

Career Opportunities in Agriculture and Allied Sciences

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The Indian agriculture has undergone transformation from traditional cultivation methods to hi-tech agriculture requiring manpower equipped with latest knowledge and technologies for continued growth and sustainability. Success of an educational institute is rated not only based on development of technologies but also on demand and marketability of its product, i.e. quality of students and their placement in market. Agricultural education must ensure employment of these 'products' to make it more relevant to the society and the nation. In spite of great demand and opportunities for agricultural graduates in banking and insurance sectors, retailing industry, multi-national companies, government departments and non-governmental organizations, the agricultural graduates are unable to decide their career options even after four years of university education. Unlike medical and engineering disciplines, for which there is great awareness amongst the parents and students, the agricultural education has not received much attention due to lack of matching publicity and visibility. This paper would serve as a useful source of information and guiding tool for the students seeking admission to various undergraduate programmes in Agriculture and Allied Sciences in Agricultural Universities under the Indian Council of Agricultural Research – Agricultural University system. Apart from students and parents, educational institutions too might find the information useful to guide the 10+2 pass-outs to choose agriculture as one of the career options.

Key words: Agricultural Education, Career opportunities

NATIONAL Agricultural Research and Education System in India is one of the largest national networks of Agricultural Education System in the world, comprising 75 agricultural universities. ICAR works in a partnership mode with state agricultural university (SAUs) and has significantly contributed in developing first rate human resource by way of coordinating, supporting and guiding various aspects of higher agricultural education. It provides funds for development and strengthening facilities in vital areas, training to faculty and scholarships/fellowships to the students and grants accreditation to agricultural universities for ensuring quality assurance.

ICAR and Agricultural Education

The Indian Council of Agricultural Research (ICAR) has taken several steps to promote agricultural education in the country, viz. attracting talented students for pursuing higher agricultural education by granting scholarships/fellowships, promoting capacity building of faculty in agricultural universities by enhancing their competency through training programmes, accreditation of agricultural universities, their colleges and programmes for improving the standards, quality and relevance of higher agricultural education, and providing financial assistance to agricultural universities for infrastructure development, etc.

To attract talented students to

pursue higher agricultural education, ICAR offers the following scholarships/fellowships:

- Post-matric Scholarship for scheduled caste and scheduled tribe candidates
- Merit-cum-means scholarship for undergraduate studies
- Apprenticeship/Internship allowance to veterinary Graduates
- Scholarships/Fellowships through All India Entrance Examination
- Institute Scholarship at ICAR-Deemed to be Universities
- International Fellowships for globalization of agricultural education like Netaji Subhas-ICAR International Fellowships and Fellowships under India-Africa Forum Summit, India-Afghanistan fellowship

programme and Nepal Aid Fund The details of these scholarships/fellowships are available at Agricultural Education portal (<https://education.icar.gov.in/>) of ICAR.

Competency enhancement of faculty: For strengthening capacity building, creating excellence in specific cutting edge areas and creation of skilled human resources, ICAR provides advanced training to faculty of National Agricultural Research and Education System in various disciplines of agriculture and allied sciences with the objective of improving the quality of agricultural education, research and extension system in the country. The training is provided through 40 Centres of Advanced Faculty Training and organization of Summer/Winter Schools of 21 days' and Short Courses of 10 days' duration.

Accreditation of agricultural universities for educational quality assurance: To maintain the standards and relevance of higher agricultural education in the country, and based on defined parameters, ICAR regularly conducts accreditation of the programmes and colleges in the agricultural universities under the agricultural universities system. The students qualifying through AIEEA-UG, AIEEA-PG and AICE-JRF/SRF(PGS) are given admission only to the accredited programmes at the accredited colleges of these universities.

Development of infrastructure through financial assistance: The ICAR provides Development Grant to AUs for construction of hostels, examination hall, sports and recreational facilities, Niche areas of Excellence, modernization of farms, IT support, libraries etc. for upgradation and development of their infrastructure.

Role of agricultural education in food security

Thus, human resource developed through AES in the country has been primarily responsible for various agricultural revolutions, viz. green, white, blue, yellow, pink leading to enhanced agricultural production and productivity. Not only this, the scientific expertise developed and

research facilities manned by highly skilled and trained persons have been internationally recognised and a number of developing and developed countries have shown keen interest to work together and get mutually benefited through exchange programmes and collaborative research projects.

