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Short Communication

Bt Battle

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Today, in the era of 21st century, nothing is out of human reach. Man is ready to buy land on the moon. Science has made magnificent achievements in the field of Plant Biotechnology. Now, it is possible to transfer the characters of animals to plants. This technology is known as gene transfer technology and the crop plants are called as Genetically Modified or GM crops. This technology has been used in a large number of crop plants but the most successful example in India is Bt Cotton. Initially, Bt cotton increased the income of farmers by reducing the input cost but with the passage of time insects developed resistance against Bt cotton. So, the farmers' income reduced drastically. So, the question of the hour is- Does India need GM crops or not?

Backdrop of Bt

GM crops came to commercial existence in 1996 in the countries like USA, Canada, Mexico, China, Argentina and Australia. The spectacular success of GM crops led to the adoption of these by more than 1.8 crore farmers across 26 countries by the year 2016. Four-fifth of the world's soyabean, two-third of cotton and one-third of the maize is GM. In 1993, USA became the first country to approve trials of Bt cotton and after the successful trials, it was approved by the USA for commercial use in 1995. The journey of Bt cotton in India started in 2002, with a joint venture between Monsanto and Mahyco. In 2002, Monsanto introduced Bollgard I (BG-I), its first generation Bt cotton and then in 2006, it introduced the present day commercial Bt cotton, Bollgard II (BG-II). Till today, Bt cotton is the only commercialized GM crop of India.

Figure 1

Mechanism

Over 200 different Bt toxins are produced by the strains of bacterium *Bacillus thuringiensis.* These Bt toxins possess insecticidal properties against a wide range of insect pests such as the larvae of moths and butterflies, beetles, cotton bollworms etc. Bt cotton is being developed by inserting the gene coding for Bt toxin into the cotton crop as a transgene. It leads to the production of this natural insecticide in the tissues of the plant. So, the need to use large amounts of expensive broad-spectrum insecticides, especially against lepidopteran pests, is eliminated. This also maintains the farm ecology because the natural insect predators are not killed which further contribute to non-insecticidal pest management.

What's the problem?

In February, 2018, the anti-trust regulator, the Competition Commission of India, initiated a probe into alleged anti-competitive practices by Monsanto. Then, in March, 2018, the government cut the share of royalties that is being paid to Monsanto by local seed companies, for the second time in two years. The reason of all this is the increasing pink bollworm infestation in cotton. Monsanto's second-generation insecticidal technology, BG-II, was supposed to give more protection against the pink bollworm, but it is being observed in the field that the pest has become resistant to the toxins produced by this improved trait also. The brunt of which is being beard by the farmers of the country. Along with the high cost of Bt cotton seeds, they are spending large sums on pesticides also. This case is specific to India only, whereas other 14 Bt cotton growing countries have not seen this resistance. Chinese farmers are still cultivating first generation Bt cotton whereas the farmers of USA and Australia have moved to the third generation, BG-III, without having faced this problem.

Figure 2

Indian misfortune

Cotton researchers agree that the reason behind this unique Indian misfortune is the cultivation of only long duration hybrids in India since the introduction of Bt cotton in 2002, whereas open pollinated cotton varieties are being grown in other countries. India restricted itself to hybrids because of the agreement between Indian seed companies and Monsanto that these traits can only be introduced to hybrids only. Indian seed companies find hybrids more attractive because that offer "value capture mechanism". India is the only country where intellectual property laws have never prevented its farmers from either saving or selling the seeds. That is why seed companies prefer hybrids than open pollinated varieties because hybrids lose their genetic viability when their seeds are replanted. This protects the corporate revenues because farmers are compelled to repurchase the seeds every year.

Hemizygous and long duration hybrids

Introduction of Bt gene into single parent of Indian hybrids is itself a problem because it leads to hemizygosity. The hemizygous hybrids express only one copy of Bt gene as a result of which some cotton bolls become toxic to pink bollworm and some remain non-toxic. On the other hand, the homozygous open pollinated varieties of USA, China or Australia produce only toxic bolls. Hemizygous hybrids are undesirable because they give chance to the larvae of pink bollworms to survive on toxic free seeds. Also, the long duration of Indian hybrids makes the crop more vulnerable to the lepidopteran pests. These pests damage the crop mainly in the latter half of the growing season. So, the long duration of 160 to 300 days allows this pest to thrive and develop resistance faster as compared to short duration crops. In other cotton growing countries, cotton is strictly terminated within 160 days.

Need to do

Now some researchers argue that banning GM crops is the solution of this menace, but that is not right at all. The real solution to this problem is to move swiftly towards short duration open pollinated varieties. This is where Monsanto's first-generation Bollgard comes in. As Monsanto didn't patent BG in India so seed companies can develop open-pollinated varieties with BG-I, but they can not do it with BG-II, which is being patented by Monsanto. So, technology reluctance is not the solution to this problem in any way. The solution lies in making the technology environmentally adoptive.

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