

White collar farmers

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Agriculture is a vast and diversified field offering numerous career options. Other than those directly engaged in farming and other agricultural activities, the biotech industry needs people in the areas of research and development and also in various other agri-biotech related fields. There are specialized areas with good career prospects like horticulture, floriculture, dairying, poultry farming and fishery. One can specialize in food processing or post harvest technology or GM (genetically modified) technology. The fields in agriculture based biotechnology include biopesticides, biofertilizers and biofuels.

Agriculture currently accounts for a fourth of the gross domestic product (GDP) and employs more than two thirds of the labor force in the country. It meets our basic need for food and also the requirement for most of the raw material needed by the manufacturing sector. Science and technology have contributed significantly to agriculture in terms of improving productivity and quality. In order to gain a footing in the highly competitive global market and to make major gains in the export market, there is an increasing demand for professionally qualified people in this sector.

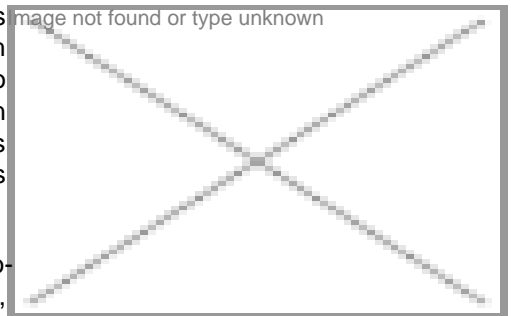
Agriculture based biotech industry needs people who are qualified in the field of molecular biology, plant transformation and tissue culture, biochemistry, plant genetics, pathology, entomology and agronomy for trait evaluation and integration. One can join the sector as a microbiologist for developing microbial products for plant growth enhancement or as a statistician or as a bio-metrician.

The major share of the research and development in the public sector is carried out by the Indian Council of Agricultural Research (ICAR) which works on cereals, pulses, vegetables and floricultural crops by funding about 200 projects in 15 institutions and 28 universities. There are more than 75 ICAR institutes dedicated to research on different products. The

Department of Biotechnology has invested substantial amounts in research and development in biotechnology. The National Research Center for Biotechnology at the Indian Agricultural Research Institute (IARI), New Delhi, focuses on plant genetic engineering related research activities to boost agricultural production. Both private and public institutions are developing hybrid tomato, brinjal, transgenic plants, tissue culture technology, seed technology and bio-pesticides. Hybrid seed technology is a way to combat the shortage of food grains evolved by the ever-increasing population. The hybrid seed technology for sunflower, rice, wheat, corn, tomato and vegetables is currently under development. Development of disease resistant plants, cloning genes for floral meristem initiation and tagging genes of agronomic importance are the other major projects being done in both private and public sectors.

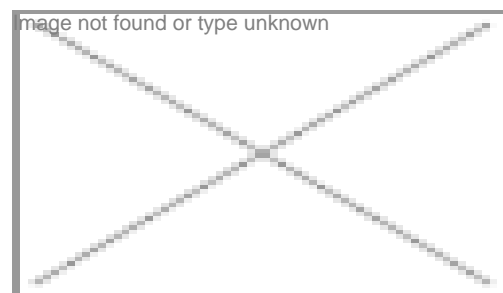
According to a Biotech Consortium India Ltd (2001) report, there are a total of 176 biotechnology based companies in India. As many as 49 per cent of the companies are agriculture-based companies having interests ranging from tissue culture to bio pesticides. Almost 25 per cent of the companies are active in health related activities and are in medical sciences while 24 per cent have varied interest including environmental biotechnology. Although in terms of numbers, health biotechnology companies are lesser than those active in the agriculture sectors but they account for a much higher proportion of foreign alliances.

"Being a science based industry, we look for highly qualified people like Ph.D.s with experience (in some instances), ability to work in a team, ability to teach others and learn from others, share credit, ability to be flexible and adaptable to changes," says an official at Monsanto. Monsanto is one of the global leaders in the field of biotech based agricultural solutions. Monsanto in India has its corporate office at Mumbai. The company's research wing in Bangalore employs 45 agricultural scientists.



Experts say that by 2020 India can become the world's largest exporter of agro-commodities thanks to the R&D efforts in the agri-biotech industry. The country, which is the world's second largest producer of fruits and vegetables, stands to benefit greatly from plant biotechnology. There are about 50 private companies in the field and the total seed market has been estimated as Rs 7,500 crore in the year 2001. According to an Exim Bank report, about 400 organizations are doing commercial research in agriculture, which include 200 research labs, 150 companies and 50 service firms. Some medical food and nutraceuticals are also under development. The foreign direct investment norms at present permit (under the segment of agricultural production and plantation) foreign investors to use the automatic route if the foreign equity limit is 51 percent. Monsanto, Proagro, Hindustan Lever, Dupont, Indo-American Hybrid seeds, Advanta India, Hoechst Schering AgrEVO-PGS, Pioneer-Hi-Breed, SPIC, Novartis, AV Thomas, EID Parry, National Organic Chemical Industries Limited, Rallis, Cadila Plant Biotechnology and Godrej Biotech are active plant biotech companies in India. Monsanto, which is expanding its Indian subsidiary, has a seed joint venture with Mahyco.

"The scope of agriculture based biotech industry is tremendous. This field is developing day by day and it seems that there is no dearth of trained manpower in the field of agriculture based biotech industry, as there seems to be so many around with diverse qualification and background," says Deepak Mallik, CEO, Advanta India Ltd.