Admission in agricultural universities

The Council has made an arrangement with agricultural universities to set aside 15 % of their seats for Bachelor's degree programmes and 25% seats each for Master's degree and Doctoral degree programmes to be filled through All India Entrance Examinations, annually conducted for admission in accredited agricultural universities.

The basic objectives of All India Entrance Examination are to reduce academic inbreeding in agricultural education by encouraging mobility amongst students to go for study outside their home states, infuse merit, encourage talent and national integration and promote uniform examination standards across the AUs leading to improved overall quality of higher agricultural education in the country.

Degree courses in 10 UG disciplines are presently offered with emphasis on hands-on-learning through practice sessions and field experience training. The PG programmes are offered in 93 disciplines.

Disciplines for undergraduate courses

The agriculture curriculum is multi-disciplinary covering a wide array of subjects into its fold which makes its product "agri-graduates" multi-functional and suitable for a broad spectrum of career options. These undergraduate degree courses have recently been declared as professional degree courses by the Council which has further encouraged the pursuit of learning in agriculture and allied science subjects.

The undergraduate degree programme of SAUs is of minimum 4 years' duration. The following 10 disciplines are offered for pursuing Bachelor's degree programme across all the universities under ICAR-AU

system:

1. Agriculture
2. Horticultural Science
3. Forestry Science
4. Fisheries Science
5. Community Science
6. Sericulture
7. Agricultural Engineering
8. Dairy Technology
9. Food Technology
10. Biotechnology

Scope for higher education

All the undergraduate programmes offer the scope for pursuing higher education by joining M.Sc. and Ph.D. degree programmes. There are a total of 95 courses at Post-graduate level and 80 courses at Ph.D. level in agriculture and allied subjects in India. These programmes elevate the level of thinking of students in the subject and are focused to specific aspects of that field. Attainment of comprehensive and specialized knowledge about a specific subject, through higher education, helps to get better pay packages. Apart from this, they can go for Master's degree in Business Administration, i.e. MBA (Agri-business).

Agricultural education has become internationalized and there is a growing demand for agricultural graduates to get employment in foreign countries, particularly middle-east and African countries. Plenty of opportunities are also available in other foreign countries, especially USA, Canada, United Kingdom, Germany, Australia, and Japan. Students may appear for examinations like TOEFL, GRE and IELTS in order to pursue higher education abroad.

Career options for graduates and postgraduates predominantly exist in academics, research and the industry.

CAREER OPPORTUNITIES AND JOB AVENUES IN DIFFERENT DISCIPLINES OF AGRICULTURAL SCIENCES

Agriculture

Agriculture has been a progressive sector for the past three decades. Today, India's agriculture has become globalized and the idea of integrating Indian agriculture with the world

economy is getting support.

Job Opportunities and Avenues

Public Sector: There are plenty of job opportunities in various central and state agricultural development departments for agricultural graduates to join as Agriculture Officer or Agriculture Development Officer (ADO). The post is equivalent to that of the Block Development Officer (BDO). Similarly, there are opportunities to join as Horticulture Development Officer in the state department of horticulture and as Soil Conservation Officer in soil and water conservation department in certain states. Recruitment to these posts is made on the basis of competitive examination conducted by the State Public Service Commission/concerned department. The agriculture graduates are also sought after as teachers in rural public schools.

A number of nationalized banks and private sector banks offer openings for agriculture and allied science graduates as Field Officers, Rural Development Officers and Agricultural and Probationary Officers.

Job opportunities also exist in seed companies as Seed Officer, Scientist, Technical Officer, etc. Other opportunities exist in the areas of farm/tea garden management, land appraisal, agricultural grading, packaging and labeling.

Career opportunities also lie in Agro-industry sector: Agro-industry provides jobs to postgraduates in agriculture as scientists, in sales & marketing and as production experts. These areas of work relate to production, food processing, grain and seed processing, machinery and equipment, fertilizers, pesticides, herbicide, etc. for which people with adequate qualification/knowledge in the respective field are required.

