

Careers

in the agricultural sector



agriculture,
forestry & fisheries

Department:
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Careers

in the agricultural sector

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Introduction

This document was developed to inspire and capture the interest and commitment of the South African youth, particularly young black people, to agriculture and agriculture-related opportunities that exist in the sector. Although the disadvantaged groups will be the primary focus of this initiative, other nontarget groups such as the white male youth will also be included. The initiative also aims to develop support structures and incentive opportunities for its target, where possible. The purpose of this document is more than just creating interest in pursuing agriculture as a career, but it is also about encouraging everyone who has an interest on embarking in agriculture-related activities.

Agricultural awareness, training and education are not adequately addressed in primary or secondary school curricula. The inadequacies of Mathematics and Science subjects at school for black students have minimised these students' opportunities for acceptance into tertiary agricultural programmes. It is at this level that children should be made aware of careers in agriculture, and that agriculture can be a career option worth taking. In order to achieve this, the Directorate: Education, Training and Extension Services came up with an Agricultural Career Awareness Programme to conscientise children about agriculture and to promote careers in agriculture.

It is critical to understand that learners make two choices during the course of their high school career which are: subject choices and career choices. It is, therefore, very important that they make informed choices while deciding on a career path. This will also assist in changing the attitude students have towards agriculture.

Scope of information

Issues addressed under each career:

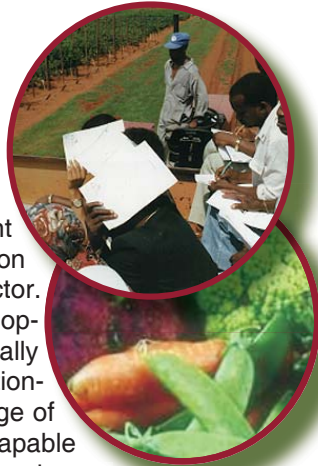
- An explanation of the career
- School subjects required
- University entry requirements
- Career or job opportunities
- Qualifications acquired
- Career or job opportunities
- Qualifications acquired



Scarce skills in agriculture

AGRICULTURAL ECONOMICS

Agricultural economics and agribusiness management form part of the effective functioning of an organisation concerned with the agricultural and agribusiness sector. Agricultural economists analyse and advise on the optimal use of production factors for the environmentally sustainable production of food and fibre in an internationally competitive milieu. They have a broad knowledge of agriculture, commerce and social science and are capable of solving problems relating to agricultural development, marketing and finance, agricultural policy and consumption affairs; agricultural sales and marketing; brokerage; market research; international trade and market development; finance; public relations; food manufacturing; processing; distribution and purchasing; as well as farm input industry. Students wishing to be considered for admission at first-year level have to comply with the following entry requirements (Table 1).



Curriculum

Areas of study at university level include economics, agricultural economics, agricultural development planning, agricultural marketing, agricultural policy, accounting, labour law, business law and business management.

TABLE 1 Entry requirements for BSc/BCom Agricultural Economics

Career	Universities	Qualification	Duration	Entry requirements
Agricultural Economist	Stellenbosch Pretoria KwaZulu-Natal Free State	BSc Agricultural Economics	4 years	Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %)
		BCom Agricultural Economics	3 years	Life orientation: 4 (50–59 %) (excluded when calculating the APS) English/Afrikaans: 4 (50–59 %) An additional language: 4 (50–59 %)



Role of agricultural economists

Agribusiness management

- Developing, designing and managing supply chains as well as value systems for specific products, industries and subsectors.
- Examining resources' demand by business and their supply response.
- Farm planning and control, farm information systems, data analysis and budgeting, organisation of capital, farm machinery management.
- Economics, labour economics and management, financial leverage, farm enterprises' growth and liquidity, and risk management.

Marketing

- Production, processing and distribution of goods, thereby, focusing on the flow of food and fibre to their final destination and the determination of prices at each stage.
- Commodity futures trading: trading commodities such as maize, wheat, citrus, etc. between farmers and the market.
- Market research, brand management, economic analysis (trend management), surveys, import and export management, therefore, examining foreign trade relationships for food and fibre products.
- Agricultural statistics such as trend analysis in production, agricultural exports, prices; variations analysis, indices (CPI, PPI, Chain Index, etc.).
- Financial services (banks, financial institutions and agribusiness industries).
- Financial needs analysis, risk and valuation analysis, feasibility studies, cash flow planning and profit management.
- Financing and supply of capital to business.



