

Weekly Publication of



**Cotton
Association
of India**

COTTON STATISTICS & NEWS

Edited & Published by Amar Singh

2016-17 • No. 10 • 7th June, 2016 Published every Tuesday

Cotton Exchange Building, 2nd Floor, Cotton Green, Mumbai - 400 033
Phone: 30063400 Fax: 2370 0337 Email: cai@caionline.in
www.caionline.in

Bt-Cotton Twenty20?

(Dr. K.R. Kranthi, Director of Central Institute for Cotton Research (CICR), Nagpur has completed his Ph.D in Entomology from IARI, New Delhi. He has more than 20 years of experience in the field of cotton research.)

Two high level meetings were held recently on 17th May and 19th May 2016. One was chaired by the Director General, ICAR (Indian Council of Agricultural Research) and the other was chaired by the Director General CSIR (Council for Scientific and Industrial Research). Both meetings discussed a common topic - 'public sector initiatives on GM (genetically modified) crops'.

While the ICAR meeting discussed 17 crops for seven GM traits, the CSIR meeting was focussed on *Bt*-cotton events developed by the public sector institutions. *Bt*-cotton contains cry (crystal) genes derived from *Bt* (*Bacillus thuringiensis*) and inserted into the cotton plant genome (genetic material of the cell) to provide protection against bollworms.

The agenda for these meetings was actually prompted by the pink bollworm. Nobody is in doubt that the bollworms are coming back with a vengeance. The challenge before the country is clear. The underlining concern was 'how best can we sustain the bollworm control efficacy of *Bt*-cotton until 2020?' Why 2020? Because, the closest date for a possible regulatory approval and possible commercialisation of any new *Bt*-cotton technology in India, is not likely before 2020.

New Technologies?

The CSIR meeting narrowed down two options -stacking two *Bt*-toxins 'Cry1Ac and Cry1EC' and use of pink bollworm pheromone technologies of CSIR-IICT (Indian Institute of Chemical Technology) Hyderabad. The Cry1EC *Bt*-cotton event developed by NBRI (National Botanical Research Institute) Lucknow was supposedly found to be effective in killing the pink bollworm. The Indian company JK Agri Genetics Ltd., stacked their own Cry1Ac *Bt*-event with Cry1EC. NBRI also proposed stacking

of *Bt*-cotton with another exciting GM cotton event for whitefly control using a *tma12* gene patented by NBRI.

Another prospect is Monsanto's new Bollgard-III® (BG-III) which contains a new gene vip3A (Vegetative insecticidal protein of *Bt*) stacked with the existing Bollgard-II® (BG-II), which contains two *Bt*-toxins called Cry1Ac+Cry2Ab2 for sustainable control of bollworms. The stacked JK *Bt*-cotton and BG-III are under regulatory trials and may take at least another 3-4 years for commercialisation. However, at this point of time it is not clear whether any of these two *Bt*-technologies can effectively control the 'BG-II resistant-pink bollworm'.

Thus far, there are no published scientific evidences, not even preliminary, to indicate that any of these two *Bt*-proteins i.e Cry1EC or VIP3A is highly toxic to the pink bollworm. So, for sure, at least until 2020, farmers will be unsure of the field efficacy of *Bt*-cotton in controlling bollworms. Unfortunately, the possible effective GM options for bollworm control after 2020 are also 'not in the visible range' as of today.

'Pheromone based control of pink bollworm' was one of the options discussed in the meeting. Female moths of the pink bollworm release a chemical into the air to attract male moths. This chemical commonly called 'gossyplure' is a sex pheromone. Gossyplure can be used to set up 5-6 pheromone traps per hectare to monitor the onset and intensity of the worms, so that control measures can be taken up when 8 moths are trapped per trap per night for three consecutive nights.

