



# MARKET ACCESS AND CHALLENGES FOR INDIAN AGRI-BIOTECH PRODUCTS

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**Abstract :** Agricultural biotech is the emerging scientific area which is useful to breed more nutritious, high-yielding and less resource input-demanding crops. In India, where the agricultural sector still continues to play an important role, the tools of plant biotechnology offer a greater scope for overcoming the challenges of malnutrition, productivity stagnation and crop diversification. The evolved biotech crops have potential to achieve food security, conserve biodiversity, reduce agriculturally-induced environmental problems and mitigate climate change. However, in recent times, agro-biotechnology is evolving from a pre-commercial phase dominated by basic research science to a commercial phase oriented around marketing products. In pursuing innovation rents in the commercial phase firms are reorienting their strategies around complementary marketing and distribution assets. No doubt, the size of agricultural biotech segment has grown over time, yet it is realised that Indian economy is facing various challenges and issues in promoting biotech crop. The present paper thus attempts to examine the market opportunities provided by the crop biotechnology sector to progress Indian agriculture towards productivity and quality to sustain production for future generations along with the challenges that are faced by the Indian agri-biotech industry.

**Index Terms -** Agri-biotechnology, Agri-biotech products, Genetically improved plants.

## 1. INTRODUCTION

Broadly speaking, biotechnology is any technique that uses living organisms or substances from these organisms to make or modify a product for a practical purpose. Biotechnology can be applied to all classes of organism - from viruses and bacteria to plants and animals - and it is becoming a major feature of modern medicine, agriculture and industry. Modern agricultural biotechnology includes a range of tools that scientists employ to understand and manipulate the genetic make-up of organisms for use in the production or processing of agricultural products. Thus like many other applications, biotechnology has one more application that is its use in agriculture. Due to its more use in medicine, it is considered as totally the medical field. But biotechnology has vast approach to agriculture in studying, cloning and altering genes. Genetically modified crops and food are the major issue of biotechnology. But still agricultural biotechnology is producing various varieties of crops and other products to change over lives and making them better.

## 2. OBJECTIVES OF THE STUDY

Realising the useful application of biotechnology in agricultural sector, the present paper attempts to highlight the following objectives :

- 1) To make an overview of status of agri-biotech industry in India.
- 2) To focus on areas of agri-biotech research.
- 3) To examine the various challenges in promoting biotech crops.
- 4) To highlight the Government policies to implement biotechnology policy in agricultural sector in India.

## 3. METHODOLOGY

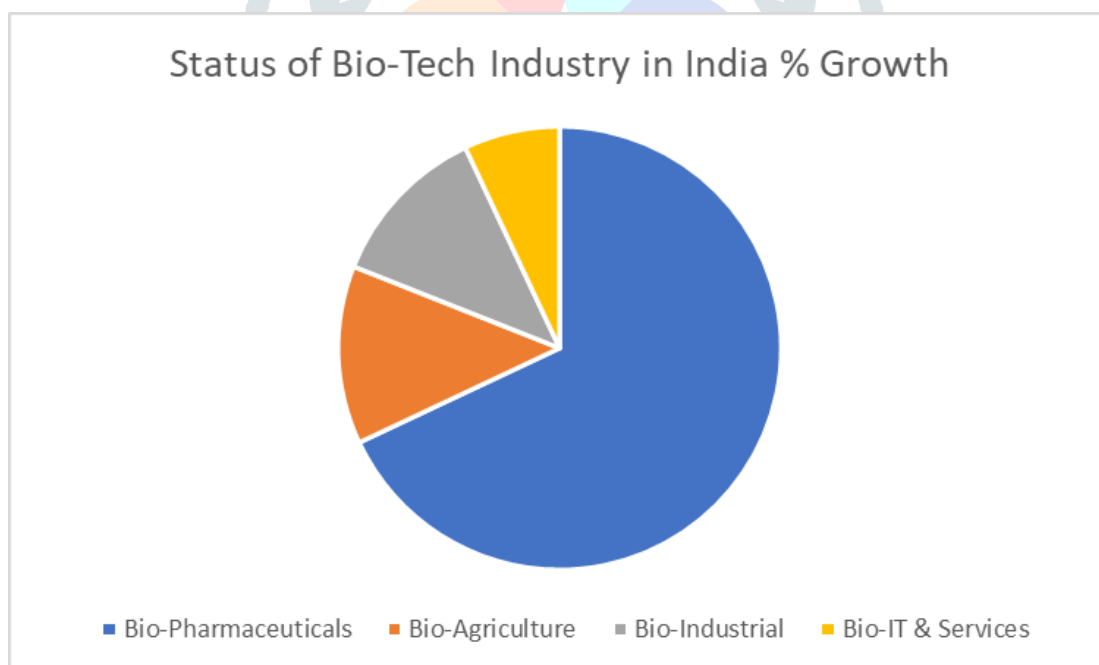
The study is based on secondary data. Secondary data has been collected from the various books, journals, articles, committee reports, government publications etc. The present study is descriptive in nature.