Resource economist (focuses on the use and preservation of natural resources)

- The application of economic principles to issues such as air and water pollution, resource conservation, land-use policy, and the evaluation of environmental resources.
- Identifying and analysing policies and strategies for meeting the world food needs in ways that ensure sustainability of the natural resource base.

Agriculture and rural development

- Government programmes for specific commodities that will support incomes of farmers and provide food and fibre to low-income consumers.
- Business plan formulation, capacity building (training) and support for small-scale farmers and resource-poor farmers.
- Identifying and overcoming constraints to development of agriculture in developing countries.

Potential employers

Interesting and innovative careers and opportunities exist for agricultural economic graduates in agricultural corporations, agribusiness firms, food and fibre organisations, government institutions, NGOs and rural development institutions, farming and ecotourism, financial institutions (commercial banks), futures and commodity trading, research and policy institutions, international economic development and donor institutions, universities and consultation services.

BIO-RESOURCE ENGINEERING

Bio-resource engineering is the application of science and technology in agriculture, food and biological systems. The agricultural engineer's field of employment includes a wide spectrum of activities which are connected to nearly all other engineering disciplines. Students wishing to be considered for admission to the first year have to satisfy the following entry requirements (Table 2).



Curriculum

The university curriculum consists of water resource management, which includes drought and floor planning, water quality, irrigation and drainage, and dam design. Engineering for food fibre production includes design, development and the efficient utilisation of machinery. Environmental engineering incorporates animal-friendly building and devices, soil conservation and animal waste management.



Role of agricultural engineers

Interesting and innovative careers and opportunities exist for agricultural economic graduates in: agricultural corporations, agribusiness firms, food and fibre organisations, government institutions, NGOs and rural development institutions, farming and ecotourism, financial institutions (commercial banks), futures and commodity trading, research and policy institutions, international economic development and donor institutions, universities and consultation services, energy sources and mechanisation.

TABLE 2 Entry requirements for BSc in Agricultural Engineering (M-score 33–35)

Career	Universities	Qualification	Duration	Entry requirements
Agricultural engineer	KwaZulu-Natal	BSc Agricultural Engineering	4 years	Mathematics: 6 (70–79 %) Physical Science: 6 (70–79 %) English: 4 (50–59 %) Life Orientation: 4 (50–59 %) And three other subjects (50–59 %)



Bio-resources engineering goes well beyond the farm boundaries, into areas such as water resource management, forestry, mining rehabilitation, food processing, peri-urban and rural development, machinery development and manufacture, waste management and ecology as well as agricultural vehicles and systems.

Energy sources and mechanisation

Through innovation, research and development sourcing/finding, agricultural engineers contribute to alternative sources of energy and machinery, and improvement of the existing machinery. Agricultural engineers select appropriate materials and manufacturing processes, to carry out construction and testing of basic devices.

Farm structures

Agricultural engineers also contribute to environmental control for livestock and plants such as poultry, piggery and dairy structures, greenhouses and agricultural production systems. In addition, intensive meat, milk and egg production, storing, and egg production, storing, drying, refrigeration, and processing of a large variety of other agricultural products are also designs of agricultural engineers. These structures are created in accordance with the animal's need and product demands.

Irrigation engineering

Irrigation engineers' services involve the design of new and improvement of existing irrigation and pumping systems such as centre pivot, microjet, drip, sprinkler and flood irrigation systems.

Engineering and environmental hydrologists

Engineering hydrologists' tasks encompass flood estimation, flow routing, dam design for agricultural and small catchments, spillway design, plunge and spray dip designs and water resource management.

Food engineer

Food engineers can make a meaningful contribution towards value adding and extension of the shelf-life of perishable products such as dairy products, meat, eggs, vegetables and fruit. This field of work includes the



degree of cooling installations for milk products, long-term conservation of vegetables and fruit, milling and mixing processes as well as the spray drying process used in the production of powdered milk.

Professional status

A BSc Agricultural Engineering degree is recognised as qualifying degree for registration as a professional engineer under the Professional Engineers Act, 1968. The degree is accredited by the Engineering Council of South Africa and the South African Institute of Agricultural Engineers.