There are several government agencies at centre, state and district levels (e.g. MARKFED, PUNSUP, Mandi Board, various other state level and central level agricultural boards and organizations, etc.) with openings for agricultural graduates. Various corporations and agencies viz. National Seed Corporation, State

Farm Corporation, Warehousing Corporation, Food Corporation and agricultural food processing and export related agencies, etc. also provide job openings to agriculturists.

In addition, after postgraduation, one may get placement as plant quarantine agricultural technician, agricultural consultant, agricultural statistician, and implement the regulations for food, feed, and seed & fertilizers. At the international level, the Food and Agriculture Organization of the United Nations, ICRISAT, ILRI, and some other agencies related to the development of agriculture also appoint consultants.

One may choose career under ICAR in the areas of research and become an Agricultural Research Scientist (ARS). The recruitment to these posts is made through ARS/NET examination conducted by ASRB for scientific posts and lectureship in SAUs. Bachelor degree holders can apply for some technical posts in ICAR institutes. Technical post of the level of T-5 (Technical Officer) is a better option for postgraduate and above. Technical posts like T-6 & above and Subject Matter Specialist (SMS) in Krishi Vigyan Kendras are better opportunities for Ph.D. degree holders. The postgraduate students may also work as Research Associates or Senior Research Fellow in ICAR funded research schemes.

The agricultural graduates are also eligible to apply for Indian Civil Services (IAS/IFS and Allied Services) examination conducted by Union Public Service Commission, New Delhi.

Private sector: Agro-based industries such as seeds, fertilizers, pesticides and sugar industries are some of the potential sectors in which a large number of agri-graduates may get placement well before their graduation. In order to tap the potential of food industries, several retailing markets such as Reliance Fresh, Aditya Birla Group, Walmart, ITC, Nilgiris, Pantaloons, Q shops, Food Bazaars, etc. are expanding their business that augment job opportunities for

agriculture graduates.

Jobs are also offered in the field of agricultural marketing and sales, transportation, farm utilities, storage, warehousing, etc. both in the public and private sector.

Entrepreneurship: Agriculture graduates can become good entrepreneurs. There are a number of success stories of agripreneurs in the field of agriculture, horticulture, etc. The Student READY programme introduced by the ICAR in the undergraduate curriculum motivates them to seek self-employment and become entrepreneurs. This eventually helps them to turn out as job providers rather than job seekers. There is a great opportunity for start-ups and standup programmes in agriculture and its allied sectors. Insofar as entrepreneurship is concerned, there are about 135 sub-sectors in agriculture.

The Ministry of Agriculture, Government of India, in association with NABARD has launched a unique programme to take better methods of farming to each and every farmer across the country. This programme aims to tap the expertise available in the large pool of agriculture graduates. Irrespective of whether one is a fresh graduate or not, or whether one is currently employed or not, one can set up his/her own Agri-Clinic or Agri-Business Centre and offer professional extension services to innumerable farmers. MANAGE, Hyderabad, organizes 'free of cost' training programs for students for a period of three months. On completion, students get a certificate which is a pre-requisite for the individuals before qualifying to secure a loan up to 15 lakh from the nationalized banks funded by NABARD. This financial support helps the graduates to set up their agri-based business.

Horticultural Science

It deals with the cultivation of fruits, vegetables, flowers, spices, plantation, medicinal and aromatic crops. It also covers the post-harvest management and value-addition through various commercial products of horticultural produce. India is

among the largest producers of vegetables and fruits in the world and has an equally strong floriculture base. Horticulture with its offshoot branch floriculture has become a focus of export activity. India's exports of roses, carnations, gladioli, chrysanthemum, jasmine and other tropical plants and flowers are touching new heights.

Scope for landscaping and beautification business

There is ample scope for horticulturists to venture into business opportunities for landscaping and beautification in different settings. They can cater to the demands of industries, hotels/health farms/holiday resorts, golf courses & construction companies, etc. for landscaping and beautification of their surroundings. Florists and nurseries are doing lucrative business especially in the metropolitan cities. Suburban farmhouses have become important suppliers for the domestic market.

