

## **Areas of Agricultural Engineering Specialization**

The following areas of agricultural engineering specialization is identified today

1. *Farm Power and Machinery Engineering (FPME)*: Most fruits and fiber comes from the farm, which means that plants must be grown and animals produced to supply man's needs. Anyone who has grown plants or worked with any of the sources of power in preparation of seedbed, planting, cultivating, irrigation, thinning etc. has done a hard work. It is generally agreed that there will be some elements of drudgery to such tasks and the farmer will strive to lessen the work to reduce drudgery. Progress was then made by the application of power operated machinery. This option is divided into *farm power* and *farm machinery*.

2. *Soil and Water Conservation Engineering (SWE)*: Soil and water conservation engineering employs engineering principles to the solving of *soil* and *water* management problems. The conservation of these vital resources implies utilization without waste so as to make possible a high level of production, which can be, continued indefinitely.

3. *Irrigation and Drainage Engineering*:

Irrigation is defined as the application of water to land using means other than the natural rain, the purpose of which is to provide sufficient water for plant growth and productivity. Irrigation is necessary to provide enough water to fill the deficit arising from the depletion of soil moisture from the combine action of two separate phenomena of evaporation and transpiration. Land drainage deals with the control of water logging and soil salinization in agricultural lands. In flatlands, a first problem emerges if soil infiltration rates are low and rainfall or irrigation water stands on the ground surface in small depressions or at the edges of the irrigation basin. This problem can be solved by leveling and smoothing the land and providing it with a uniform slope for excess water

to flow through furrows or shallow ditches toward the surface drainage outlet. Surface water is discharged into a collector drain through pipes to prevent the erosion of the open ditch bank.



#### *4. Post Harvest Systems Engineering:*

This deals with the processes and machines required to convert agricultural raw materials or products into finished consumer goods. It involve, harvesting, transporting, handling, storage, processing and packaging.



#### *5. Farm Structures and Environmental Control Engineering:*

Farm structures include farmstead, settlements, animal houses, storage structures farm and allied products, machinery and processing equipment house etc. These structures need specialized designs. Control of environmental factors, external and within in the structures, waste disposal systems, biogas generation etc are also involved. Operations and management of food processing machines such as rice mills, flourmills, vegetable oil processing outfits, beverages and biscuit manufacturing, bread and other confectioneries.

#### *6. Wood Products Processing Engineering:*

This branch of engineering has not been fully developed. It involves the study of engineering properties of woods, composite products from wood and associated wood products processing; design of machines required for forestation projects and for exploiting forestry products. This includes machines for planting, pruning, transporting, milling and other wood processing machines.

### *7. Emerging Technologies in Agricultural Engineering:*

The discipline is currently undergoing major and important changes as it responds to global economy. These emerging technologies (ET) include: Information technology (IT); Biotechnology Environmental and renewable energy sources. The use of computer and communication (ICT) equipments for Data acquisition, machine control, information management and simulation and prediction of agricultural systems are becoming popular. Biotechnology involves the engineering of biological systems. Waste recycling, alternative to fossil fuel- vegetable and fruit oil-fuels etc. Renewable energy resources such as harvesting and utilization of solar, water wind energy for agricultural production, processing and handling.

## **Advancements in Agricultural Engineering Specialization**

Agricultural Engineering has advanced to the extent that the scope has been widened to embrace the various emerging technologies in the field and thus the following specialized categories have been identified:

### **1. Biological Engineering**

Biological engineering is one of the most rapidly growing sub-disciplines of agricultural engineering that applies engineering practice to problems and opportunities presented by living things and the natural environment. Areas of interest range from environmental protection and remediation, food and feed production, medicine and plant-based pharmaceuticals and packaging materials. Others may develop techniques

and strategies for natural pest control and treatment of hazardous wastes, for composting, and for enzyme processing of biomass, food, feed, and waste

## **2. Natural Resource Engineering**

These agricultural engineers are equipped with expertise in environmental work to better understand the complex mechanics of these resources, so that they can be used efficiently and without degradation. These engineers determine crop water requirements and design irrigation systems. They are experts in agricultural hydrology principles, such as controlling drainage, and they implement ways to control soil erosion and study the environmental effects of sediment on stream quality. Natural resources engineers design, build, operate and maintain water control structures for reservoirs, floodways and channels. They also work on water treatment systems, wetlands protection, and other water issues.