Potential employers

The profession offers exceptional opportunities in aspects such as research, development, project management, consulting services and the establishment of own business enterprises and farming systems to the individual with the necessary entrepreneurial abilities and initiative. Interesting and innovative careers and opportunities open to agricultural engineering graduates exist in the Department of Agriculture, Forestry and Fisheries (DAFF), agriculture, agricultural research institutes, universities, consulting and engineering organisations, food processing companies, agricultural equipment and systems manufacturers.

FOOD SCIENCE AND TECHNOLOGY

Food Science

Food Science involves the application of scientific principles in the development and supply of healthy, safe, nutritious and affordable food for human consumption. Functions of the food scientist include the following areas; firstly, involvement in the development of many novel food products that are now freely available in shops, e.g. long-life milk, frozen and canned foods, snack foods and ready-to-eat meals. Secondly, food scientists are trained to meet the challenge of developing and supplying foods that comply with the ever-changing demands of the modern consumer. Finally, food scientists lead the fight against hunger and malnutrition through the development of affordable, nutritious foods. Examples are instant weaning porridges, components of cereals and legumes as well as vitamin and mineral fortified staple foods. A food scientist must be knowledgeable about the chemical composition, structure and nutritional value of food, food processing and preservation techniques, and the chemical, physical and biological





changes that occur in food during processing, preservation and storage.

Food Technology

Food Technology is the study of the large-scale selection, production, processing and preservation of foods as well as the development and analysis of foodstuffs in industrial food-processing facilities. It further involves packaging, distribution and the use of safe, nutritious and wholesome food. Food Technologists are involved in the following areas of food manufacture: quality assurance, processing technology, chemistry and microbiology. In addition, they are trained to ensure that both legal and industrial food standards are monitored and maintained prior to marketing.

Food technologists are also part of research teams and have to solve technical problems when raw materials are converted into preserved foods in factories. Food technolo-

TABLE 3 Entry requirements for BSc Agric Food Science and National Diploma in Food Technology (M-score 30)

Career	Universities	Qualification	Duration	Entry requirements
Food scientist	Stellenbosch Pretoria	BSc Agric Food Science BCom	4 years	Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Two languages: 4 (50–59 %) Two other subjects: 4 (50–59 %)
Food technologist	Cape Peninsula University of Technology	National Diploma in Food Technology	3 years	Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Mathematical literacy: 4 (50–59 %)



gists are concerned with aspects pertaining to the production, preservation and development of high-quality foods. They also manage processing plants and quality assurance laboratories. They are charged with monitoring of food quality standards by government bodies, namely the SABS. Students wishing to be considered for admission to the first year have to satisfy the following entry requirements (Table 3).

Potential employers

With population growth, new scientific and technological challenges emerge daily in a career that can lead to rich rewards and excellent job opportunities for both men and women. The food industry is South Africa's largest manufacturing industry, and a degree in Food Science is your stepping stone to various exciting and challenging careers. Job opportunities exist as food production manager or assistant, fresh foods manager or assistant, food buyer, cookery school consultant, food stylist, consumer advisor, food promotion consultant, customer service manager and technical representative. Qualified food technologists are employed in industrial food manufacturing concerns such as bakeries, beverage manufacturers (soft drinks, beer and wine), bottling plants, canning companies, dairies, fish and meat processors. They are involved in production, quality assurance and product development. Research opportunities exist in companies, as well as in research institutions.

VETERINARY SCIENCE

Veterinarians play an important role in the economy of South Africa. They contribute to the creation of wealth by controlling epidemic diseases of animals and increasing the profitability of commercial and small-scale farming enterprises. They also contribute to the production of sustainable sources of safe protein of animal origin, the prevention of the transfer of diseases from animals to humans, and they certify the disease (or disease-free) status of animals and the safety of products for local and international trade. They attend to the veterinary needs and general welfare of animals, both those of commercial importance and those kept as companion animals.

Curriculum

The duration of the course is six (6) years (single degree structure). The core-elective programme is an internationally recognised and recommended approach in which all candidates will complete a core curriculum over 4.5 years (9 semesters). They will then complete a chosen elective over four months which will give them increased competencies to enter the profession in their chosen career paths. The training will be concluded with approximately 14 months of experiential training in the core and chosen elective components. The first year of the programme will continue to be offered at the Hatfield campus of the University of Pretoria and students will only move to the Onderstepoort campus from the second year.