Other job opportunities and avenues

Public Sector: Horticulture graduates can be recruited through State Public Service Commission as Horticulture Officer in state departments to run various schemes and later may get promotion as Assistant Director, Deputy Director, Joint Director and Additional Director. Apart from this, they can be recruited as Technical Assistant/Training Assistant in SAUs/ICAR institutes, DRDO, CSIR, etc. and as Horticulture Inspector/Food Inspector and Vegetable Inspector/Marketing Inspector/ADO in various state departments.

In the Central Government institutions, quasi-government institutions and public sector wings, they can be recruited as officers in National Horticulture Board, Coir Board, Coconut Development Board, APEDA, National Seed Corporation, nationalised banks, etc.

Private Sector: In the private sector, the graduates are recruited as Field Level Officers in fertilizer companies, pesticide companies, seed companies, nursery units, flower production units, landscape and design,

architecture consultancy, processing units of various horticulture produce. The opportunities exist as Marketing Executive in various corporate sector units, as Horticulturist or Supervisor (Landscape) and as Manager at Plantations (tea gardens), etc.

Entrepreneurship: It can generate handsome profits through honey production, floriculture, oil extraction from flowers and plants, production and supply of nursery planting material to the growers. The graduates can start Agri-clinic or the Agri-business of Nursery raising of fruit plants and ornamental plants using various techniques of plant multiplication such as grafting, budding, tissue culture, layering and vegetative propagation. With more and more people opting for naturopathic treatment of diseases, growing of medicinal plants has become significant, which provides attractive business opportunity to horticultural nursery/gardens.

Opportunities are also available to work as horticultural therapist in conjunction or liaison with other professionals such as psychologists, occupational therapists, physicians and social workers. Horticultural therapists can treat people having physical disabilities, mental health problems and learning difficulties, those recovering from major injuries or illnesses, and elderly persons. Programmes can also be developed for the rehabilitation of offenders or those suffering from drug or alcohol abuse.

Forestry Science

Forestry is the science of development and care of forests. After agriculture and animal husbandry, forestry contributes significantly for the welfare of rural population in India. Specially trained personnel are, therefore, required to maintain and regenerate the forest cover, forest wealth and resources including the wildlife. Liking for outdoors, spirit of adventure, good health, stamina and physical fitness, patience, scientific temperament, organizing ability, public relations' skills, courage, decision-making ability, capacity to work long hours, a genuine interest in preservation of the natural environment and habitat,

inclination for research and academic bent of mind, curiosity, excellent skills of observation, interest in agriculture and geography are some of the personality traits expected from the candidates aspiring for forestry as a professional choice.

Job opportunities and avenues

Public Sector: Opportunities exist for placement as Asstt. Conservator of Forest/Range Officer in the Department of Forest and Wildlife. The graduates can take up consultancy/research work in public sector research institutions like Indian Council of Forestry Research and Education (ICFRE), Institute of Social Forestry and Eco-rehabilitation, Allahabad and Wildlife Research Institute in Dehradun, Coimbatore, etc. They can apply for the examinations like Indian Forest Services, Civil Services, banks, etc.

Private Sector: Forest wood-based industries, NGOs working in conservation and up-gradation of forests, corporates houses having own plantations for timber industries that utilize forest resources employ forestry graduates/postgraduates as consultants. There may be opportunities for working with television channels like Discovery and National Geographic. Forestry graduates can run their own private consultancy in environmental impact assessment of large projects. Still photography, film making and wildlife journalism are some other avenues for self-employment.

Organizations like World Wildlife Fund, Centre for Environment Education, Tata Energy Research Institute and consultancy firms like Ernst and Young, KPMG, etc. also hire a good number of forest and wildlife graduates.

Fisheries Science

Fishery is one of the fastest growing sub-sectors of the animal husbandry sector. With the total fish production at 11.4 MT(2016-17), India ranks second in the world and contributes to about 1% to overall GDP.

Job opportunities and avenues

A number of development

schemes are being implemented, both by state and central governments for the development of fisheries sector in the country. To run these schemes, a large number of personnel are recruited. After completing the Master's and Ph.D. degree, they become eligible to apply for the post of Scientist in various ICAR institutes as well as Assistant Professor in Agricultural Universities.