#### 4. DISCUSSION

The growth of the Indian biotechnology sector is fuelled by rising demand at both a domestic and international levels. The rise in domestic demand is fuelled by initiatives such as Aatmanirbhar Bharat and Make In India. Agri-biotech includes the application of biotechnology to improve plant and animal production and to create new, high-value products. Biotech crops help reduce the use of pesticides that pose hazards to the environment. India has made its entry into agri-biotech in March 2002 with the regulatory approval of Bt cotton by the Genetic Engineering Approval Committee (GEAC) of the Government of India for commercial cultivation. In 2022, India’s Biotechnology industry has crossed US\$80.12 Bn, growing 14% from the previous year. The Indian Bio-economy has witnessed a manifold increase in valuation in the past ten years, with COVID-19 giving the industry a much needed push. Indian Bio-economy grew from \$70.2 bn to \$80.12 bn in 2021. India's bio-economy has grown eight times in the last 8 years from \$10 bn in 2014 to over \$80 bn in 2022. Today, India is poised as one of the leading destinations for bio innovation and biomanufacturing, and hence is identified as a sunrise sector. India’s Biotechnology sector is categorised into the following categories as shown in the following table:

Segments	Features	Percentage Growth (%)
Bio Pharmaceuticals	India is one of the biggest suppliers of low cost drugs and vaccines in the world. India also leads in biosimilars, with the most number of biosimilars approved in the domestic market.	68
Bio Agriculture	With nearly 55% of Indian terrain under agriculture and allied activities, India is one of largest producer of Bt-Cotton and has the 5th Largest Area of Organic Agriculture Land Globally.	13
Bio Industrial	The application of biotechnology to industrial processes is transforming manufacturing and waste disposal across the country.	12
BioIT & Services	India offers a strong capability in contract manufacturing, research and clinical trials, and is home to the most US FDA approved plants globally outside of the US.	7

Source: Biospectrum (2022)



It need mentions here that Department of Biotechnology has funded fifty-one (51) Biotech-Kisan hubs connecting Indian farmers with best scientists and institutions out of which forty-four (44) are operational. These hubs are located in 15 agro-climatic zones of the country and are conducting activities in 169 districts. India’s agri-biotech industry comprises three broad categories of companies namely,

- a) The first category consists of larger integrated seed companies which develop their own transgenic crops e.g., Monsanto India Ltd, Mahyco Monsanto Biotech (India), Syngenta India, Rasi Seeds, Ankur Seeds, Nuziveedu Seeds, Prabhat Agri, JK Seeds, Nath Seeds and Indo-American seeds.
- b) The second category comprises smaller companies which employ techniques such as tissue culture for their breeding programmes. These included Avani Seeds, Nav Gujarat Seeds and Nimbkar Seeds Pvt. Ltd.

- c) The third category covers highly specialized technology companies that provide services for specified research such as Contract Research Organisations (CROs) for American and European laboratories and industries.

The size of agricultural biotech segment has grown over time. Within the top 20 biotech companies, five agricultural biotech companies featured in the list in 2006-07 as per Biospectrum (2007). These companies included Rasi Seeds, Nuziveedu Seeds, Mahyco Monsanto Biotech, Mahyco and Ankur seeds. Among these, Rasi Seeds, Nuziveedu Seeds, and Mahyco generated over 72 percent of the total revenue in 2006-07. Rasi seeds registered a record biotech sales of US\$ 81.10 million in 2006-07. Nuziveedu Seeds, which entered the Bt cotton market in 2004-05, increased its turnover from US\$ 15.21 million in 2005-06 to US\$ 55.1 million in 2006-07. However, the rapid growth in turnover of agri biotech companies is driven by excellent performance of leading Bt cotton companies. In 2002, Bt cotton was approved for commercial cultivation and remains the only GE crop approved for production. In a period of 14 years, Bt cotton area has grown to account for about 95 percent of India's total cotton acreage, and has led to a surge in Indian cotton production. India's cotton production in 2016 was estimated at 27 million bales (480-lb bales) from 10.9 million hectares, compared to 10.6 million bales from 7.6 million hectares in 2002. As a result, India has emerged as the world's largest producer, and second largest exporter, of cotton. To date, the GOI has approved five cotton events and more than 1400 hybrids for cultivation in different agro-climatic zones. Most of the approved Bt cotton hybrids are produced from two Monsanto events (Mon 531 and Mon 15985). An Indian joint venture company Monsanto MaHyCo Biotech Limited (MMBL), has the licensing rights for the two events in India. MMBL has sub-licensed the two events to about 42 Indian seed companies allowing the right to use the events in their cotton hybrids through a licensing agreement. The commercial cultivation of Bt cotton events is approved for use as fiber (clothing), food (oil for human consumption), and feed (meal for animals).