Students who complete the National Senior Certificate (NSC) in 2010 will not be considered for admission to BVSc I in 2011 but will be considered together with the 2011 cohort for admission to BVSc I in 2012. They may alternatively seek admission to BSc (Biological Sciences) in 2011 and then apply for admission to BVSc in 2012.

Role of veterinary scientist



Research: The veterinarian is also involved in research in a wide spectrum of areas (veterinary, agricultural and biomedical sciences) in matters relating to product development, animal improvement and monitoring the utilisation of animals for experimental purposes.



State veterinarians: They render essential regulatory services relating to the diagnosis, surveillance, monitoring, control, prevention and eradication of notifiable diseases. They are also responsible for matters relating to the import and export of animal products and for food safety and security.



The provision of routine or forensic services involving disciplines such as pathology, clinical pathology, microbiology and toxicology in the private, state and diagnostic laboratories. Veterinarians are also involved in general matters pertaining to the welfare of animals through the promotion of appropriate husbandry practices,



nutritional practices, disease prevention strategies and sound production systems.

Veterinary Public Health: Veterinarians are responsible for ensuring the maintenance of meat and milk hygiene in abattoirs and milk processing plants and the control of zoonotic diseases (diseases transferred from animals to humans).

Private practice/Companion practice: provide veterinary services to pet owners (dogs, cats, exotic animals and birds); **rural practice:** provide veterinary services to farmers (sheep, goats, cattle, horses, pigs, poultry and game); **breeders** (dogs, pigs, sheep and goats) and animal welfare organisations, game reserves and zoos.

Selection of applicants

A total number of 140 students will be admitted to the programme. The faculty endeavours to meet the veterinary needs of the country and the specific requirements of higher education legislation through selection of applicants. The recruitment and selection process is therefore structured in such a way that it will reflect national demographics and government policy. The procedure will be reviewed on an annual basis providing for the following categories:

- School leavers
- Students with tertiary exposure
- International students

Students with tertiary exposure are selected based on academic performance, an institutional proficiency test and an interview as required.

TABLE 4 Entry requirements for BVSc (M-score 30)

Career	Universities	Qualification	Duration	Entry requirements
Veterinarian	University of Pretoria	BVSc	6 years	National Senior Certificate with endorsement for admission to Bachelor's degree English/Afrikaans: 4 (50–59 %) An additional language: 4 (50–59 %)



Career	Universities	Qualification	Duration	Entry requirements
				Mathematics: 5 (60–69 %) Physical science: 5 (60–69 %) Two other subjects: 4 (50–59 %)

Potential employers

The majority of veterinarians offer clinical services, disease prevention strategies, advice in nutrition, management, production and reproduction of animals. Employment opportunities are available in government institutions, research organisations and meat-producing organisations.

VITICULTURE AND OENOLOGY

Viticulture

Viticulturists apply scientific principles to manipulate the vine to produce the kind of grapes necessary for the production of different wine types and styles as well as augmenting both the quality and quantity of grapes. Viticulturists share a mutual purpose, which is to make world class wines to accompany food for pleasurable drinking.

Viticulturists learn theoretically and practically how the correct methods of anatomy, morphology, physiology, ampelography of scion and rootstock cultivars, plant improvement, natural and artificial disorders of the grapevine, spacing and trellising, pruning, canopy quality assessment and management as well as selection of cultivar and terrain, grape handling and packaging can contribute to the desired product.

The production of wine is done by striking a balance between soil, climate, geography, winery “softness” and winery hygiene. Good wine delivers joy to the world. Students wishing to be considered for admission to the first year have to meet the entry requirements (Table 5).

Oenology

Oenologists learn about the principles and practices of wine-making such as applied chemical and microbiological processes involved in producing



TABLE 5 Entry requirements for BSc Agric in Viticulture/Oenology

Career	Universities	Qualification	Duration	Entry requirements
Viticulturist/ Oenologist	Stellenbosch	BSc Agric Viticulture/ Oenology	4 years	Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) or Physical Science and Life Orientation 4 (50–59 %) Afrikaans or English: 4 (50–59 %)

wines, sweet wines, grape juice, concentrates and brandy, wine stabilisation as well as analysis and sensory evaluation of wine and brandy.

Curriculum

Different curriculum choices enable students to major in any one of the following: Viticulture and Oenology; Viticulture and Soil Science; Viticulture and Entomology; Viticulture and Plant Pathology; Viticulture and Agricultural Economics; Oenology and Chemistry; or Oenology and Enterprise Management.

