Analyzing the adoption of Bt Cotton in India

ABSTRACT

Cotton production has been very much bountiful in the regions of India, circling the states like Gujarat, Rajasthan, Punjab and Haryana. The hybrid line of Bt cotton has many advantages like of resisting jassids, aphids and pink bollworm which poses a big economic threat to the production. In India Biotech Crop Profiles undergone severe study in the productivity rate of Bt cotton. Along with uplifting the food security of the nation its has also quite negative effects which are mainly making the respective soil exhaustive after the harvest, some soils are claimed to be non-preferable for the production and also creating a ill-commotion in the cattle. Bt cotton releases a sort of Bt toxins which lowers the soil chemical and biological activity. The adoption rate of the Bt cotton has been majorly found in the northern states of India with the farmers and the stakeholders being having a large portion of the land. During the 2014, it was being observed in the rate of adoption of Bt cotton shown a very drastic increase and also the shape of the graph formed a Roger's "S" shaped curve.

Keywords- Bt cotton, pink bollworm, rainfed Bt cotton,food security,sustainable development goal, cotton aphids, germplasm

Abbreviations- Bt- *Bacillus Thuringiensis,* SAM- micro-social accounting, GDP- Gross Domestic Production, IPM- Integrated Pest Management, IRM- Insecticidal Resistance Management, HD-SS- High Density- Short Season, EIQ- Environmental Impact Quotient

INTRODUCTION

Most of the scientists and breeders have closely watched the case of genetically altered and modified cotton which has been produced as the Bt Cotton (*Bacillus thuringiensis)* giving a quantum effect momentum in production along with having a long-term impact in India. It not only increases the yield but also resists a list of pests, diseases and frost conditions (chilling injury) which beforehand was a major economic and social issue (Kranthi and Stone, 2020). The small landholding farmers were very much beneficial through the revolution of the crop. The impact has been measured via pesticide use efficiency and cost-effective in nature which turned out to be very astonishing as the Bt cotton reduced the use of the pesticide by 50-70 percent (Kouser and Qaim, 2011).The transgenic technology of the Bt cotton production line has resulted in the adoption in high pace irrespective of the small landholding of the grower. So, the area under the Bt cotton is determined to proliferate in the coming era of farming (Barwale et. al, 2004). Wide effects in the village community have been found of the modified crop and a system of SAM (micro-social accounting) being proposed and it stimulated and attracted the growers towards its adoption (Subramanian and Qaim, 2009). In a comparative analysis between the economics of Bt and non-Bt cotton production where it was being introduced by China and its adoption was hugely admired by the masses of India. Many concerns were being put up regarding the social organizational aspect but were mitigated after being proven as environmentally friendly, it also linked with employment ratio and reduced the poverty rate (Orphal, 2005). Previously, the cotton had a hazardous relation with pink bollworm which costed

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in economic crisis and yield retardation but after the establishment of the Bt cotton technology the production and hamper related problems vanished with a fast rate. Now, the cotton produced is very quality- sensitive in nature along with resistance to many diseases and pests (Naranjo and Ellsworth, 2010). The acquitted venture of Bt cotton started when in some particular districts, Bt cotton may have presented some indirect effects to farmer indebtedness, leading to the suicides of the farmers, but the failure was mainly recognized as a process of plantation in a wrong environment to grow (Gruere and Sengupta, 2011). From a preliminary study conducted in India, data showed certain good statistical values in relation to the yield perspective per hectare/acre, some requirements were urged by the farmers like a better demonstration and field extension (Gandhi and Namboodiri, 2009). A study of the "Biotech Crop Pofiles" where every detail was being taken and the producibility rate was being measured (Choudhary and Gaur, 2010). In order to take a great advantage of the hybrid technology, the farmers urged to lower the seed cost, more demonstration of the crop via extensionist and wanted more Bt varieties to check the environment suitability (Gandhi and Namboodiri, 2009). A very good transition was found after the success of Bt cotton, and the evolvement of Bt brinjal (Herring, 2015).