## 5. AREAS OF AGRI-BIOTECH RESEARCH

Most of the research on crop biotechnology presently underway in India is being supported by DBT (Department of Biotechnology), which has supported a large number of research projects in GM crops over the past two decades. However, to further strengthen research in the area of crop biotechnology, National Centre for Plant Genome Research (NCPGR) was established in 1998 at New Delhi. To bring investigators with expertise in different facets of crop biotechnology together to address defined research goals, a large number of collaborative multi-institutional projects have been conducted in public and private sector institutes. Most of the R&D work in India has been, and is still conducted in the central government-funded public sector research institutes, universities and research centres. Agricultural universities receiving substantial financial and infrastructure support from respective state governments and Indian Council of Agricultural Research (ICAR) are also involved in conducting research in biotech crops. Moreover, the private sector began their efforts at introducing GM crops into India in 1995. Maharashtra Hybrid Seed Company (MAHYCO) was the first to obtain the approval of DBT to import Bt cotton seeds from the USA-based multinational corporation Monsanto for backcrossing into selected Indian cultivators and breeding hybrids resistant to biotic stresses. Most Indian farmers lack awareness of the technology due to the absence of various approved GE field crops, except for cotton. Major industry associations are generally supportive of agricultural biotechnology and GE crops. The Federation of Seed Industries of India (FSII), comprised of leading seed technology developers, works with other pro-biotech organizations, biotech regulators, the scientific community, farmer groups, and the general public to highlight the benefits related to agricultural biotechnology. In April 2018, major seed and agricultural technology companies (mostly MNCs) operating in India formed a new association, 'Alliance for Agri-Innovation (AAI)', to promote new and emerging agricultural technologies, including agricultural biotechnologies and other plant breeding innovations, for the benefit of Indian farmers. Several anti-biotech environmental and consumer groups, often supported by Greenpeace and other international affiliates, run aggressive and sustained campaigns against GE crops and products in India. Most agricultural researchers and Indian scientists believe that biotechnology is an important tool for addressing India's future food security, sustainability, and climate change concerns. MOST/DBT, MAFW's Indian Council of Agricultural Research (ICAR), and bodies like the National Academy of Agriculture Science (NAAS) have supported several outreach activities to educate the public about the benefits of biotechnology and GE crops, but with limited success. Besides application of biotechnology to development of promising crop varieties, there is a growing interest among public and private organisations to develop products like bio-diesel, bio-fertilizers and bio-pesticides.

## 6. VARIOUS CHALLENGES IN PROMOTING BIOTECH CROPS

Although the country recognizes the tremendous potential that can be achieved from biotechnology, several challenges need to be met before the goals set can be achieved, some of which are mentioned in what follows:

- 1) Increase Productivity: Yields of crops and livestock have been declining, while demands are increasing, because of the rapid increase in population. Conversion of prime agricultural lands into other uses has placed tremendous pressure on the agricultural sector to increase productivity per unit area. Productivity has been affected by poor soil fertility, the incidence of pests and diseases, abiotic stresses and climatic factors. The challenge is to use biotechnology to increase productivity and yield on the farms using minimal inputs.
- 2) Global Competitiveness: With impending trade liberalization, the country expects to receive cheap agricultural products from other countries, thus widening its balance of trade. The challenge is to use biotechnology to produce local products that are highly competitive with those from foreign sources, thereby promoting exports of quality products while reducing imports.
- 3) Biosafety and Risk Assessment: The challenge is to improve and better implement the current biosafety guidelines, taking advantage of knowledge generated worldwide. The challenge is for the country to develop its capability to undertake risk assessments and management, based on scientific evidence.
- 4) Regulation of Biotechnology Products: The commercial release of new products must be regulated. The challenge is to create guidelines to regulate commercialization of GIGOs (genetically improved organisms), the establishment of support laboratories and infrastructure, and the training of people for these regulatory bodies.
- 5) Transfer of Technology/Commercialization: Products of research will not create any measurable impact unless they are transferred to endusers and/or commercialized. The challenge is to transfer products to users, particularly to small farmers and fishermen. This requires the proper packaging of the product to attract private investors for eventual commercialization.