Aquaculture: Job opportunities exist as Hatchery Manager (India and/or abroad mainly in South Asian and African countries), Aquaculture Consultant, Farm Operator (India and/or abroad mainly in African countries), Technical Officer in research institutes, national organizations, e.g. National Fisheries Development Board (NFDB) and state fisheries department, etc., feed technologist in feed manufacturing companies, subject matter specialist in KVK's, pharmaceutical industry for the preparation of various medicines, as a fishery inspector or a deep sea fishery worker.

Fish processing: The job openings are available as Quality Inspector in fish processing plants (India and/or abroad mainly in Middle East, South East and African countries), Auditor (Inspection) (India and/or abroad mainly in Middle East, South East and African countries), HACCP Manager/Consultant (India and/or abroad mainly in Middle East, South East and African countries), Technical Officer/Project Officer in MPEDA, CIFT, EIA, CIFNET, FSI, NIO, WHO, NACA, NABARD, etc., Supply Chain Manager in Super Market Chains like Reliance, Tata, Godrej Agro, etc.

Fishing Technology: Technical Officer in CIFNET, FSI etc., Technical position in Private Companies (eg. Garware ropes)

Fisheries Extension: There is a scope to work as Assistant Director/Fishery Extension Officer (FEO)/Inspector of Fisheries /Assistant Fishery Development Officer (AFDO) in state fisheries department.

Apart from these, fisheries' graduates and postgraduates can find opportunities in the banking sector as Agricultural Officer/Field Officer in national banks, as lecturer in

vocational higher secondary schools, state government, teaching positions in state fisheries agencies, South Asian and African countries. They are also eligible to apply for all the Central Civil Services (IAS, IPS, IFS etc.) and State Services (Group I and Group II officers).

Entrepreneurship: Commercial fish farming, seed production and export of marine products and ornamental fishes are potential areas of self-employment and entrepreneurship development in fisheries.

Community Science

Community Science (erstwhile Home Science) is an academic discipline extremely popular among girl students and recently even amongst the boys. Rise in awareness related to health, diet and lifestyle has resulted in more inclination towards the field of Community Science. The course is not necessarily aimed at making women better housewives, but useful to the society to enable them to provide expert advice to enrich social and family life.

Job opportunities and avenues

Public Sector/Private Sector: Many government organizations like Food Corporation of India recruit many home science graduates every year. For getting a job in the government sector, candidates need to pass the competitive exam organized by the concerned authority. The candidates can enter the job as teachers, consultant in development labs, etc. They may also work for government departments as programme consultants or in home economics division of food and utility companies.

Opportunities may also be available for them to work in polytechnics, Industrial Training Institutes and Institutes of Hotel Management and Catering, etc. for housekeeping jobs. Training centres of Anganwadi workers and other community organizations also require teachers from field of home science. Home scientist may run hobby classes or teach small groups in all vocational areas of home science. They can seek employment as Anganwadi worker/supervisor,

Balwadi worker/Manager, nursery or preschool teacher and nursery school supervisor or principal.

Employment opportunities exist to work with social workers and community programmes in welfare organizations working for women, child, old people, youth, drug addicts and alcoholics welfare.

Food nutritionists are also required in social welfare programmes, institutional catering, food services, mass media for health awareness dissemination and R& D. They can also be placed in apparel merchandising, fashion journalism, counselling in schools, as interior designer, furniture designer and makers. Booming commercial food services industry offers the job as a Manager for cooks, waiter/waitress and supervisor/worker in a confectionery/bakery, ready to cook/serve food manufacturing industry as a Production Supervisor/Manager, Production Assistant, Quality Control Assistant, instructor of the community canning centre, etc. Sales promotion of food items (baby foods) may be given to home science graduates.

Service Sector: Home science graduates may be employed in textile designing industry for weaving, dyeing, as a printing manager, Production Assistant, Pattern maker, Cutter, Supervisor, Dress designer in garment designing houses.

Entrepreneurship: Community Science graduates can run childhood care units like day-care centre, crèches, nursery school/pre-schools and after school centres. The trained professionals can also undertake catering services for people who are working in factories, offices and do not have time or arrangement to cook meals, particularly unit day meals, canteen, cafeteria, restaurant, tea shop, contract catering services and mobile catering service. Hobby classes in bakery/confectionery, tie and die, batik, fabric painting, hobby centres can be started where interested persons can learn candle making, paper flower making, preparation of decorative articles, soft toys, Rangoli, jewellery designing, pot making, Ikebana, bonsai, wall painting and making useful articles

from the household waste products, etc., grooming centres to provide services for skin and hair care, old age homes by offering proper food services and psycho-emotional enrichment rehabilitation centres for children with impaired senses.

