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## *Past Successes, Future Prospects and Hurdles*

### SESSION II Q&A

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Ithaca, NY*

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*Peggy Lemaux (University of California at Berkeley):* For Vijay. I have two Indians in my lab and when the issue of problems with *Bt* cotton came up I asked them to find out what was going on. They mentioned, along with some other people, that there is a black market in *Bt* cotton seed. And sometimes seed that is supposedly *Bt*, but is not, is being sold. Can you either confirm or deny that?

*K. Vijayaraghavan (Sathguru Management Consultants, India):* Initially just one company, Mahyco, produced *Bt* cotton seeds in India, in a joint venture with Monsanto. But their ability to satisfy demand was limited. In the second and third years it was realized that they needed distribution across the country so they took a strategic decision to sub-license various companies that produced locally adapted hybrids for different regions. The price of a regular pack of seeds is about 400 rupees, whereas transgenic seed sold at about 1600 to 1700 rupees. This steep increase in price made it difficult for many small farmers to procure them. To satisfy demand for transgenic seed, “informally” crossed genotypes became available, But then they realized in the second and third seasons that some of the F2s were not performing well and there was huge disappointment. That’s where the government intervened. There is a considerable social factor in this. You have farmers

who can afford the seed and are able to increase their income many-fold. And you have a huge segment of farmers who have no access to transgenic seed because the public sector has not adopted any strategy to bring out transgenic seeds there. It's going to take a lot of time to convert them to hybrids. The affordability of hybrids can only be increased by increasing the credit to farmers. There are no data on "informal" seed adoption, so it's difficult to determine precisely to what extent it takes place; but there is considerable acreage with informal seed cultivation.

*Steve Pueppke (Michigan State University):* Ana, I was interested to hear you say that you can double the yield of ethanol from sugar cane by digesting and fermenting the fiber. Have you compared that yield to a process that converts the fiber to syn gas then the syn gas to ethanol?

*Ana Claudia Rasera da Silva (Allelyx Applied Genomics, Brazil):* The enzymatic process is best. One approach is to add enzymes to the bagasse, a second approach is to engineer the microorganism to digest the cellulose and the third is to put the enzyme inside the sugar cane such that when the cane is crushed the enzyme is released. We are still developing the technology to put the enzymes inside the plant.

*Dalia Abbas (University of Minnesota):* For Ana: how do higher sugar-cane yields affect soil nutrient status?

*Da Silva:* Actually it's not a problem at all because we just increased the capability of converting fibers to sugar. There is a balance between sugar and fibers, and in the energy cane you have more fibers than sugar. So there is no impact for the soil. And also for all the field trials that have been done in Brazil we have regulatory approval from the government.

*Ralph Hardy:* Can the panel offer guidance on aspects of industrial biotechnology that may produce problems similar to those that arose in food biotechnology?

*Vijayaraghavan:* From the Indian perspective, one area we have been heavily investing in, in the recent past, is the application of technologies for alternative fuels. There are several options for farmers to go with when talking about fuel from farm produce, fuel from non-farm produce, fuel from food produce, fuel from non-food produce. As of now, we don't have any clear scientific approach in accessing the economic compatibilities of these options. We may find a farmer growing tapioca then he gets to know that sorghum is better so he gets into sweet sorghum but then he gets to know that sugar cane is a better option and he jumps into sugar cane. We need to marry good economics with good science and say that these are the options that are worth exploring in these environments, rather than seeing science as an independent analysis. We need to entice investments with a clear economic analysis that reflects compatible application of science in different environments. That's essential when considering industrial applications.

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*Peter Welters (Phytowelt, Germany):* One of the mistakes we should not repeat is to keep things secret. Industrial biotechnology people like to keep things secret where they are not forced to label their products. If they were forced to label, you would have labeling on nearly 70% of all of the processed food in Europe. Washing powders contain enzymes produced in genetically engineered microorganisms for cleaning of apple juice, also for bread baking and cheese making. Even organic food shops sell cheese produced with chymosin from genetically engineered microorganisms. I think we should tell the consumer where genetic engineering is already making positive contributions.

*Hardy:* I appreciate your comments.