Cotton 2040: A Fairy Tale
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If it's not against the laws of physics, it can be done.
Paraphrasing Dr. Richard Feynman, Nobel Laureate in Physics

In 1810 farmers thought about what next year would be like. In 1910 farmers thought about what the next 50 years would be like. By 2010 farmers were thinking about what the next 1000 years would be like. Realizing the extent of their present technological capabilities, people began asking, "If we could do anything we wanted, how would we best (re)design a system to produce X?" By 2040 the cotton growing industry had emerged as one of the first agricultural industries to be certified by the United Nations as "Sustainable."A combination of anthropology, ecology, biotechnology, mechanical engineering, and information systems technology combined into a Buckminster Fullerian conglomerate that met needs of workers, industry, and environment.

Long before 2040 "organic" certification was if little use, as it was displayed on many products, and had been shown to be, in some cases, less environmentally friendly than conventional methods of production for some agricultural products. As opposed to "organic" certification, "sustainable" certification could not be given to single products, but to an entire industry within a large geographic region. "Sustainable" industries had to meet strict criteria in three categories: 1) energy and material inputs, 2) ecological balance, and 3) worker pay, safety, and health benefits.

From a hard economic standpoint these three categories make sense. Energy and material inputs, such as gasoline, pesticides and application, fertilizers, and manpower cost money. Governments, groups, individuals, and finally industries realize that environmental degradation is a true societal cost that is cheapest when it doesn't occur at all. And well paid, healthy workers cost less to insure, have lower turnover rates, and are more productive.

The captains of the cotton industry realized early on that they were in a unique position to tap all the technological innovations available, especially from the biotechnology revolution. Cotton had a weakness, it and tobacco required more pesticides than any other agricultural product in the US. But, cotton had a strength, it was not used for consumption. Therefore, the government and public would be more willing to accept bioengineered cotton.

Annual plants are inefficient to grow, due to the large inputs of energy and materials to prepare the soil, plant the crop, and later remove or render innocuous the remaining plant matter. High energy and material inputs are needed to reduce the biodiversity of an area to a single species (monoculture). A side effect of this practice is increased soil erosion and nutrient loss.

Genomes of cotton's closest relatives were scoured for important genes and genetic combinations. Ultimately this led to several distinct varieties, each with their own suite of subtle genetic differences. These varieties are perennial and differ in respect to drought tolerance, resistance to pathogens, and soil quality requirements. Messages to the public emphasized that these organisms are engineered using existing genes from closely related species and could have been produced in an elaborate series of cross pollination events (like gardeners use).

Multiple cotton varieties are planted in a single field, guaranteeing that, despite the climatic variations of a given year, a large crop will be produced. A cocktail of native plants and animals are seeded or encouraged to grow among and around the cotton plants. The easiest way to stop a weed that will negatively impact your crop is to plant something else that will push that weed away. This "no till, rarely plant" farming has an added benefit of reducing soil and nutrient loss. The increased retention time of rainwater in fields reduces effects of drought and reduces high water events in neighboring streams. Natural predators and parasites of cotton pests, which require overwintering habitat and food sources as adults (such as nectar from flowers) to effectively reproduce and keep pests at an acceptable level, are easily accommodated by the native flora grown among the cotton plants. "Beetle banks" used in northern Europe since the 1990's were the model.

Not all pests of cotton can always be effectively managed in this way. Insect specific viruses called baculoviruses, ubiquitous in the natural environment and harmless to mammals including humans, are specifically engineered to target particular species of cotton pests, such as the Boll Weevil. When dusted with baculoviruses, natural parasites of the Boll Weevil (such as particular wasps) serve as a vector that delivers a lethal disease to individuals throughout the field. Thus pesticide application is not accomplished with heavy machinery over hours or days, but is accomplished by a single person releasing several hundred adult wasps in three to five locations within a field. This technology was already being developed before 2010. By 2040 a single laboratory provided the needs of all US cotton farmers.

Collection of the cotton itself is accomplished using sophisticated machinery patterned after existing machines used to collect fruits and nuts from perennial shrubs and trees. Often tracks are placed among the rows of cotton for machinery to run on, reducing the energy needed to move across a field. Multiple machines are operated remotely by a single farmer. GIS and GPS technology record yield as the harvester moves across the landscape with high enough resolution that individual plants are monitored and yield is tracked over time. Soil nutrient content is largely stable due to reduced loss and added inputs from neighboring plants, but remote sensing through aerial and/or satellite imagery is used to monitor soil nutrient values. Where it is low, individual plants receive an appropriate amount of fertilizer.

Summary of the Theory Presented

A “natural” environment requires no additional inputs of energy or materials by humans to flourish. The vast majority of energy and materials (expenses) used to grow cotton today are because of poor designs. Ask yourself this, “Could a system ever be devised whereby we could produce high yields of cotton with virtually no human inputs of energy or materials?” The outline above will bring you very close to this reality.