Potential employers

Qualified viticulturists are employed in universities, the Agricultural Research Council, wine companies, estates, wine cellars, farms, consulting companies and marketing companies.



Other careers in agriculture

AGRICULTURAL BIOTECHNOLOGY

Biotechnology

Agricultural biotechnology is a range of tools, including traditional breeding techniques that alter living organisms or parts of organisms to make



or modify products, improve plants or animals, or develop microorganisms for specific agricultural uses. Modern biotechnology includes the tools of genetic engineering.

Role of biotechnologists

The biotechnologist applies biological processes to the production of a wide range of organic substances and to ways of recycling waste. Multi-disciplinary techniques applied in a number of scientific areas are used.

The biotechnologist can be concerned with microorganisms, genetic engineering or cell culture and may do some work on the development of new organisms. A biotechnologist can also design and develop systems for industrial manufacture of materials such as fuel, animal foodstuffs or antibiotics.

Requirements of biotechnologists

As a biomedical scientist you should:

- have a scientific approach
- have an inquiring mind
- be able to show initiative
- be able to give attention to detail
- be precise and methodical
- be able to work as part of a team.

Curriculum

Different curriculum choices exist in the field of biotechnology. Therefore, students should ensure that they major in biotechnology in order to be able to follow a career path in agriculture. In some institutions, this can only be done from second year, i.e. the University of Stellenbosch offers BSc Molecular Biology and Biotechnology and students who wish to graduate in Biotechnology have to major on Biotechnology I & II from their second year of study. Rhodes University also offers Biotechnology at the postgraduate level.



TABLE 6 Entry requirements for BSc/ND in Biotechnology

Career	Universities	Qualification	Duration	Entry requirements
Food scientist	University of Western Cape University of the Free State University of Pretoria	BSc Biotechnology	3 years (full time)	Matric exemption Mathematics: 4 (50–59%) Physical Science: 4 (50–59 %) Biology (recommended)
	Tshwane University of Technology Vaal University of Technology Durban Institute of Technology	National Diploma in Food Technology	3 years (full time)	Senior certificate Mathematics and Physical Science: 4 (50–59 %) Pass in English

Potential employers

ARC, CSIR, other research institutions, government departments (national and provincial), food fermentation and pharmaceutical industries, private pathologists, SABS, universities and universities of technology.

AGRICULTURAL TECHNICAL SERVICES

Agricultural technician

Agricultural technicians assist agricultural scientists in their work and assist with the collection of information. They also give advice and information to the farming industry.

Agricultural resource technician

- Works together with the agricultural resource officer.
- Is involved in the classification, description and plotting of a region's natural resources.



TABLE 7 Entry requirements for National Diploma in Agriculture (agricultural technician)

Career	Universities	Qualification	Duration	Entry requirements
Agricultural technician	Most universities in the country	National Diploma in Agriculture: Botany, National Diploma: Nature Conservation, National Diploma: Analytical Chemistry, and National Diploma: Agriculture: (Animal Production)	3 years (full time)	English/Afrikaans: 4 (50–59 %) Other languages: 4 (5–59 %) Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Life Orientation: 4 (50–59 %)

Agricultural extension technician

- Assists the agricultural extension officer.
- Collects information to determine the needs of extension.

Potential employers

ARC, DAFF, DWAE, agricultural cooperatives.

AGRONOMY

Agronomy is the integration of the disciplines of Agricultural Engineering, Agro-forestry, Crop Production, Genetics and Plant Breeding, Horticulture, Plant Protection and Soil Science. All of these disciplines are supported by a strong foundation in the physical and biological sciences. Special attention is given to the sustainable intensive and extensive production of food and fibre crops, under rain-fed conditions or with irrigation, for local and export markets.

This degree covers the following: Overview regarding the grain industry and more specifically the small-grain



TABLE 8 Entry requirements for BSc and National Diploma in Agronomy

Career	Universities	Qualification	Duration	Entry requirements
Agronomist (scientist)	Most universities	BSc (Agric)	4 years (full time)	Mathematics: 4 (50–59 %) Physical Science/ Biology (recommended)
Agronomist (technician)		National Diploma: Agronomy and BTech in crop production	3 years (full time)	Mathematics and Physical Science

industry; relationship between soil, climate, environment and production capacity; problem areas; marketing and market tendencies in the grain.