The department of biotechnology (DBT) is supporting 23 M.Sc. courses in general biotechnology, four in agricultural biotechnology, one each in medical and marine biotechnology and a couple of diploma courses in molecular and biochemical technology. The total intake of students in the various post-graduate courses supported by the DBT in the country is around 550 per year. As a part of the restructuring of the post doctoral research and training program, DBT has scraped the existing programs with different institutions and has given this responsibility to the Indian Institute of Science (IISc), Bangalore. This is to ensure competitive attitude and quality output in the life sciences. IISc would award up to 75 fellowships of two-year duration in different streams of

biotechnology. DBT is also supporting overseas associateship and short-term training courses for at least 22-25 scientists in a year to expose Indian scientists to newer trends in R&D. This helps working researchers and scientists to upgrade their knowledge and research areas of interest

"We have employed about 60 agricultural scientists in Avesthagen and we recruit passing out students from the academia. They need rigorous training to be reshaped to fit the industrial bill. We have an international scientific advisory committee that pulls us up on this score every year. Right now we have with us Dr David Frisch from the US who is training our personnel on genome sequencing and studies. Each individual in Avesthagen needs to have at least an idea of the issues interphasing the

special field he or she deals with. Here we are not doing science for an altruistic cause; we mean serious scientific business which sells. The scientist needs to have an understanding of the basics of finance and the accountant should have some idea of the science, and the legal person has to be equipped with the fundamentals of science. It is a unique melting pot which needs a special training no matter what the qualification is. And finally the interpersonal skills which gives the individual the capacity to learn, to mould, to change is what's most important," says Viloo Morawala-Patell, founder and CEO of Avesthagen.

The Tamil Nadu Agricultural University at Coimbatore offers M.Sc. and Ph.D. programs in agricultural biotechnology. Every year the university takes seven students for the doctoral program. The Bioinformatics Center at the Department of Plant Molecular Biology and Biotechnology at the university is one of the Information Sub-Centers under the Biotechnology Information Systems (BITS) program of the DBT. The thrust areas taught in this center, equipped with state-of-the-art hardware and software, are plant molecular biology and biotechnology.

The Bangalore- based University of Agricultural Sciences is offering M.Sc. in Agricultural Biotechnology for students who have completed the BSc program in agriculture or horticulture from the same university. The two year program includes subjects such as plant molecular biology and biotechnology, principles of recombinant DNA technology, biotechnology for plant micro interaction and the practical papers like computer application in biotechnology, methods in biotechnology. The students have to submit their research papers in the second year.

"Bioagri is a boon to the country to fulfill the domestic needs in the foodgrain sector. The department of biotechnology in our university, since its beginning in 1996, has added more students to its list. Every year 17 students in India (Agriculture Biotechnology) at the department," said Dr AM Krishnappa, vice chancellor of the University of Agricultural Sciences, Bangalore.

The research institutes and research-based companies require more people in this sector. Indigenous efforts in this sector are also flourishing in a number of government and university laboratories. For instance, greenhouse and field tests on insect-resistant brinjal, cabbage, rice, cauliflower and tomatoes are underway at the Indian Agricultural Research Institute (IARI), New Delhi. " Our students are getting placement in several biotechnology institutes, institutes like IARI and companies like Monsanto," says TKS Gowda, the head of the department of biotechnology, UAS, Bangalore.

There are 29 agricultural universities spread in different parts of the country. In addition to these there is the Indian Agricultural Research Institute in New Delhi, Indian Veterinary Research Institute in Izatnagar (Bareilly), the National Dairy Research Institute in Karnal and the Central Institute of Fisheries Education in Mumbai, all of which fall in the category of deemed universities.

Addressing a two-day conference of vice-chancellors of agriculture universities, the Union minister for Agriculture, Ajit Singh asked the universities to forge closer ties with industry and commercialize their technology to raise funds. He also stressed the need to commercialize agricultural education to keep pace with rapid privatization.

The agricultural education system in the country offers degree programs in 11 specific disciplines viz. agriculture, veterinary science, agricultural engineering, forestry, home science, dairy technology, fisheries, sericulture, marketing, banking and co-operation, horticulture and food science with a total intake of about 11,000 students every year. It also offers postgraduate programs in more than 55 fields of specialization with a total intake capacity of about 5,000 students. ICAR offers about 1200 scholarships and fellowships from the undergraduate to post-doctoral levels.

Agricultural biotechnology is a collection of scientific techniques, including genetic engineering, that are used to create, improve, or modify plants, animals, and microorganisms. Biotechnology enables reshuffling and manipulation of genes that is not likely to happen in nature to open up a vast new source of genetic diversity for crop improvement. It provides a set of tools that, if appropriately integrated with other technologies, can be applied for the sustainable development of agriculture, fisheries and forestry, as well as the food industry. Biotechnology includes a wide array of techniques and applications. Examples include micro propagation, allowing for multiplication of virus-free plants; marker-assisted selection applied to conventional breeding, or genetic engineering, for the production of genetically modified organisms with new, improved traits.

Company	Locations
Monsanto India	Mumbai
Hindustan Lever	Mumbai
PWERTY	Gurgaon
Maharashtra Hybrid Seeds Company (Mahyco)-Monsanto	Mumbai
SPIC Hybrid Seeds Transgenic Crops	Chennai
Rallis India Ltd	Mumbai
Proagro -PGS India Ltd	New Delhi
EID Parry (India) Ltd	Chennai
Godrej Plant Biotech Ltd	Hyderabad
Sid Agro Industries Ltd	Chennai
Advanta India	Bangalore
Indo American Hybrid Seeds (India) Pvt. Ltd	Bangalore
White Field Agri Tech Pvt. Ltd	Bangalore
Biotech International Ltd	New Delhi
Biotissues Pvt. Lab Ltd	Habsiguda AB
Bharat Starch Industries Ltd	New Delhi
Ajay Biotech (India) Ltd	Pune