

in evolution of new varieties of plants and animals brought about drastic developments in the field of agriculture.

Agricultural Engineering was mainly concerned with improving farm machinery and implements originally improvised by farmers. Mechanization assumed controls in Western Europe in 1785 and a contributed a larger share in agriculture in 1803. A well fabricated seed drill was developed in 1880s. The mechanized agriculture was started with tractors, cultivators, drills and harvesters which over a period of few years enabled the agriculture to enter into new era of advancement and large scale agriculture. The inventions of modern machinery and techniques related to food post-harvest processing, preservation and storage have created the greater ease in food processing and preservation thus modernized the agriculture on industrial basis. Through modern agricultural breeding techniques, scientists have evolved high yielding varieties of animals, plants and poultry thus enhanced productivity and efficiency of agricultural production. Everywhere in the world, agricultural teaching and research organizations are endeavoring to enhance yields by creating new knowledge and technology in agriculture and spreading latest knowledge of improved agricultural technology and by extension and outreach activities.

#### **1.4 History of Agriculture:**

Agriculture concerning domestication of plants and animals turned into evolved round 12,000 years in the past, although despite the fact that earlier people started out altering groups of vegetation and animals with aim to get personal advantage including fire-stick farming. It has been said that native Australians made use of fire to burn the natural flora to facilitate hunting and to alter the vegetation and animal's composition within the area they inhabit.

Agriculture has experienced enormous evolutions since days of oldest farming. The fertile crescent of Western Asia, India and Egypt has been region of the earlier deliberate crop domestication and production. In addition, independent advancement in agriculture happened in China, New Guinea, Africa's Sahel (transition zone between Sahara Desert and Sudanian Savana), several parts of Americas and regions of India.

Agricultural practices such as fertilizer application, crop rotation, irrigation were advanced just after the Neolithic revolution (era of agriculture revolution including such a huge level shift from the existing life style of hunting and gathering to organized agriculture) around 8000 B.C. but at rapid pace during the previous 200 years. One of the examples is the Haber-Bosch method of preparing  $\text{NH}_4\text{NO}_3$  constituted a chief lap forward to boost-up many folds. The journey of agriculture development from primitive to today agriculture was travelled in following 7 phases as elaborated below:

### **1. Hunting and gathering:**

It was the oldest form of agriculture. Its era is reported to be Paleolithic prior to 7000 B.C. During these times, men usually concentrated on hunting and gathering. Whereas women due to their deep insight firstly observed plants emerging out of seeds. We can safely say that women have been the pioneers of crop production who started to grow the crops from wild vegetation.

### **2. Shifting Cultivation:**

It is an older style of agriculture that existed in era belonging to Neolithic age (about 7000 B.C.). In this era, people started to live on new land where they cut and burn the natural vegetation and grow crops. After few years, when fertility of that land area is lost and heavily infested with weeds and soil-borne crop enemies, they leave that land and shift to a new land area.

### **3. Subsidiary Farming:**

It was the rudimentary system of settled farming, which was the form of farming integrating cultivation, with old way of gathering and hunting. In this system, group of farm families started to live and settle near a river, form sort of permanent village and practiced crop production in a continuous manner. However, the crops, methods and tools were older.

### **4. Subsistence Farming:**

It is somewhat progressive shape of subsidiary farming as people started to do agriculture for themselves but for the entire family. However, the theme was 'grow it and eat it' instead of 'grow it and market it' which means grow crops only to satisfy the needs of family instead of growing on commercial basis.

### **5. Mixed Farming:**

Keeping in view the importance of animals, man instead of hunting them started to rear them at their farm along with crops grown. Thus a farming system was developed where animal and crop components are united together. The crop residues were fed to animals by grazing after crop harvest. While the animal dung was used as manure for crops. Thus at this stage, farming fashion was transformed from food gathering to food growing.

### **6. Advanced Farming:**

Advanced farming included selection of suitable crops and their cultivars, enrichment of soil fertility through manures derived from animal and crop refuse, green manuring with legumes, irrigation, crop rotation, pasture management, rearing of milch, meat and wool animals, and rearing of birds for poultry etc.

**F. Scientific Agriculture:** During 19th century, due to research and development in different aspects of agriculture, that field assumed a form of learning science. Centers of agricultural research, teaching and extension were developed. The write-up and publication of scientific literature in the form of books, journals, and articles were introduced. By the innovation of internet and web services, audiovisual aids, the dissemination of agricultural knowledge and technology was speeded up resulting in better awareness.

**G. Present Day Agriculture):** Now-a-days, agriculture has not remained limited to the aim of production but it has assumed shape of business that constituted of many enterprises like crop production, livestock, dairy and poultry, fisheries, apiculture, sericulture etc. Now, drastic developments in mechanical, hydrological, chemical, technological and genetic attributes of agriculture are in progress.

## **1.5 Global Agriculture:**

The development of modernized human society has remained closely linked to the development in agriculture as it is the sole sector that provides food to human being for satisfying the hunger. However, agriculture has always been facing challenges due to ever increasing population. According to an estimate, the present global food production must have to become double to maintain the food supply for human beings. Thus food security has become a major issue all over the world as about one billion global population lies below the poverty line. It can be predicted that Agriculture in the 21<sup>st</sup> century will have to face multidimensional challenges. The first challenge will be the production of more food and fiber for huge population with a squeezed labour supply. The second big challenge will be the production of more feedstocks for a potentially growing bioenergy market. Thirdly, there should be considerable contribution to innovative and scientific development throughout all agriculture-dependent developing countries. Another big challenge will be the adoption of more efficient and sustainable agricultural production techniques and adaptation strategies to climate change. An overview of the major challenges expected to be faced by global agriculture has been presented below:

### **1.5.1 Food security:**

World population is speculated to reach up to 9.1 billion through the addition of almost 2.3 billion people in 2050. Although, that population growth rate would be much slower as recorded during the last four decades which was almost the addition of 3.3 billion people, nearly all of this growth has been forecasted to occur within developing countries. Surprisingly, the pace of population growth would be the fastest (+114 percent) in sub-Saharan Africa whereas the slowest (+13 percent) in East and Southeast Asia. Moreover, the larger proportion of about 70 percent of this population