

## Introgression of *Bt* Genes in Novel Germplasm and Contribution to Indian Cotton Economy

VIDYASAGAR Parchuri

(*Vibha Agrotech Ltd. Hyderabad, India*)

Emergence of transgenic *Bt*-cotton technology has opened up a new chapter in Indian cotton production in 21st century. The *cry1Ac* gene of Monsanto derived from American Upland Coker-312 background was not directly suitable for varied cotton growing situations in India. Delivery of *Bt*-gene technology to Indian farming systems should be superimposed on hybrid technology, fiber quality, and superior agronomic adaptation. Protection offered by this alien *Bt*-gene against major serious pest *Helicoverpa armigera*, by preventing annual losses ranging from 15~35 percent, automatically contributed to higher yield. In addition, it also reduced cultivation costs, environmental pollution, and crop duration by 10~15 days. Indian textile industry requires wide range of cottons with varying staple grades and spinning potentials. *Bt*-hybrid cotton technology had to be designed to meet these requirements, while meeting the expectations of farmers. This challenge, imposed by genetic limitations, has made cotton breeders develop their own germplasm by extracting novel germplasm derivatives from proven and superior hybrid combinations. *Bt* cotton was first adopted in India as hybrids in 2002 and grown in approximately 50000 hectares. The *Bt* cotton area increased again four-fold in 2004 to over half a million hectares and in 2005 to 1.3 million hectares, an increase of 160% over 2004. The percentage increase in India at 192% was almost a three-fold increase from 1.3 million hectares in 2005 to 3.8 million hectares in 2006). The number of events, as well as the number of *Bt* cotton hybrids and companies marketing approved hybrids increased from one event and 20 hybrids in 2005 by more than three-fold in 2006 to four events and 62 hybrids. Coincidental with the steep increased adoption of *Bt* cotton between 2002 and 2005, the average yield of cotton in India increased from 308 kg per hectare in 2001–2002 to 450 kg per hectare in 2005–2006, with up to 50% of the increase attributed to *Bt* cotton. Apart from the increase in yields there was a concomitant reduction in the use of insecticides due to *Bt*-cotton. Taking into account the decrease in application of insecticides for bollworm control, estimates of the net economic benefits for *Bt* cotton farmers in India ranged from Rs 6200 per hectare in 2002 to Rs 11700 per hectare in 2005, with a four year average of Rs 10100 per hectare. The benefits at the farmer level translated to a national gain of \$ 339 million in 2005 and accumulatively \$ 463 million for the period 2002 to 2005. Out of the 9.5 million hectares of cotton grown in India in 2007–2008 over 6.8 million hectares were transgenic *Bt*-hybrid cotton and in 2008–2009, it is likely to swell to 8.0 million hectares. Responsibility of delivering the seeds rests with private seed industry and breeding for a wide diversity of conditions and consumer requirements is a great challenge. Cotton production in India crossed 5.27 million tonnes of lint in 2007–2008 and target is 7.65 million tonnes for 2011–2012. *Bt*-gene and hybrid technology appears to be the perfect answer for meeting this ambitious target.