

BT 001

BT (*Bacillus thuringiensis*) COTTON CULTIVATION IN NIGERIA, A PANACEA TOWARDS POVERTY ALLEVIATION.

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ABSTRACT

Cotton production had been a good contributor to the Gross Domestic Product (GDP) of Nigeria, especially in the 1960s and 1970s but the contribution of cotton to Nigeria's GDP dropped significantly from 25% in 1980 to 5% in the present day. Out of 51 ginneries which were in operation across the country in the 1980s only 10 are currently operating at low capacity. Biotic factors especially insect pest reduced production/yield of cotton. Despite all these factors, production still continued on a small and medium scale among farmers. One of the agriculture's best defences against plant-eating insects is BT (*Bacillus thuringiensis*) fortification. Bt cotton refers to a transgenic cotton which contains endotoxin protein inducing gene obtained from soil bacterium *Bacillus thuringiensis*. It was developed to reduce the heavy reliance on pesticides which can either be sprayed on the surfaces of crops to provide temporary protection or can be genetically engineered into the crops to protect it against insects throughout the lifespan of the plants. BT has allowed the growers to avoid applying large quantities of potentially toxic insecticides. However, the widespread use of BT in many parts of the world has prompted concerns that insects might someday become resistant to this important treatment. This is a valid concern that has engaged agricultural researchers before BT crops reached the market place. Although, the technology is still young and have not been understood by many, they have contributed immensely to development of many new plant forms. Many people have criticized the use of BT cotton, nevertheless, the advantages still overwhelm the disadvantages, and it remains the best option to solve the problem of reliance on pesticides in Nigeria. This paper discusses the economic impacts of BT cotton and how it can be used to increase yields, profits, and living standards of smallholder farmers. It also highlights how Nigeria being a tropical country can benefit from introduction and cultivation of BT cotton.

INTRODUCTION.

Cotton (*Gossypium Spp*) remains by far the most important natural fibre, it represents 38% of the fibre market. Cotton is crucially important for income and employment, provided its production and processing is adequate. In Nigeria, prior to the oil boom, cotton was one of the main source of foreign exchange and second largest employer of labour after the public sector (Ghadegesin and Uyovnisere 1994). The current cotton production in Nigeria as reported by United States Agency for international Development (USAID) (2012) is 120,000 tons in the year 2012. Nigeria and its neighbourhood can indeed be called cotton country. Blessed with just the right soil, climate, and natural abundance of other necessities for the growing of the crop, and since the turn of the century, has been a viable alternative source of cotton after the United States. Cotton is also the means to prosperity for several thousand farmers in the region, who reap the dividends of global demand. According to Raw Material and Research Development Council (RMRDC) (2004), consumption of cotton lint by textile industry in Nigeria is about 100, 000 metric tons plus or minus 15%.

What is BT?

The BT is a short form of ubiquitous soil bacterium (*Bacillus thuringiensis*). This bacterium is gram positive and spore forming that forms parasporal crystals during stationary phase of its growth cycle. The synthesized crystalline proteins called 'endotoxins' are highly toxic to certain insects. They kill the insect by acting on the

epithelium tissues of midgut of caterpillars. These proteins often appear microscopically as distinctly shaped crystals and constitute about 30-30% of dry weight of sporulated cultures. These proteins are characterized by their insecticidal activity and are therefore grouped into four classes i.e. Lepidoptera-specific (Cry I), Lepidoptera and Diptera-specific (Cry II), Coleoptera-specific (Cry III) and Diptera-specific (Cry IV). Different strains of Bt produce more than 23 different but related insecticidal crystal proteins (ICPs). These are toxic to larvae of different insects including disease vectors and many agricultural pests. Cotton bollworms belong to the order Lepidoptera and therefore are sensitive to Bt Cry I and Cry II proteins, which are specific to them. Other beneficial insects are unaffected by these proteins. The gene bank data base of Bacillus Genetic Stock Centre (BGSC) have given a list of Cry (Crystal), Cyt (Cytolytic) and Vip genes either synthetic or modified versions from *B. thuringiensis*. About 22 classes of Cry including 136 Cry genes have been registered along with a Crt gene and 3 Vip (Vegetative insecticidal protein) genes. But popularly and effectively utilized are Cry I Ac, Cry I Ab in different crops.

What is BT Cotton?