Sericulture

Sericulture involves mulberry production, silkworm rearing, silk cocoon reeling and weaving. It is a commercially attractive, sustainable, farm-based economic enterprise, positively favouring its adoption by rural poor in the unorganized sector due to low investment. Sericulture is an integral part of agriculture in the rural agro-ecosystem that provides livelihood, employment and income for sustenance in the diverse environmental conditions; both under rainfed and irrigated conditions of India. Holistically, sericulture is well-suited for polyculture production system, being complementary and supplementary component of Integrated Farming System (IFS) in the country.

Job opportunities and avenues

Public Sector: In Karnataka and southern states of India, West Bengal in the east and Jammu & Kashmir in the north, separate Directorates/Commissionerates of Sericulture have been functioning and absorbing the technical manpower so produced. The Govt. of Karnataka has also included the subject for state public service examinations for the recruitment of gazetted officers in the state. The graduates are employable in the line departments in the concerned states, banking and agricultural financing sectors, input manufacturing and supply agencies, non-governmental organizations involved in zonal development, private enterprises dealing with silkworm egg production, Chawki rearing centres (CRCs), silk marketing, import & export of silk and the forward and backward linkages of the enterprises. Besides, the Central Silk Board, Bangalore, being a premier commodity based organization that has its research and extension units spread across the country, has also been regularly

absorbing the trained sericulture graduates. They can also go to banking sector, private Sector or be a service provider through seripolyclinics, consultancy.

Entrepreneurship: Sericulture is the sole agro-based industry that produces low volume high value commodity i.e., silk of commerce. The mulberry silk cocoon producing farmer can earn a net profit of 1 75,000 - 1, 00,000 per annum from an acre of irrigated mulberry garden.

Agricultural Engineering

The job of an agricultural engineer is to develop better engineering technologies, equipments, methods and inventions for speedy and efficient farm operations, soil and water conservation, post-harvest processing and value addition. Enhancement in farm structures, biogas, agricultural farm machinery, rural electrification, new technologies in the design and production of agricultural products and also conservation of soil and water are some of the job avenues for an agricultural engineer.

Job opportunities and avenues

Agricultural Engineering provides better job prospects as compared to other branches of agriculture. The job is related to activities aimed at improving agriculture, reconstructing rural areas in general and agricultural machinery, power, farm structures, soil and water conservation, rural electrification, etc., in particular.

Public Sector: Central and state government organizations and private firms recruit agricultural engineers as agricultural officers for the development of agriculture in a district. The job opportunities for graduates lie in agriculture department, soil conservation department, cooperative department, rural development department, etc. in state and central government organizations including railways, municipal corporations, telecommunications departments, etc. The agricultural engineers are also doing well in administrative services. They are engaged in planning and construction of warehouses/ godowns for the storage

of food grains and greenhouses or glasshouses for the intensive cultivation of horticultural crops. They may also work for tubewell borings, irrigation and drainage projects, canal irrigation programmes, land reclamation and soil conservation projects.

As financial and banking sector has been playing a key role in the development of farm sector, therefore, agricultural engineers are getting jobs in almost every leading bank. They are also required for water resource management, mining and rehabilitation, forestry, peri-urban and rural development, food processing and retail industry, machine development and many other sectors.

Private Sector: The candidates after their graduation (B.Tech.) or post-graduation (M.Tech.) in agricultural engineering can get placements in leading national and multinational companies like Mahindra and Mahindra, Escorts, TAFE, John Deere, New Holland, CLAAS, Sonalika, Kirloskar, Nestle, Pepsi, Jain Irrigations, Reliance and many more. These firms choose students through on-campus interviews. Since the markets are expanding in rural and semi-urban sector for all commodities, the agricultural engineering graduates having exposure to this sector are getting jobs in companies in automobile sector like TATA Motors, Maruti, Bajaj, Toyota, Honda, software and IT sector organizations like TCS, Infosys, etc. Agricultural engineers can work with NGOs in rural areas as part of their rural development programme. In India, a total of 16 companies for power tiller manufacturing, 24 companies for tractor manufacturing and more than 1,250 companies for farm implements manufacturing are presently working.