## **3. Power Systems and Machinery Design Engineering**

These agricultural engineers focus on designing advanced equipment, making it more efficient and less demanding of our natural resources. They develop equipment for food processing, highly precise crop spraying, agricultural commodity and waste transport, and turf and landscape maintenance. This is in addition to the tractors, tillage equipment, irrigation equipment, and harvest equipment that have done so much to reduce the drudgery of farming. Their work remains challenging as technology advances, production practices change and equipment manufacturers expand globally.

## **4. Structures and Environmental Engineering**

These agricultural engineers understand the importance of creating and maintaining a healthy environment for growing agricultural commodities and for the labourers who produce them. They also understand that our natural resources must not be diminished, in quality or availability, by agricultural operations. Toward these ends, these

agricultural engineers are equipped with expertise in structures and environment to design animal housing, storage structures, and greenhouses, with ventilation systems, temperature and humidity controls, and structural strength appropriate for their climate and purpose. They also devise better practices and systems for storing, recovering, reusing, and transporting waste products.

### **5. Food and Bioprocess Engineering**

Food, fiber, and timber are only the beginning of a long list of products that benefit from efficient use of our natural resources. The list includes biomass fuels, biodegradable packaging materials, pharmaceutical and other products. These engineers understand microbiological processes and use this expertise to develop useful products, to treat municipal, industrial and agricultural wastes, and to improve food safety. They are experts in pasteurization, sterilization, and irradiation, and in the packaging, transportation and storage of perishable products. Food and processing agricultural engineers combine design expertise with manufacturing methods to develop economical and responsible processing solutions for the industry as well as look for ways to reduce waste by devising alternatives for treatment, disposal and utilization.

### **6. Information and Electrical Technologies Engineering**

The application of information and electrical technologies in agriculture is very versatile. It is applied to virtually all the other sub-disciplines of agricultural engineering, from machinery design to soil testing to food quality and safety control. Geographic information systems, global positioning systems, machine instrumentation and controls, electro-magnetics, bioinformatics bio-robotics, machine vision, sensors, spectroscopy are some of the exciting

information and electrical technologies being developed and used today in agriculture and agro-based industry.

### **7. Forest Engineering**

Agricultural engineers apply engineering principles to solve natural resource and environment problems in forest production systems and related manufacturing industries. Engineering skills and expertise are needed to address problems related to equipment design and manufacturing, forest access systems design and construction; machine-soil interaction and erosion control; forest operations analysis and improvement; decision modeling; and wood product design and manufacturing. Forest engineers are involved in a full range of activities in natural resource management and forest production systems.

### **8. Energy Engineering**

Energy is needed to power the machines, devices, and systems in our homes and workplaces. But many of the energy sources are nonrenewable and create undesirable byproducts. Agricultural engineers are at the forefront of the effort to identify and develop viable energy sources such as biomass, methane, and vegetable oil and to make these and other systems cleaner and more efficient. These engineers also develop energy conservation strategies to reduce costs and protect the environment, and they design traditional and alternative energy systems to meet the needs of agricultural operations.

### **9. Aquacultural Engineering**

As natural fish supplies are threatened, agricultural engineers are needed to help design farm systems for raising fish and shellfish, as well as ornamental and bait fish. They specialize in water quality, biotechnology, machinery, natural resources, feeding and ventilation systems, and sanitation. They seek ways to reduce pollution from

aquacultural discharges, to reduce excess water use, and to improve farm systems. They also work with aquatic animal harvesting, sorting, and processing.

#### **10. Nursery & Greenhouse Engineering**

Nursery and greenhouse operations like large-scale production agriculture have many similar needs such as irrigation, mechanization, disease and pest control, and nutrient application.

However, other engineering needs also present themselves in nursery and greenhouse operations such as equipment for transplanting; control systems for temperature, humidity, and ventilation; and plant biology issues, such as hydroponics, tissue culture, and seedling propagation methods.

#### **11. Safety and Health in Agricultural Engineering**

Farming is one of the few industries in which the families work and live on the premises and are at risk for injuries, illness, and death. Agricultural engineers analyze health and injury data, the use and possible misuse of machines, and equipment in compliance with standards and regulation. They constantly look for ways in which the safety of equipment, materials and agricultural practices can be improved and for ways in which safety and health issues can be communicated to the public.