Alternatively, 20-30 traps per hectare can be used for mass trapping. But this technique was not found to reduce pest infestation significantly. Another method is to use the pheromone all over the field at about 1000 spots per hectare to confuse the male moths from finding females. But again this technique apart from being expensive, works only when the pink bollworm population is low in the fields. Sterile Insect Technique has also been

EXPERT'S Column



Dr. K.R. Kranthi

used in the USA to control pink bollworms. Lab reared male moths are sterilised with radiation and released in fields in large numbers to compete with wild female moths for mating. Mating of the sterile male moths with wild female moths does not result in viable offspring. This technique has never been explored in India.

Mystery Of The Pink Bollworm

Pink bollworm wasn't a major concern for 35 years before 2015 in India. How then did it appear now? Though it occurs as a small peak during flowering, pink bollworm is mainly a late season pest that affects most after the 5th month on long duration cotton of more than 6 months duration. Short to medium duration (5-6 months) cotton invariably escapes pink bollworm. Irrigated cotton in India extends for 6-9 months. It is here that pink bollworm survives on the long duration cotton. The longer the duration, the better it is for the worm to survive in multiple cycles.

For 20 years from 1981 to 2001, insecticides called pyrethroids were used by farmers to effectively control the pink bollworm. *Bt*-cotton came in 2002 and was effective until 2015 in keeping the bollworms under control. Pink bollworm is surviving happily on *Bt*-cotton now and farmers were not resorting to pyrethroid sprays. Irrigated regions of Gujarat, MP, AP and Maharashtra will be under the grip of pink bollworm as of now. North India is just a year or two away from the pink bollworm attack.

What do we do now to manage the pink bollworm? Grow short-medium duration cotton to escape the pest or resort to insecticide sprays on long duration cotton? I prefer short duration cotton as a long term solution. Yields can be increased with short duration cotton under high crop density of 40,000 to 80,000 plants per acre as is done in Australia, China, USA, Brazil, Mexico and several other countries which harvest 2-4-fold more than India.

In several meetings that I attended over the past few months, I found that there is a lot of discomfort with the idea of short duration cotton in India. Many seed companies feel that their hybrids perform best when grown for a longer duration. Many contend that farmers would invariably extend the crop with irrigation, especially when there are cyclones or drought.

Beyond doubt, hybrid cotton performs best under long duration where it needs to produce larger number of bolls over a longer time period. This is necessary, because of the low density of 4000 to 6000 thousand plants per acre recommended for hybrid cotton.

More than 95% of India's area is currently under *Bt*-cotton hybrids. With this background, if the current system continues, pink bollworm will survive and feast on the long duration hybrid cotton. Therefore, options of pheromone traps and biological control using a small wasp called *Trichogramma bactrae*, become very important. Also as mentioned in my previous articles, it is important that farmers must not use excess urea at vegetative stage of the crop and choose jassid tolerant varieties/hybrids to avoid insecticides such as monocrotophos, acephate, imidacloprid, thiomethoxam etc., which are known to extend the crop duration. But the best option would be to shift over to short duration cotton.

GM-Cotton T20 Toss

While the third week of May witnessed high level meetings on GM cotton, an important gazette notification on *Bt*-cotton licensing agreements, dated 18th May 2016 was released by the Ministry of Agriculture. However the gazette was suspended just four days after it was released. The gazette is now placed on the Ministry's website for 90 days inviting comments and discussion before its future is decided. The reactions to the gazette and the actions thereafter remind you of a typical T20 cricket match, all in short quick spells. But in this case the result went for a toss.

Prof. Ashok Gulati, Infosys Chair Professor for Agriculture at the Indian Council for Research on International Economic Relations, said that "the Centre should fully roll-back recent moves at controlling prices and royalties for *Bt*-cotton seeds" Prof Gulati was scathing in his comments on the gazette in his recent article 'Genetically modified technology: Fiasco in the name of the farmer' published on 1st June 2016 in the *Indian Express*.