A genotype or individual which is developed by the techniques of genetic engineering is referred to as transgenic. In other words, genetically engineered organisms are called transgenics. A transgenic may be a plant, an animal or a microbe. Transgenic plants contain foreign gene or genetically modified gene of the same species. The foreign gene may be from a distantly related species, closely related species or unrelated species or from micro-organisms such as fungi, bacteria and viruses. Bt cotton refers to transgenic cotton which contains endotoxin protein inducing gene from soil bacterium *Bacillus thuringiensis*. The first transgenic plant was developed in 1983 in tobacco (Fraley et al. 1983) in U.S.A. In cotton, the first transgenic plant was developed in 1987 in U.S.A. by Monsanto, Delta and Fine companies (Benedict and Altman,

2001). Later on, the research work on development of transgenic was intensified all over the globe and several transgenic plants were developed. The transgenic cotton is of two types viz. (1) bollgard and (2) roundup ready cotton. The former confers resistance to bollworms and the latter is resistant to herbicides. The area under herbicide resistant transgenic cotton is restricted to USA. However, bollworm resistant Bt transgenic cotton has spread to several countries. Transgenic resistant cottons have not yet been developed. Characterization of antifungal factors is underway at the USDA (Rajasekharan et al., 1999). In India, a few resistant genes against *Fusarium* and *Vorticillium* wilts have been isolated and are being transformed into cotton. Chinese scientists have isolated 'GO' gene and have transformed them into cotton which have shown resistance to both the wilts (Zhang et al., 2000).

THE MAJOR ADVANTAGES OF BT (*Bacillus thuringiensis*) COTTON.

1. The Bt cotton has inbuilt genetic resistance to bollworms and is very effective in controlling the yield losses caused by bollworms to a considerable extent (Rummel et al., 1994; Flint et al., 1993; Bachelier and Mott, 1996). The resistance is governed by a single dominant gene.
2. Use of Bt cotton reduces use of pesticides resulting in reducing the cost of cultivation.
3. It results in improvement of yield levels and also improves margin of profit to the farmers.
4. It provides opportunities to grow cotton in areas of severe bollworm incidence.
5. Reduction in environmental pollution by the use of insecticides rarely.
6. Bt cotton exhibit genetic resistance or inbuilt resistance which is a permanent type of resistance and not affected by environmental factors. Thus protects crop from the attack of bollworms.
7. Bt cotton is ecofriendly and does not have adverse effect on parasites, predators, beneficial insecticides and organisms present in soil.
8. It promotes multiplication of parasites and predators which help in controlling the bollworms by feeding on larvae and eggs of bollworm.
9. No health hazards due to rare use of insecticides (particularly who is engaged in spraying of insecticides).
10. Bt cotton are early in maturing as compared to non Bt cotton.

DISADVANTAGES OF BT (*Bacillus thuringiensis*) COTTON

BT cotton has several advantages but it has some limitations also, which were given as below;

1. High cost of Bt cotton seeds as compared to non Bt cotton seeds makes not afforded by small and marginal farmers of India.
2. Adverse effect on insecticide manufacturing companies due to reduced use of pesticides significantly by Bt cotton.
3. Adverse effect on the employment of those persons engaged in pesticide industries.
4. Ineffective against sucking pests like jassids, aphids, whitefly etc.

How Bt (*Bacillus thuringiensis*) Cotton was Produced.

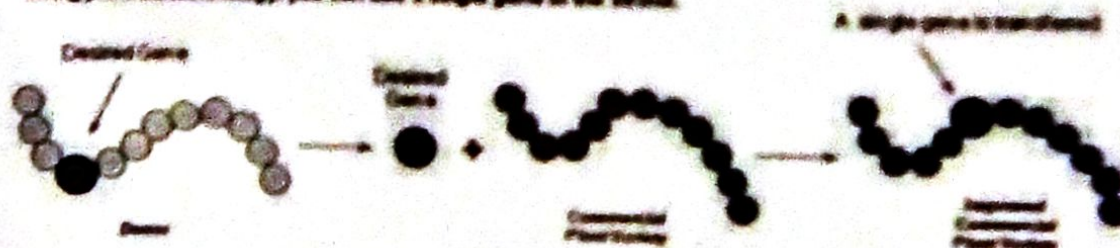
TRADITIONAL PLANT BREEDING

DNA is a strand of genes, much like a strand of pearls. Traditional plant breeding combines many genes at once.



PLANT BIOTECHNOLOGY

Using plant biotechnology, you can add a single gene to the strand.



Source: PICSE

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