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Book Review

Biotechnology in Indian Agriculture: Potential, Performance and Concerns

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The book provides a systematic economic analysis of the benefits of Bt cotton to farmers. It tests three hypotheses: (a) there is significant yield gains with Bt cotton; (b) small holder cultivators participate and get benefited equally along with large farmers; and (c) there is positive impact on employment, where harvesting is done manually.

Chapter one sets the context of the book. Indian agriculture is facing stagnation in yield and declining profitability. This calls for second green revolution and the biotechnology has great potential to offer. In order to examine the potential of biotechnology in addressing the challenges faced by the agricultural sector, the authors conducted two rounds of survey of cotton farmers in 2004-05 and 2006-07 in four districts of Andhra Pradesh. The first survey consisted of 623 farmers of which 70 per cent were Bt cotton farmers. In the latter survey, the total number was 814 and the Bt cotton adopters constituted 75 per cent.

Chapter two provides a detailed discussion of the potentials of biotechnology in pro-poor agricultural development and also the concerns surrounding agricultural biotechnology. The advantage with plant biotechnology is that the genetic modification can be more efficient and time saving as compared to conventional plant breeding. Besides pest control, technology can be used to incorporate value added traits in food crops. The role of green revolution was confined to the irrigated areas. Dry land agriculture continues to play an important role in total agricultural production in India. Sixty seven per cent of the net cultivated area falls under dry land category and more than 60 per cent of the food grain production is from dry land areas. However, there are different views on the impact of agricultural biotechnology. It is often criticised that

modern agricultural biotechnology is against the rules of nature. Concerns have been raised over the likely control to be exercised by multinational companies (MNCs) on the technology, and the impact of the technology on environment and health. It is feared that widespread application of the technology might result in monoculture and genetic homogenisation. Given these concerns, the authors suggest that risk assessment studies need to be carried out on a case to case basis before commercialisation of the technology. Sound regulations for biosafety and food safety are to be established. A responsible management of biosafety is a pre-requisite for sustainable development of agriculture.

The advanced countries are far ahead of developing countries in the investment in biotechnology. They account for 90 per cent of such investments. MNCs in the west are the main drivers of this investment. The investment in the developing countries is so meager that the entire investments of CGIAR institutes of many developing countries would constitute only a fraction of the investments made by some of the MNCs. As private players are the key drivers of investments, it results in market failure. The focus has been on those crops that are produced in the industrialised countries. Several crops of critical importance like minor millets, pulses and oilseeds and traits like drought and salt tolerance have been out of the radar of the private investors. It is estimated that 85 per cent of the 125 million hectare covered under transgenics in the world in 2008 was under herbicide resistant crops. Seventy per cent of all the field trial research globally is on maize, potato, mustard, soybean and cotton. In countries like India, agricultural research account for only 0.5 per cent of the value of the agricultural production. Hence, the public sector needs to come forward in addressing this market failure.

Commercialisation of biotechnologies has potential for reduction in poverty and malnutrition and creation of employment. It can reduce the cost of food by increasing productivity. This will benefit farmers in terms of increase in net incomes.

Chapter three provides an overview of the history of the commercialisation of GM crops. First commercialisation was in 1996. By now GM crops have entered into more than 25 countries covering about 125 million hectares. But just five countries – US, Argentina, Brazil, India and China– account for 95 per cent of the area under GM crops. In India, Bt cotton was permitted in 2002-03. In 2007-08, about 82 per cent of the area under cotton was Bt. Currently field trials are on for 13 crops, including brinjal, rice and cabbage.

The experience of counties with Bt cotton shows positive outcomes. In China, there was 65 per cent reduction in insecticide use and 24 per cent increase in yield. But the labour use declined by 5-6 per cent.

Chapters four, five and six give the sampling method, methodology and analysis of the study. It is found that the overall cost of production (C2 cost) is higher for Bt cotton. However, the per quintal cost of production is lower for the Bt cotton. This is due to the higher yield of Bt variety. It is found in the first survey that the cost of production is cheaper by 11 per cent as compared to the non-Bt varieties. Second survey showed further decline in the cost of production; it was 31 per cent lower as compared to non-Bt, primarily on account of reduction in the cost of Bt seeds on account of state intervention and reduced use of chemical pesticides. As farmers became familiar with the technology, indiscriminate sprays began to get reduced and as a result the number of sprays came down. Reduction is pesticide use was 18 per cent in 2004-05 and 56 per cent in 2006-07. There is also significant increase in yield of Bt cotton. Those farmers who shifted to Bt got 42 per cent higher yield.

As a result of reduced cost of production and increased yield, the Bt cotton farmers have higher net incomes as compared to their non-Bt counterparts. Farmers got a farm business income, which is surplus over variable cost, of Rs 9596/acre after adopting Bt cotton compared to just Rs. 2029 before the adoption. The study estimates that there is a total gain of Rs 7122 crore to Bt cotton farming community in 2006-07. Extrapolating this to the entire area under cotton in the country (if all cotton farmers shift to Bt cotton), the gains to cotton farmers would amount to Rs 16000 crore, 2.5 per cent of the agricultural GDP of India. The study also estimates that out of the total gains generated by the technology, a major share (96 per cent) went to farmers and only 4 per cent went to the private companies. Thus, it dispels apprehensions that the technology would result in private companies appropriating most of the gains from the technology.

It is observed that there is variation in the benefits accrued to farmers belonging to different social groups and farm hold sizes. Generally the SCs, STs and small farmers are found to be obtaining relatively lower yields as compared to other social groups and large farmers. Though the technology should have benefitted all the social groups equally, the difference in the asset position and different positions due to social stratification results in this variation. However, irrespective of social groups and land holding sizes, those who went for Bt cotton are found to be better off as compared to non adopters.

The study in the first round had found that the technology positively contributed to employment generation. As the harvesting is done manually, higher yields of Bt provided more opportunities for hired labour especially female labourers. The total man-days equivalent for human labour for Bt was 66 per cent higher than non-Bt. But in the second survey, it was found that the technology did not offer any significant employment opportunity. The positive employment effect due to increase in yield was offset by the decline in the labour used in pesticide application.

While concluding the book, the authors emphasise the need to having a more balanced view of the technology. The precautionary principle should not be viewed in such a way that makes us not to avail the enormous potential of the technology. They also points out that negative outcomes of the technology which are not visible immediately after the commercialisation of the technology, may become visible after a few years and therefore urging a long-term monitoring of the impacts of the technology.

Though it is stated in the outset that the book deals only with the economic impacts, it has drawn attention to the discussions taking place on broad socio-economic considerations associated with agricultural biotechnology and Bt cotton in India. The moratorium on the release of Bt Brinjal in India clearly indicates the need of having a full-fledged system for the incorporation of socio-economic considerations in the decision making. Such a system is vital for the responsible management of biotechnology for sustainable agricultural development. Such a system should provide for collecting data on the impact of the technology on relevant socio-economic considerations at different phases of commercialisation of GM crops, including post-production monitoring. The observation of the study on the impact on employment generation points to the need of having a long-term post-production monitoring system. At the same time, it is also important to analyse whether widespread adoption of Bt cotton is resulting in monoculture and if so what is its likely impact on economic outcomes in future. The mandate of this study, perhaps, did not include this, but assessment of socio-economic considerations should include such parameters. The book is a major value addition to the literature on agricultural biotechnology and the economic impacts of Bt cotton and provides important clues on extending the research to include wider social and economic concerns.

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