But in my view, the relevance of the gazette is not actually about the price of *Bt*-cotton seeds. It is about new rules that could ensure a level playing field. It is also about paying constant royalties, irrespective of the progressively depreciating trait value, such as the one for insect resistance. Should

the farmer continue to pay the same royalty for trait value year after year, even if the efficacy of the trait depreciates or fails after a few years? The gazette is about restrictive agreements that keep licensees captive without the option of marketing fresh technologies from new licensors. It is about strengthening the public sector varieties by providing them access to all GM-technologies.

All of the 14 *Bt*-cotton growing countries in the world except India have *Bt* in their public sector varieties and not in private hybrids as in India. If *Bt*-varieties were also available along with *Bt*-hybrids, India would have benefitted immensely. The seed cost could have been highly competitive, given the low cost of varietal seed production as compared to the 10-fold higher hybrid seed production cost. Short duration varieties under high density would have given high yields at low cost of production. But *Bt*-hybrids had a free run for full 14 years in India without any competition from *Bt*-varieties. This is not a level playing field. Neither is this current set-up of restrictive licensing or restrictive conditions in the licenses, in the interest of the farmer or the country. The gazette is open for comments now on the Ministry of Agriculture website.

The GM-Cotton Gazette

As per the notification S.O.1813 (E) dated 18th May 2016, titled, 'Licensing and Formats for GM Technology Agreement Guidelines, 2016', all GM technologies would be essentially available to all companies and institutions in India on common terms of licensing agreements. The gazette prescribes that new GM technologies shall be licensed at a maximum ceiling of Rs. 25 lakhs or less as upfront fees and a royalty of not more than 10% of seed sale price, for the initial period of five years from commercialisation. From the sixth year onwards, it shall depreciate every year by 10% of initial trait value.

The new gazette defines that the "commercial life of the GM Traits is considered as 10 years subject to review in case of efficacy of trait is lost earlier". As per clause 4(3) of the gazette "any GM Trait which loses its efficacy as reported by States and verified by the Indian Council of Agricultural Research (ICAR) shall not be eligible for any trait value whatsoever" even if it is under patent.

One clause that appealed to me the most was that all GM technologies would be essentially available to all companies and institutions in India

on common terms of licensing agreements. This would make available all GM technologies in the best of varieties and hybrids of the country. The best elite cotton varieties and hybrids of public sector institutions such as the ICAR and Agricultural Universities would also be available to farmers as *Bt*-cotton varieties at highly affordable prices to create a tough competition for the private seed companies. Farmers can reuse farm saved seeds of these varieties in the ensuing seasons.

Thus far, all the *Bt*-technology developers and seed companies preferred only 'hybrids' over 'varieties' for *Bt* conversion, to ensure that farmers had to buy fresh *Bt*-hybrid seeds every year from the market. Therefore until now, Indian farmers had access only to *Bt*-cotton hybrids, whereas all across the world, farmers cultivate open pollinated *Bt*-varieties through agreements signed with multinational companies restricting them from any subsequent use of farm-saved seeds. While farm saved seeds of 'varieties' can be used by farmers for sowing in the subsequent years, sowing of farm saved seeds from a hybrid field, does not result in a homogenous crop. Within 1-2 years from now, under the influence of the new gazette, for the first time Indian farmers could gain access to open pollinated *Bt*-cotton varieties in addition to the existing *Bt*-hybrids.

Maharashtra and Telangana are the only two states which have more than 90% cotton area under rainfed conditions. Varieties, especially the short duration compact types under high density cultivation are better suited for rainfed conditions as compared to the existing *Bt*-hybrids which give relatively low yields in these two states. In the absence of any restrictions on pyramiding of various approved GM technologies as authorised by the new gazette, excellent multi-gene *Bt*-cotton varieties can now be developed by public sector institutions to enhance sustainable efficacy of *Bt*-cotton by intelligent pyramiding of toxins with different modes of action.

