

The Problem with Your Clothes: Examining the Sustainability of Cotton Production Practices

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Flip the label of any shirt in your closet and chances are you will find cotton listed as a large percentage of the material used in its manufacture. Cotton is used in more than half of the world's fibers to make clothes and garments. Yet not enough attention is paid to the environmental, social, and economic impacts of this extensively-grown crop. Cotton farming has been labeled as one of agriculture's most environmentally destructive activities due to the massive amounts of pesticides and water it requires [1]. Cotton covers only two and half percent of the world's cultivated land, yet uses up to a quarter of the world's insecticides; this is more than any other single crop [2]. Against this backdrop, cotton farming is severely threatening the environment. The challenge for today's consumerist world is to find environmentally sustainable ways to farm cotton.

Problems with High Water Demand

As cotton is a heavily cultivated crop that requires large amounts of water and insecticide, it is not difficult to see why it has been labeled "environmentally destructive." The production of enough cotton for a simple shirt and a pair of jeans can use more than 20,000 liters of water, and 75% of global cotton harvest comes from irrigated land [3]. Such extensive irrigation inevitably leads to water-logging of soil and falling water tables. If left unchecked, this will ultimately deplete freshwater resources. Falling water tables in agricultural areas result in saltwater intrusion into freshwater sources and salinization of the soil, which causes many problems for wildlife. The effects of irrigation are most starkly illustrated by the depletion of the Aral Sea, an inland freshwater body located between Uzbekistan and Kazakhstan. Continual withdrawal of freshwater from the Aral Sea for the purpose of irrigating cotton fields led to a decrease in the surface water level. Shrinking of the sea, which now covers only 10% of its original area, has been described by the UN Secretary-General Ban Ki Moon as "one of the worst environmental disasters in the world" [4]. Freshwater influx from the Syr Darya River and Amu Darya River that feed the

sea declined as flows were diverted for irrigation, and salinity increased over large areas of the river basins. Consequently, 20 out of 24 native fish species disappeared [3]. As Uzbekistan remains the world's second largest cotton exporter [5], Uzbek leaders are unwilling to give up their main irrigation source and the Amu Darya River is still being diverted [6]. Hence, the risk of continued shrinking of the sea and further loss of marine biodiversity remains.

In addition, dam construction to increase irrigation and land reclamation for cotton fields directly destroys freshwater habitats. Ecosystems downstream of dams are severely affected by the reduced and regulated flow of freshwater. In

Egypt, where cotton is of high economic importance [7], the Egyptian government pays great attention to the quality and quantity of the cotton crop. Located in a geographic region that receives little appreciable rainfall, Egypt's cotton industry depends entirely on irrigation. Hence, the Aswan High dam was built between 1960 and 1970 along the Nile River to boost agricultural production. Following the construction of the dam, the Nile river ecosystem has seen a drastic decrease in the diversity of fish populations due to the trapping of sediments behind the dam, which prevents the flow of nutrients downstream [8]. It is clear then, that the large requirements for water on cotton fields, imposed by irrigation and dam systems, has generated numerous environmental problems in countries dependent on



cotton production.

Problems with High Chemical Demand

Additionally, cotton production consumes large quantities of chemicals, which have serious environmental and health impacts. These chemicals are added to ensure high yields, efficient mass production, and consistent quality. For example, bug repellents are used during seeding, herbicides and insecticides are used to protect the plants, and fertilizers are added to enhance growth. However, these chemicals are not absorbed by the plant but rather dissolve in runoff water and go on to

contaminate rivers, wetlands, and groundwater. The toxic properties of these chemicals may then kill wildlife directly or accumulate to fatal levels in the ecosystem. This was the case in 1995, when Endosulfan was sprayed on cotton fields and contaminated runoff from these fields resulted in the death of more than 240,000 fish in Alabama [3]. Organisms that feed on the pests are also indirectly harmed in the process of pesticide application. In one case, laughing gulls in Texas were poisoned by a parathion application meant to eliminate bollworms on a cotton field a few miles away. The birds died after feeding on the poisoned insects from the cotton field [3]. Such heavy use of insecticides has also resulted in health concerns among growers and consumers. Direct exposure to the chemicals by farmers could potentially have long-term effects on the health of farmers. The cottonseed hull extracted from the cotton plant is a secondary crop that is used as a food commodity. It is estimated that 65% of cotton production ends up in our food chain, whether directly through food oil or indirectly through the milk and meat of animals. Traces of cotton pesticides have been reported in cow's milk in Brazil, fueling concerns of safety to human health [2]. Also, groundwater runoff from cotton fields containing the chemicals could potentially contaminate drinking water sources.

Furthermore, it is not only the growing of cotton that negatively affects wildlife. During the processing stages of cotton manufacturing, which include cleaning, dyeing, and finishing, many hazardous chemicals are added; this results in large quantities of toxic wastewater. Some of these chemicals include silicone waxes, heavy metals, and softeners. When the contaminated effluent is disposed of into the environment, the chemicals present can deplete river water of oxygen and destroy aquatic ecosystems [2]. It has been estimated that over 8,000 chemicals are used in various stages of dyeing and bleaching alone [9].

Measures to Achieve Sustainable Cotton

In an effort by the cotton industry to mitigate damage to humans and the environment, there have been measures taken to grow 'sustainable cotton.' Yet the measures are still in their infancy and are themselves controversial. This is clearly exemplified by genetically modified (GM) cotton, which many claim could potentially solve the problem of heavy pesticide

thuringiensis is inserted into cotton so that the plant is able to produce a toxin that acts as a natural insecticide to kill pest larvae. Higher yields coupled with less pesticide use have been reported with the introduction of the GM crop (Fig. 1).