In addition, job opportunities exist for private consultancies as well as large farms or estates managements, in agribusiness firms, fertilizer and irrigation companies, farming companies, industry service organizations (like sugar industry, rice industry and so on), food processing and retail industry,

agricultural equipment manufacturing industries, as database specialists, business analysts, etc. Private firms investing money in medicinal crops and plantation crops generally recruit agricultural engineers for sales and management.

As the demand for healthy and quality food, and providing services for complete solution in on/off farm production technologies has been increasing, there are many business opportunities available at small and large scale value addition, bringing more sophistication into supply and demand frameworks, process improvement, testing and advisory services, etc. Many government supported schemes are available for the youth and professional in agricultural engineering to start their venture by setting up farms, production and marketing of food grains and other farming activities. Agricultural engineers can provide consultancy services to agricultural workers and farming and agro industries.

Dairy Technology

Dairy industry plays a vital role in India's agro-based economy. **Dairy technology** is a branch of engineering that deals with the processing of milk and its products. Dairy technology study involves processing, storage, packaging, distribution and transportation of dairy products by implying the science of bacteriology, nutrition and biochemistry. In 2016-17, India registered highest milk production at global level producing 165.4 million tonnes of milk.

Job opportunities and avenues

Presently, there are more than 400 dairy plants in the country and several dairy equipment manufacturers. Graduates from this field can seek employment in government and private organizations such as rural banks, manufacturing firms, dairy cooperatives, milk product processing

units and dairy farms. Professionals can also opt for teaching jobs in universities and colleges as Assistant Professor. This field has lot of opportunities for those who want to pursue a career as a researcher. Dairy technologists can also set up their small-scale milk plants, ice-cream units, creamery products' processing units and/or can work as consultant. A consultant needs several years of working experience in dairy farms to be successful. Quality control departments also recruit dairy technologists.

Food Technology

Food science is the applied science devoted to the study of food. This is a discipline in which engineering, biological, and physical sciences are applied to study the nature of foods, the causes of its deterioration, the principles underlying food processing, and the improvement of foods for the consumers. Owing to lifestyle changes, consumerism, media interventions, and newer technologies, the demand for processed, packaged and convenience foods has increased manifold among all strata of society leading to massive career and employment opportunities.

Job opportunities and avenues

Food Science empowers the students to get a career, not just a job. Instead of becoming only job seekers one can become job providers by setting up entrepreneurial ventures. Food Processing in India is considered a 'Sunrise Industry', having the potential to become the food factory of the world, thereby creating a huge volume of job opportunities.

Food Science being a multidisciplinary, interdisciplinary versatile and collaborative area of specialization, the career opportunities are immense in teaching, research, food quality control, consumerism, nutrition and

dietetics, placement in industries, hospitals, health clinics etc.

The graduates and postgraduates can find employment in diverse areas as Foodproduct Development Scientist/Production Manager/Product Development Manager, Sensory Scientist, Flavor Technologist, Quality Assurance Manager/Food Quality Control Officer, Food Safety Expert, Food Microbiologist, Food Chemist, Food Technologist, Food Process Engineer, Food Packaging Manager/Designer, R & D Scientist/Executive, teacher, researcher, educator, laboratory officer, administrator in schools, polytechnics, colleges and universities, nutritionist and councillor, catering food service management professional, food/nutrition journalist, food and drug inspector, sales and marketing professional, food/nutrition consultant, subject matter specialist in NGOs and GOs, dietician, food science laboratory certifier, bakery/confectionary professional, cookery professional, etc.

Different types of employers includeschools/ polytechnics/ colleges/ universities/research organizations/laboratories, food industries like Amul, Dabur, Haldiram, Marico, Hindustan Unilever, Nestle, Britannia, Coca cola, Cadbury, Heinz, Kraft, etc.; dairy and dairy product companies, confectionary companies, media and advertising companies, food manufacturing and packaging firms, flavour and fragrance companies, airlines, beverage companies, scientific and educational journals and books, hospitality industry, health and fitness organizations, NGOs and GOs, national and international organizations like UNICEF, WHO, CARE, etc., state and local public health agencies, administrators and consultants, etc. These companies/organizations are potential recruiters of food technology graduates.