India Has Half Of The Global *BT*-Cotton Area

Having 38% of the global area under cotton cultivation, India is the world's largest market for cotton seed. The global business of *Bt*-cotton is spread in 226 lakh hectares. Out of this area, China and Pakistan have their own *Bt*-cotton. Thus only 160 lakh hectares of global area is open for all *Bt*-cotton technologies provided by several multinational companies. Indian *Bt*-cotton area

with 115 lakh hectares accounts for 72% of the global *Bt*-cotton business.

Interestingly this 72% global share of *Bt*-cotton is entirely under the Bollgard technologies of Monsanto. So far six *Bt*-cotton technologies have been approved by the Ministry of Environment for commercial cultivation in India. However, only Bollgard-II® *Bt*-cotton is being cultivated extensively in almost 90% of the cotton area in the country, marketed by 49 Indian seed companies, under licence agreements from Monsanto. The trait value or royalty thus far has been about 20% of the sale price of *Bt*-cotton hybrid seeds.

Over the past few years until 2015, a packet of 450g Bollgard-II seeds was being sold for Rs. 930. The Central Government issued orders on 8th March 2016, under the Cotton Seeds Price (Control) Order, 2015, to fix the maximum sale price for a packet of 450g seeds of Bollgard-II at Rs. 800, including royalty of Rs 49. Reducing seed price is good, but availability of *Bt*-technology in varieties holds the key to lowering production costs to obtain high yields.

With such a large share of 72% in the global open market *Bt*-cotton area, India is a great destination for cotton seed business. No company can afford to ignore such a huge business or stop investments on new technologies for such a large market. The new guidelines have very strong provisions for new innovators, technology providers and licensors in a fair manner, only to ensure that monopoly and over-exploitation are minimised under a level playing field.

The gazette guidelines on compulsory licensing agreements and dynamic royalty on trait value over time may not be comfortable for the technology developers, who would like to dictate their business dealings and operations to ensure complete control on the commercial market of their GM technology to maximise profits and returns on their investment.

Therefore, there is an opinion that the gazette may discourage private investment on development GM technologies for agriculture. But this seems unlikely. After all, India has the largest cotton seed market worth about Rs. 4800 crores covering an area of 120 lakh hectares with only China, USA and Pakistan placed second at about 30-34 lakh hectares each. It is unlikely that any private company would want to vacate such a huge market, irrespective of the guidelines imposed such as those in the new gazette.

Moreover, there are new *Bt*-cotton and herbicide-resistant-cotton technologies from Monsanto, Bayer, Dow and JK seeds that are in the final stages of regulatory trials in India and may take 1-2 years from now to be approved by the environment ministry. These private companies may still be able to commercialise their new technologies after getting approval from the environment ministry and licence them, to earn good returns on their investment. It is not clear as to how and why a competitive level playing field would discourage private investment on new technology development.

Conclusion

Nevertheless, the context of the current predicament points out to the ephemeral nature of the so-called high valued agri-technologies such as chemical pesticides and insect resistant GM crops. These technologies look highly attractive in the short term, but at some point of time push farming into uncertainty and risk. Insecticides and *Bt*-cotton belong to this league. Insect resistance to chemicals and *Bt*-toxins can render cotton farming vulnerable and defenceless. Frequent inevitable instances of insect defiance to chemicals and *Bt*-toxins also prove the transience of short term approaches.

Short term solutions are like googlies and sixers in a T20 cricket match. Rookies and bookies find them most attractive, seasoned thinkers will not. But needless to say, in the absence of robust long term solutions, all stakeholders including scientists are forced into the 'short term quagmire', knowing well that these are transient.

In this context, it is important that the investment on research in the public sector institutions must be properly prioritised, channelised and strengthened to develop competitive technologies that can be made available to farmers at an affordable price thereby combating the profit oriented market of the private technology developers.

Good technologies should ensure long term sustainability. Therefore, it is important for cotton scientists to set up robust 'chemical-free pest management systems' as urgently as possible, to restore natural control in cotton fields for robust, durable and sustainable crop health management.

(The views expressed in this column are of the author and not that of Cotton Association of India)