ANIMAL SCIENCE

Animal scientists are qualified people involved in research and development, and they give advice to the livestock industry concerning the production of animals and their products.

Focus areas

These scientists' focus area is as follows:

Agricultural Genetics (Plant or Animal Genetics)

This course covers breeds and breeding standards of animals as well as basic breeding principles, selection systems, and performance. It also involves the most important dairy and beef cattle breeds in South Africa, qualitative and quantitative inheritance, responses to selection, methods of selection and selection system for dairy and beef cattle.

Animal Nutrition

Practical feeding of different farm animals and balancing of feed rations are covered in this field.



TABLE 9 Entry requirements for BSc Animal Science

Career	Universities	Qualification	Duration	Entry requirements
Animal scientist	Most universities	BSc Agric Viticulture/ Oenology	4 years (full time)	English/ Afrikaans: 4 (50–59 %) Other languages: 4 (50–59 %) Mathematics: 4 (50–59 %) Life Orientation 4 (50–59 %)

Dairy Science

Dairy Science involves the anatomy and physiology of the udder and the elements of milking procedure, the composition of milk, factors that influence the composition of milk, machine milking, milk hygiene, bad taste in milk and dairy products.

Poultry Science

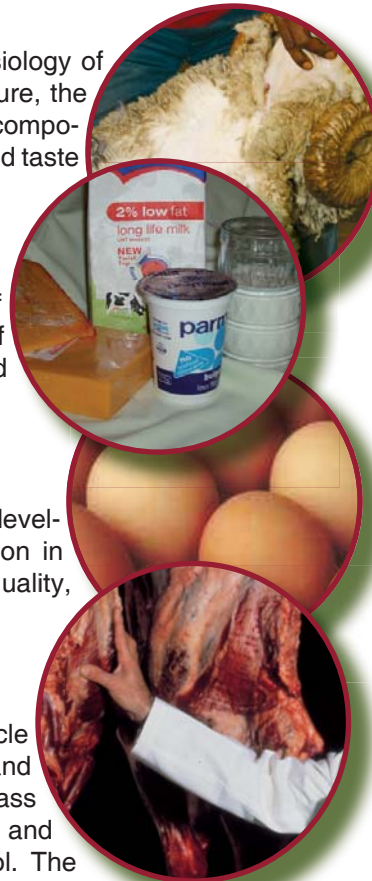
This field involves behaviour and biology of poultry, poultry management, production of broilers, egg production, hatching of eggs and rearing of young hens and disease control.

Meat Science

The study of Meat Science involves growth, development and tissue composition and distribution in small and large stock. It also covers meat quality, meat processing and meat ageing.

Wool Science

The field covers the biology of the wool follicle and physical characteristics of wool, shearing and shearing-pen organisation (management), class and class standards of wool, wool processing and wool products, as well as byproducts of wool. The



marketing of wool and other natural and synthetic fibres are also included in this field.

Potential employers

The ARC, DAFF (national and provincial departments), universities, agricultural cooperatives and manufacturers of feeds.

BIOLOGICAL NITROGEN FIXATION

The biological nitrogen fixationist should be a person with a strong interest in biology and research, and should love to work with the soil under uncomfortable conditions.

What is Biological Nitrogen Fixation (BNF)?

The availability of nitrogen in the soil is probably the single most important factor limiting plant growth and crop yields. Some free-living and symbiotic bacteria directly influence the availability of nitrogen in the soil by conversion of atmospheric dinitrogen to ammonia in the process termed BNF. Worldwide, BNF accounts for 65 % of the nitrogen used in agriculture, of which the symbiosis of legumes with nitrogen-fixing rhizobia is by far the most important source.

Potential employers

The ARC, DAFF (national and provincial), universities, commercial inoculant manufacturers, and own company—consultant.

TABLE 10 Entry requirements for BSc in Microbiology (nitrogen fixationist)

Career	Universities	Qualification	Duration	Entry requirements
Biological nitrogen fixationist	Most universities	BSc Agriculture or Microbiology	3 years (full time)	Biology, Agricultural Science and Chemistry



ENTOMOLOGY

The Entomologist is basically involved in research to ensure plant protection. He has a strong interest in science studies and research. There are various categories such as Plant Pathology, Microbiology and Insect Diversity.