Readers

The National Agricultural Policy recognized the potential role of the private sector in agricultural research, need for human resources development, and recognition of the changing rural landscapes with the rapidly growing importance of post-harvest management and value addition.

Almost all nationalized and private sector banks, viz. Punjab National Bank, Oriental Bank of Commerce, Axis bank, State Bank of India, Federal Bank, Union Bank, Canara Bank also employ food technologists to boost the food processing industry. Food testing laboratories, Food Corporation of India, Markfed, Milkfed and other co-operatives also employ food technologists for quality control.

Entrepreneurship: Self-employment opportunities also exist in the form of dynamic delivery networks for those who want to work on their own. The challenge for the food technologist is to increase the variety and improve the quality and nutritional value of foods for consumers, while at the same time maintaining affordability through efficient manufacturing. A food technologist trained through the professional course, including food engineering, food nutrition and internship in the food industry, besides scientific knowledge, has good understanding of problems at the farmer level and capability to handle situations on hand.

Biotechnology

Biotechnology is a multi-disciplinary field and the Government of India has allotted high priority to development in the area of biotechnology and its exploitation in agriculture and other related disciplines. The degree provides knowledge in different fields of plant tissue culture, genetic transformation, genetic engineering, molecular biology, molecular genetics, agriculture, biochemistry, microbiology, tissue culture techniques, etc.

Job opportunities and avenues

Public Sector/Private Sector: India's biotechnology industry has tremendous employment potential.

Major opportunities are in areas such as environment, health, agriculture and pharmaceuticals. Molecular biology, genetic engineering, tissue culture, transgenic, sericulture, animal, marine and microbial biotechnology, bio-fertilizers, conservation of biodiversity, ecology and environment, genetic counselling, DNA fingerprinting, preservation and propagation of human cell line, bio-ethics, medicinal biotechnology with special reference to indigenous medicinal plants, and immunodiagnostics are some of the avenues into which biotechnology has ventured.

Most biotechnologists are employed in research and development departments or institutions involved in biotechnological work. From the production of antimicrobial agents, reagents and consumables to the marketing of instruments used in biotechnological applications and research, the opportunities for biotechnologists are on the rise. Biotechnologists work extensively in the production departments of these industries. Generally, biotechnology students from engineering stream are given preference for production jobs. In India, Government laboratories such as Central Drug Research Institute, Lucknow, various ICAR institutes are constantly employing research workers/scientists.

The private sector offers placements both in technical and managerial positions. The management levels match those of a business firm and the task relates to industrial, production and marketing management. More than 100 Biotech industries are operating in India and some industries employing biotechnologists are Hindustan Lever, Thapar group, Indo- American Hybrid Seeds, Syngenta, Monsanto,

Pioneer-Dupont, Rasi Seed, Namdhari Seeds, Bincon India Limited, Bivcol, IDPL, Indian Vaccines Corporation, Hindustan Antibiotics, Sun Pharma, Cadila, etc.

Service Sector: Biotechnologists can work in industries producing food, chemicals, bio-processed products, etc. They are involved in research in genetics, biochemistry and biochemical engineering, tissue engineering and all areas where these processes are implied. Industrial Research and Development covers areas such as chemical processes, increase in productivity, waste and pollution management. Some industries employ biotechnologists in their marketing department to develop business in the sector where their product would be most required. They also help to identify biotechnological development opportunities for the industry in India and abroad. A steep rise in employment is envisaged in environmental biotechnology.

SUMMARY

The opportunities are available to work as research scientist, teacher, Marketing Manager, science writer, Quality Control Officer or production in-charge in the food, chemical and pharmaceutical industry, Analyst (Venture-Capitalist) Environmental /Safety Specialist. Biotechnology companies require corporate executives with business/management degrees. A graduate in biotechnology can get a job in government sector such as universities and colleges, research institutes or at private centers as research scientist/assistant.

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Pradhan Mantri Krishi Sinchai Yojana

This Yojana brings

- Per Drop More Crop.
- Inputs from MoWR and DOLR received.
- Increase in agricultural production and productivity and enhance farm income.