Fascination for Genetically Colored Cottons

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Abstract

The article provides an insight into the history and development of genetically colored cotton in the world. Though extensively grown and used in the past, after industrial revolution short-fibered colored cotton was replaced by long-fibered white linted cotton processed better in the industrial looms. However, the cultivation of commercial white cotton is pesticide dependant. Moreover, its processing involves the use of chlorine-bleaching agents, formaldehydes and phenols quite harmful and dangerous to human and other life forms. The naturally colored varieties were almost going to extinct until Sally Fox, a graduate from University of California in Integrated Pest Management, rediscovered brown cotton seeds in 1982. She branded her discovery as Fox Fiber-strong long-fibered colored cotton which increased its color intensity with repeated washing. In India, cultivation of the colored cotton and its use did not receive encouragement for various reasons. It may be environment friendly, aesthetic and fascinating, but its continued patronage will be determined by economic outlook and long-term benefits.

1. History

The fibers of the cotton plant, in the genus *Gossypium*, have been harvesting for around 5000 years. The historical varieties of cotton of the early civilizations came in a wide range of colors. Colored cotton agriculture was reported to have begun around 2700 BC in Indo-Pakistan, Egypt and Peru. It was then common to grow cotton in a variety of natural colors such as mocha, tan, gray, brown, black, mahogany, red, pink, blue, green, cream and dull white. Later on, white linted types were developed with the human civilization progressed, thus the commercial white cotton has become markedly different from its venerable ancestors. In pre-revolutionary America the slaves were known to grow colored cotton for their own use. The Central Institute for Cotton Research (CICR) in Nagpur of Maharashtra state in India maintains global pool of cotton genetic resources. There are over 40-50 accessions, which produce naturally colored lint of various colors in various shades of brown, *khaki* and green. These naturally colored cotton varieties were grown in special pockets of Andhra Pradesh, Maharashtra, and West Bengal state of India for until even 1950-60s for specialized hand spinning by local expertise into medium count yarns. Some bulk samples were also procured, tested in mills and woven cloth of *khaki* supplied for defense personnel. But they have become obscure and redundant without a demand in the market especially in the mill industry at the subsequent periods. These were found unsuitable for industrial processing because of the short fiber length and weaker fibers. In India, the earlier source of naturally colored *khaki* fabric was also abandoned for commercial use and started growing white cotton during the past 60-100 years. The improved white linted cotton varieties have dramatically altered the culture and processing of cotton fiber all over the world.

The industrial revolution brought us industrial cotton looms. Short-fibered colored cotton was replaced by long-fibered all-white cotton that processed better in the industrial looms. Commercially grown globally, the white cotton became a highly pesticide-dependent crop in the world, and only after the transgenic Bt-cotton becomes resistant to bollworms in the last one decade or more, the pesticide use in cotton production has come down significantly.

2. *Fox Fiber*

Ms Sally Fox of USA in 1980s worked with a cotton breeder in Davis, California, as a pollinator for a pest-resistant cotton breeding trial. Sally Fox came across seeds that produced natural brown cotton. Despite their pest-resistant qualities, the breeder was not interested in that brown lint cotton variety, as they produced unusable short fiber. There are some wild species like *Gossypium anomalum* and certain perennial types,

which produce colored fiber hairs that are either non-spinnable or of poor quality for machine spinning.

The Peace Corps sent Sally Fox to the Gambia in West Africa. There she observed the extensive misuse of pesticides which magnified her concern for the environment, encouraging her to develop safer methods of pest management. After returning home, Sally Fox entered a graduate program at the University of California, and in 1982 received her Master's degree in Integrated Pest Management (IPM).

Sally Fox took on the challenge of improving an ancient agricultural art. Ms Fox was able to successfully breed and market a variety of naturally colored cotton she called *Fox Fiber*. In 1989, she opened Natural Cotton Colors, Inc. Thereafter, she started making designs in fabrics with her cotton and continued colored cotton research.

The natural-colored varieties were almost going to be extinct until Sally Fox rediscovered a small amount of brown cotton seeds in 1982. She began to research creating commercially viable long-fibered colored cotton (better for today's looms). The invention was called *Fox Fiber*- strong long-fibered colored cotton.

Sally Fox in USA used the rustic skill of hand spinning to guide her in the development of an environment friendly technology. She improved traditional pest-resistant self-colored cotton to accommodate the modern textile process. Sally Fox's interest in fiber began in 1968 when she was only 12 learning the skill of hand spinning. A few years later she developed an interest in entomology, joined the Peace Corps after college and found herself battling rice and peanut pests in Africa. Cotton processing also involves the use of chlorine-bleaching agents, formaldehydes and phenols quite harmful and dangerous to human and other life forms. Hence, Sally Fox tried working with a family mill in Mexico.

She took seeds and grew them out, year after year, with organic methods. The textile artist Sally Fox was the scientist who understood the importance of naturally colored pest-resistant cotton. Seven years of hand selection for fiber length and spinning quality produced two varieties protected by Plant Variety Protection Certificates and a United Nations Environmental Program Award. Her timing was perfect. Major textile corporations were eager for organic products and Fox was soon heading a multimillion-dollar enterprise. Life was golden because she had enough to do for all the cotton breedings desired for protecting the environment. There was strong opposition that Fox's cotton would contaminate the white cotton crops grown in the same valley and processed in the same mills.

Sally Fox successfully presented her research findings to potential investors. She reported that after repeated washings, the fabric got darker, and the *Fox Fiber* brand cotton of Sally Fox increased its color intensity with repeated washings. Later on, a two-year study funded by the California Agricultural Technology Institute and headed by Professor Dianne Dickerson, California State University, Fresno revealed that all naturally colored cotton fabrics got darkened with repeated washings.

Highlight of Sally Fox's fieldwork occurred in F_2 generation of some colored cotton crosses. While evaluating over 1,000 progeny, and was about to choose one magnificent, golden blonde long-limbed four feet tall plant loaded with cotton, Sally Fox observed a scrawny little bright green cotton plant with only two small bolls. None of the thousands of plants screened was exactly the same as the first green cotton Sally Fox had ever seen. She indeed found avery bright green cotton bearing plant was located. The textiles artist was thrilled to see that as many as three colors can be in one fiber. The profit she was able to retain was used to fund her breeding program. Sally was determined to breed for interesting cotton colors and longer fibers.

3. Colored cotton in India

Indian cotton scientists also did excellent breeding work on cotton in the last century and in this decade, but none could excel the white cotton breeding program. And above all, the colored cotton cultivation and use did not receive encouragement for various reasons and the setback it may bring to the textile industry. Research on colored cotton has brought out the role of multiple allelism, dominance and modifier complexes with intensifiers and suppressors in the inherent color lint producing gene system. It has also high environmental influence especially soil types, nutrition, sunlight and post-boll opening environment. These features affect the lint length development, maturity and strength.

Cotton Research Stations at Khandwa (Madhya Pradesh) and University of Agricultural Sciences (UAS), Dharwad, Karnataka state, India have done excellent research on colored cotton including organic production of cotton as well as yarn and cloth, and also made colored cotton shirting, etc. in cooperation with organic farmers and ginning, spinning, weaving and garment industries without the use of chemicals and other dyes.

It may be environment friendly, aesthetic and fascinating, but its continued patronage will be determined by economic outlook and long-term benefits. Commercial production of color-linted cotton does not appear to be in the interest of seed and textile industry at present. But biotechnology may have some interest, if there is a future demand.

Figure 1: Nice brown color cotton in nature