According to sustainable goal 1, 8 which are No Poverty and Decent Work Economic Growth the cultivation and adoption of Bt Cotton has been found to be very influential towards No poverty as it has made gain to economic development so poverty would start to vanish or get eradicated and it would cause a counter-effect towards zero hunger. Decent Work and Economic Growth being a key in all these developments attains a sustainable mark of achievement in fulfilling goal directed activity towards sustainability (SDG,United Nations, Envision, 2030).

Beneficial Roles of Bt cotton

The yielding attributes of the Bt cotton has marked a new benchmark in the production along with the seed costs, pesticide application. It also increased the employment, education and standard of living quality (Kiresur and Ichangi, 2011).The rainfed Bt cotton crop which is being grown in some parts of Gujarat and Rajasthan, has shown very remarkable effects in production and thus it has put the HD-SS application behind, so a better implementation of the High Density-Short Season(HD-SS) should be monitored due to the high costs of Bt hybrid seeds (Gutierrez, 2018). As a major fiber crop cotton has a great importance in the textile factories which also adds to the GDP (Gross Domestic Product) of the country.Btcotton crop uses only45 percent of the total pesticides used in Indian Agriculture. In order to reduce the pesticide usage more in cotton several strategies like Integrated Pest Management (IPM), Insecticide Resistance Management (IRM) has been advocated (Yadav et. al, 2018). A Field survey has been done in Karnataka where it included 100 farmers. The Bt cotton technology was accepted by the farmers and the survey report concluded as mentioned by the farmers that the Bt cotton gave higher yields, low pest attacks, low insecticidal sprays (Hosmath et. al, 2012). Studies portray that if the official adoption of Bt cotton have shown an incredible hike both in production and economy after 2005, then the unofficial Bt cotton might have also the part of the observed increment of yields in a sequential pattern in the early stages of the era i.e, 2002 which was the official year of Bt cotton introduction in India (Gruere and Sun, 2012). Very minimal amount of variation has been shown in the agronomic performance with the adoption the hybrid technology

Comment [H4]: These data/information seems mismatch with the area and environmental conditions, In Rajasthan cotton is irrigated crop

(Suresh, 2018). As hunger and under nutrition are still the broad range problems in many countries so the technology has depicted positive effects on the upliftment of the food security of all sections of the society addressing the labors, farmers and stakeholders (Kouser and Qaim, 2013).

Negative aspects of Bt cotton

In the state of Andhra Pradesh, it has been noticed that the Bt cotton due to excess production got a lesser demand in the market with a very low-price value, making the soil exhaustive in nature, causing skin allergies in humans and mild cough and sneezing in cattle (Prathyusha et. al, 2015).In Gujarat, the total cost per hectare is higher in Bt cotton than the hybrid variety (Visawadia et. al, 2006). It has been observed that Bt cotton releases a sort of Bt toxins which lowers the soil chemical and biological activity. Thus, giving an exhaustible symptom to the soil(Singh and Singh, 2013). Haryana farmers also faced the problems of lack of technical guidance, marketing and financial constraints (Yadav et. al, 2018). Bt Cotton varieties produces a special type of cry protein which are grown worldwide. So, this protein attracts pest. Thus, researchers examined the fact that how much aphids are keen towards Bt protein. The study poses that negligible hazardous threat towards Bt cotton and a implication was also made the aphids should remain under natural atmosphere in the cotton field (Lawo et. al, 2009).A myth in relation to Bt Cotton has been bought to the mankind which courts that presumptions were being made of the production increment of cotton was due to *Bacillus thuringiensis* cotton but the fact is that genetic engineering had been at a neutral position in the production area and Bt cotton has also put the production of average cotton yields in a static and rigid position (Kuruganti, 2009).