## 7. GOVERNMENT POLICIES TO IMPLEMENT BIOTECHNOLOGY POLICY IN AGRICULTURAL SECTOR

The agri-biotech industry is promoted by the Indian government through a regulatory framework and policies after India made its entry into agri-biotech in early-2002. The support from the Government of India and the Department of Biotechnology for funding research in crop biotechnology has increased and at the same time, private sector investment in agri-biotech industry has also increased over time. The Ministry of Agriculture, Government of India, constituted a Task Force on “APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE”, with Dr. M.S.Swaminathan as the Chairman. The Foundation for Biotechnology Awareness and Education (FBAE) was invited to meet with the Task Force on November 18, 2003, at the Ministry, New Delhi, to present the FBAE’s views on the subject. The FBAE submitted its report to the Task Force which focussed light on issues like technology development, technology transfer, public and private sector collaboration, encourage entrepreneurship, awareness and education and the like. A Network of Technology Centres and promotion of start-ups by Small Industries Development Bank of India (SIDBI) are among the steps taken by the Government of India to promote innovation and entrepreneurship in the agro industry proposed by the Ministry of Micro, Small & Medium Enterprises (MSME) in a new scheme. The Department of Biotechnology (DBT) along with other government funded institutions such as National Biotechnology Board (NBTB) and many other autonomous bodies representing the biotechnology sector, are working together taking various initiatives in order to project India as a global hub for biotech research and business excellence for example, DBT has allocated Rs 4.6 crore (US\$ 0.69 million) to the University of Agricultural Sciences (UAS) to support a national multi-institutional project titled 'A value chain on jackfruit and its products', foreign Direct Investment (FDI) up to 100 per cent is permitted through the automatic route for Greenfield and through the government route for Brownfield, for pharmaceuticals, promoting innovations through Biotechnology Industry Partnership Programme (BIPP), Small Business Innovation Research Initiative (SBIRI), Biotechnology Industry Research Assistance Council (BIRAC) and biotech parks. In 2001, India enacted the Protection of Plant Varieties and Farmers’ Rights Act to protect new plant varieties, including transgenic plants. The Protection of Plant Varieties and Farmers’ Right Authority was established in 2005 and, to date, has notified 150 crop species for registration, including Bt cotton hybrids.

## 8. CONCLUSION AND RECOMMENDATIONS

The development of genetically modified foods and other agricultural biotechnology products has generated significant development in agricultural sector. Although the country is lagging behind the industrial countries in terms of R&D in biotechnology, many windows of opportunities are still open, for example,

- a) Increased yield of plants by providing for the basic needs of the plant such as bio-fertilizers and bio-control agents.
- b) Genetically Improved Plants containing genes that provide pesticidal properties, resistance to herbicides, tolerance to pests, disease, and stress (salt, heavy metals, and drought), or combinations of these properties.
- c) Marker Technologies speeding up the selection and production of more effective hybrids specifically in rice, corn, banana, and coconut.
- d) Opportunities for the use of microorganisms for bio-fertilizers, bio-pesticides, and bio-remediation of the environment, etc.

Hence, considering the importance, opportunities and challenges faced by the agri-biotech products in India, the following suggestions are recommended:

- i) Though, biotechnology provides solutions to most problems related to sustainable production, the regulatory system should be followed strictly to address the food-safety issues.
- ii) The performance of biotech crops in the field, environmental issues and genetic drift should be monitored and evaluated carefully.
- iii) Controversies like farmers suicides due to the failure of Bt cotton, cattle and goat death on grazing Bt cotton fields, should be clarified through scientific research.
- iv) The public and private sector should fully utilize the market opportunities provided by crop biotechnology sector to progress Indian agriculture towards achieving higher productivity and quality which is sustainable in future generations.

Thus, researchers, policymakers, industry people, must address the challenges, opportunities, and constraints that face R&D in biotechnology at this critical time of increasing population, globalization, trade liberalization, concerns with biosafety, regulation, and intellectual property. Biotechnology in agricultural sector will only prosper if the private sector along with public sector actively participates in the R&D aspect as well as in the commercialization stage.

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