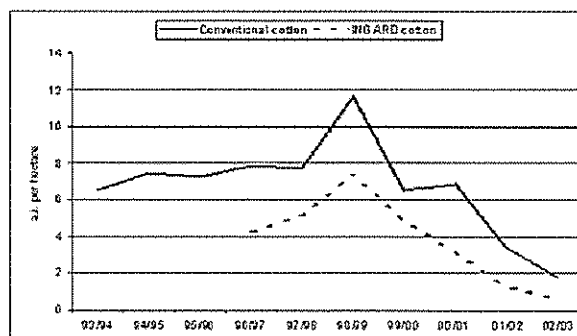


Fig 1. Change in pesticide use (kilograms of active ingredient per hectare) on Australian cotton crops. Significant reductions have been achieved on both conventional and INGARD® cottons over the last five years. Source: Cotton Consultants Association Market Audit Survey 2003.

However, Bt cotton has created a host of other environmental and ethical issues, and is itself unsustainable. Non-target pest populations are increasing, which leads to even greater use of pesticides. In addition, there have been reports that target pests are developing resistance to the toxin naturally produced in these transgenic crops, which suggests that the Bt strain is losing its effectiveness [10]. Bt cotton has also subjected farmers to manipulation by large multinational biotechnology companies, the most famous of which is Monsanto. Due to clever genetic seed segregation by Monsanto, farmers are unable to harvest seeds from crops already grown and have little choice but to buy new seeds every year [11]. They are charged high prices for the Bt cotton seeds, forced to purchase Monsanto pesticides, and at the same time experience a significant loss in income from failed Bt cotton crops. Over the past decade, 200,000 farmers in India have committed suicide after suffering huge losses and mounting debts from loans taken out to purchase the seeds. The cotton growing region in India is now described as the "suicide belt" [11]. As the genetically modified Bt trait is only available to farmers in hybrid seeds, the crop requires more water than traditional Indian seeds. Hence, Bt cotton has also failed to address the problem of heavy water usage [11]. A recent study by anthropologists from Washington University has revealed that GM crops are causing significant problems for sustainable farm management while offering little or no increase in yield [12].

Transgenic cotton appeared to be a 'wonder crop' when first introduced in 2002, yet the numerous negative effects of Bt cotton we see today forces us to question its viability as a replacement for conventional cotton. Yet there is hope for the industry. Organic cotton farming has been heralded as one of the most promising solutions to address the problems of

Cotton farming has been labelled as one of agriculture's most environmentally destructive activities

application. Bt cotton, a type of GM cotton, was developed to reduce reliance on pesticides. In Bt cotton, a strain of *Bacillus*

conventional cotton as minimal, if any, pesticides are used, water use is lower, and impacts on the environment are considerably fewer than for GM cotton and conventional cotton. In organic farming, farmers switch from reliance on chemicals to more biologically sound practices, such as Integrated Pest Management and innovative weeding strategies [1]. Predator insects that prey on cotton insect pests, such as boll weevils, are cultivated. Farmers also plant trap crops, which lure insects away from the cotton. Also, organic farming methods use natural fertilizers, like compost and animal manure, that recycles nitrogen in the soil instead of introducing more. This reduces pollution, nitrogen dioxide emissions, and reliance on chemical fertilizers.

It is popularly thought that organic cotton requires more water than conventional cotton. Such misinformed views partly account for the reason why organic cotton currently represents less than one percent of global cotton production [2]. During the transitional phase from a conventional to organic cotton field, it is reported that organic cotton will require more water. However, recent evidence has shown that once fields completely make the switch to organic, the need for water is reduced and organic cotton could become a rain-fed crop. In fact, organic cotton grown in Brazil is almost entirely rain-fed [13]. With time, organic cotton could help reduce both water and chemical demands.

Even if cotton is grown sustainably through organic means, it may still be labeled unsustainable due to chemical additions in the processing stages. To circumvent the problem of heavy chemical use during dyeing and bleaching, eco-brands have also developed the manufacture of un-dyed clothing or low-impact fiber-reactive dyes. Prominent companies such as Adidas, IKEA, H&M, Marks and Spencer, and Levi's have also joined in a commitment towards buying cotton grown with less stress on the environment, through an effort called the Better Cotton Fast Track Program [14]. With these large textile companies supporting the organic cotton fiber market, the future looks promising. In fact, in 2010, organic cotton

fetched a higher premium than Bt cotton in the market and earned farmers in India more [15]. As retailers and manufacturers emphasize sustainable cotton practices, consumers are encouraged to do the same. The higher cost of organic cotton, at almost 10 to 45 percent more than conventional cotton, is a significant deterrent to consumers when choosing their cotton. However, consumers need to be aware that the price includes the cost of "clean water, fresh air, and healthy farmers" [16].

Conclusion

A reconsideration of the destructive practices of cotton farming through heavy water and chemical use forces everyone in the cotton value chain to recognize the serious repercussions of traditional cotton farming. Its destructive practices and the measures taken to reduce negative impacts need to be re-examined. Current methods to achieve sustainability through GM cotton are themselves fraught with problems, while organic cotton farming remains limited in scope. Considering the widespread use and economic importance of cotton, it is difficult to recommend that more expensively produced organic cotton completely replace conventional cotton. There may not be a single alternative to conventional cotton. However, with changes in cotton production, manufacturing and use practices, particularly by large companies, sustainable consumption of cotton could well be achievable. With each player in the supply chain taking active steps, there can be a healthy and profitable industry for everyone: growers, their communities, manufacturers, retailers, and users of all cotton products. ■

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