Adoption rate of Bt cotton in India

In Northern India the adoption was much more because of the convenience of the soil, and thus Bt cotton is more likely to be successful among the farmers with less capital and landholdings (Mal et. al, 2012).In some areas of India, it was found that the germplasm can be very much effective in the future production of the hybrid seed (Naik et. al, 2005). Bt caused a hike of 24 pecent in cotton yield per acre through reduced pest damage and a positive financial procurement of 50 percent was being reported in cotton profit among smallholders(Kathage and Qaim, 2012). In a study three cotton growing states were being chosen namely Maharashtra, Andhra Pradesh and Punjab to measure the adoption and uptake pathways of Biotech Cotton among farmers. The study intimidated with several outcomes where the adoption has been vastly spread in the irrigated, semi-irrigated and rainfed areas of the respective states. The adoption rate was more than 95 percent (Mayee and Choudhary, 2013).

Comment [H5]: Seems arbitrary information

Comment [H6]: Need to be mentioned Cry1Ac and or Cry2Ab

Comment [H7]: Please describe in detail, is it due to Bt cultivars and or some other agronomica practices

Comment [H8]: Is it due to Bt transformation or due to the cultivar itself???

Comment [H9]: What is it ? Please explain

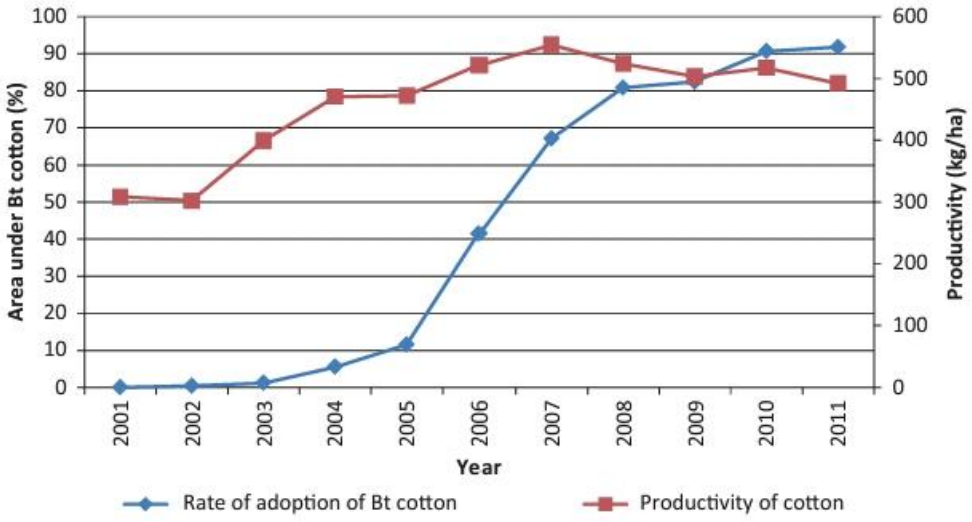

Fig. I. Peshin et al. (2014)

The figure shows the rate of adoption of cotton in India. The rate of adoption has formed a typical Roger's "S" shaped adoption curve. The productivity of cotton has increased drastically by 63 percentage since the introduction of Bt cotton in the year 2002 (Peshin et al. 2014).

Conclusion

Policy makers, instructors, media ~~personnels~~personnel and public analysts have portrayed Bt cotton which is a genetically modified crop as a pro-poor success for developing countries (Glover, 2010). Bt cotton has performed well in generating a good stability towards the use of pesticide in the crops and this study on the crop is being proven both theoretically and practically (Qiao et al.,2017). In a meta- analysis, both keeping in account regarding the Bt cotton and non-Bt cotton farms and also the farmers switching from non-Bt cotton to Bt cotton. The study here explains that the reason regarding the virtual universal adoption of the Bt cotton and also concludes that in the battle of numbers, those of the farmers who were missing (Herring and Rao, 2012). A study surveyed through Environmental Impact Quotient (EIQ). It concluded that high quality Bt seeds have more environmental efficiency than low quality Bt seeds (Veettil, 2017).

Comment [H10]: Not upto the mark need to be concluded properly. It looks very vague

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