Potential employers

Potential employers are the ARC, DAFF, and universities.

TABLE 11 Entry requirements for BSc in Entomology

Career	Universities	Qualification	Duration	Entry requirements
Entomologist	Most universities	BSc Entomology	3 years (full time)	English/Afrikaans: 4 (50–59 %) Additional language: (50–59 %) Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Life Orientation: 4 (50–59 %)

GRASSLAND/PASTURE SCIENCE

Grassland Science is divided into two categories: Rangeland and Grassland Management.

Rangeland

Rangeland Management is a discipline and an art that applies an organised body of knowledge accumulated by range science and practical experience for two purposes:

Protection, improvement, and continued welfare of the basic resources, which in many situations include soils, vegetation, endangered plants and animals, wilderness, water and historical sites.



TABLE 12 Entry requirements for BSc in Pasture/Grassland Science

Career	Universities	Qualification	Duration	Entry requirements
Pasture/grassland scientist	Most universities	BSc (Agric)	4 years (full time)	Mathematics: 4 (50–59 %) Physical Science/ Biology (recommended)
	Most universities of technology	National Diploma: Nature Conservation	3 years (full time)	Mathematics: 4 (50–59 %) Physical Science

Optimum production of goods and services in combinations needed by society. Rangeland Management requires selection of alternative techniques for optimum production of goods and services with no damage to the resources. While emphasis is often placed on effects and management of domestic animals, the main goal is rangeland resource rehabilitation, protection and management for multiple objectives, including biological diversity, preservation and sustainable development for people.



Grassland

Grassland Science entails the study of all aspects of the utilisation, conservation and improvement of the veld and cultivated pastures. The education of grassland scientists is essential for sustainable animal production, on rangeland and cultivated pastures.

Grassland Science not only plays an important role in the increasing demand for meat and other animal products, but it also make a large contribution to soil and nature conservation, game farming and the future of game parks, which are important for the tourism industry.

Potential employers

The profession offers exceptional opportunities for employees in the fertiliser and seed companies, the National Parks Board, various sections of nature conservation and the Department of Agriculture, Forestry and Fisheries (national and provincial level).



HORTICULTURE AND HYDROPONICS

Horticulture involves the application of scientifically based production systems of vegetables, fruit and ornamental plants. Hydroponics is a production system called soilless growing, in which fertilisers and minerals are added or mixed with water and supplied to plants.



Focus areas

Plant production

- propagation techniques
- production practices

Plant knowledge

- plant names
- production practices
- origins

Horticultural management

- principles of horticultural enterprises/organisations
- management of personnel
- financial management

TABLE 13 Entry requirements for BSc Horticulture Science

Career	Universities	Qualification	Duration	Entry requirements
Horticulturist	Most universities	BSc Horticulture	4 years (full time)	Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Agriculture: 4 (50–59 %)
	Tshwane University of Technology	BTech Horticulture	3 years	Mathematics Physical Science and Agriculture



Potential employers

The ARC, DAFF (national and provincial), universities, agricultural cooperatives and seed companies.

MICROBIOLOGY

Microbiology is defined as the study of microorganisms such as bacteria, viruses and protista, which can only be seen with a microscope, and these are called or known as “unseen multitudes”.

A microbiologist mostly works in a laboratory or a place where a microscope can be installed. It can be anywhere in the fields of nutrition, medicine, ecology, pharmacology, cosmetics, marine life or any place where animals and plants or people live. Identification is by means of DNA karyotyping.

Potential employers

Potential employers are the ARC, DAFF (national and provincial), food industries, wine cellars, universities, and private companies.



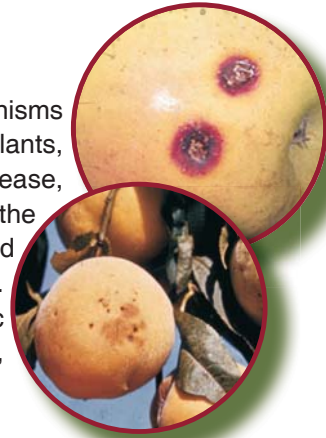
TABLE 14 Entry requirements for BSc (Agric) Microbiology

Career	Universities	Qualification	Duration	Entry requirements
Microbiologist	Most universities and universities of technology	BSc (Agric) Microbiology	4 years (full time)	English/Afrikaans: 4 (50–59 %) Other language: 4 (50–59 %) Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Life Orientation: 4 (50–59 %)



PLANT PATHOLOGY

Plant Pathology is defined as the study of the organisms and environmental conditions that cause disease in plants, the mechanisms by which these factors cause disease, the interactions between these causal agents and the plants (effects on plant growth, yield and quality), and the methods of managing or controlling plant diseases. It also interfaces with knowledge from other scientific study fields such as Mycology, Microbiology, Virology, Biology, chemistry, Bioinformatics, etc.



