizona where it grew in close proximity to commercial cotton fields.

(12) Personal communication with James Vreeland, 25 July 1993.

(13) The law draws heavily from Peru's "Codigo del Medio Ambiente" and has been ratified by at least three states in the region where the Native Cotton Project operates.

(14) Vreeland, James M., "Ancient Alternatives to Peru's Commercial Cotton Pesticide Crisis," Global Pesticide Campaigner, May, 1992, p. 6.

(15) Vreeland, James M., Paper presented in the Joint Economics and Marketing Panel Discussion on "Niche Markets for Specialty Cottons: Colored and Organic Cottons," at the Beltwide Cotton Production Research Conferences, National Cotton Council of America, New Orleans, January, 1993, p. 1535.

(16) Barton was quoted in "How blue genes could green the cotton industry," by Rosie Mestel, New Scientist, 31 July 1993, p. 7.

(17) Personal communication with Kathy Houck, Calgene.

(18) Information on coloured cotton in Russia comes from an undated brochure, The 1st International Exhibition Presentation, Russian Academy of Technological Science Association "Biotechnology Industry."

RAFI Communique is published by the Rural Advancement Foundation International. We encourage our readers to use and re-print this information to foster greater awareness and public debate of these issues. However, RAFI is a small NGO that depends on contributions and grants to support our research. We ask that credit is given to RAFI whenever our work is used or re-printed. Thank you!

THE REVIVAL OF COLORED COTTON

<http://www.perunaturtex.com/scientif.htm>