Potential employers

The profession offers exceptional opportunities for research in the government (national and provincial departments), as plant pathologists in the ARC, agrochemical companies, seed companies, fertiliser companies universities, farms, nurseries and pharmaceutical companies.

TABLE 15 Entry requirements for BSc in Plant Pathology

Career	Universities	Qualification	Duration	Entry requirements
Plant pathologist	Most universities	BSc (Agric) Microbiology	4 years (full time)	English/Afrikaans: 4 (50–59 %) Other language: 4 (50–59 %) Mathematics: 4 (50–59 %) Physical Science: 4 (50–59 %) Life Orientation: 4 (50–59 %)

SOIL SCIENCE

Soil scientists specialise in the origin of soils and the formation thereof: origin/development and composition of soil and soil-forming factors. The field also covers the most important physical characteristics of soil: texture, structure, colour, consistency, overall density, soil air, temperature and wa-



ter, as well as problems arising as a result of tillage, soil compaction and crust formation.

Focus areas

Soil Survey

This studyfield involves profile pit observation by drilling mechanical augers and later conducting physical and chemical laboratory analyses.



The results obtained (also compiled as maps and aerial photographs) are used as vital information for infractural planning (urban planning, roads, pipelines, powerlines, etc.) and agricultural management purposes.

Soil Physics and Hydrology

Soil physicists and hydrologists study problems relating to water and soil interaction, soil air permeability, etc.

Soil Chemistry and Fertility

The soil chemistry is concerned with soil nutrient availability and deficiencies using specialised techniques for the purpose of compiling the most effective fertilisation programmes.

TABLE 16 Entry requirements for BSc in Soil Science

Career	Universities	Qualification	Duration	Entry requirements
Soil scientist	Most universities	BSc (Agric) Soil Science	4 years (full time)	English/Afrikaans: 4 (50–59 %) Other language: 4 (50–59 %) Mathematics: 4 (50–59 %)
	Most universities of technology	National Diploma (Soil science)	3 years (full time)	Physical Science: 4 (50–59 %) Life Orientation: 4 (50–59 %)



Soil Biology

The focus of soil biology is on transformation by microorganisms.

Potential employers

The ARC, DAFF (national and provincial), universities, agricultural cooperatives and manufacturers of fertilisers.

STATISTICS

Statisticians generate, collate, verify, maintain and disseminate statistical information on the agricultural sector, including monitoring and projection of trends in agriculture, food security and food utilisation.

Potential employers

Potential employers are the DAFF, commercial banks and other financial institutions, and academic institutions.

TABLE 17 Entry requirements for becoming a statistician

Career	Universities	Qualification	Duration	Entry requirements
Statistician	Most universities	BSc (Agric) Economics or BCom (Agric Economics)	4 years (full time)	Mathematics, Agricultural Science or Economics/Business Economics

WEEDS BIOCONTROL SCIENCE

Biocontrol scientists specialising in aquatic weeds regularly wade in populated, weed-infested rivers or dams, wearing waders or use boats.

Role of a weeds biocontrol scientist

The field involves searching for natural enemies (either insects or disease-causing organisms such as fungi) of invasive plants (weeds) in the weed's country of origin, and studying the natural enemies in quarantine to deter-



TABLE 18 Entry requirements for becoming a weed biocontrol scientist

Career	Universities	Qualification	Duration	Entry requirements
Weed biocontrol scientist	Most universities	BSc or BSc (Hons) Entomology	4 years (full time)	Mathematics, Physical Science or Agricultural Science

mine whether these have a potential use in controlling the invasive plant, and are host-specific.

The host-specific and damaging insects and fungi are released from quarantine and placed onto their target weeds in the field. The release sites are regularly visited to see whether these insects or fungi have become established and are controlling the weed.



Potential employers

The ARC, government departments, universities, private consultant, and private companies.



Annexure

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