

## **INTRODUCTION**

Nowadays, increasing food supply to be adequate for human needs becomes a must especially in the underdeveloped countries. The substantial increase in population number in such countries creates a shortage in food supply and what is required for consumption. Some writers reported that food resources increase in an arithmetic progression, whereas population number tended to increase in a geometric progression. This will create the necessity of increasing the productivity of food crops in respect of quantity and quality in a sustainable manner. Therefore, agronomists as well as all of the other scientists of related fields are concerned with the problem of providing food for population that continues to grow at an accelerated rate. Underdeveloped countries of Asia, Africa and Latin America are now in a serious deficit position in respect of food production to meet their own population requirements.

World food production can be increase by expansion of cultivated land area an/ or by increase yield potentiality on the available agricultural land. Hence, agriculture can play an important role in solving the problem of food shortage all over the world on the national and international levels.

Therefore, the aim of the course is to acquire students with knowledge, understanding and skills related to crop origin, classification, environmental factors, seed bed preparation, sowing methods, fertilization, irrigation, harvesting process, weed control and principles of crop breeding.

## Chapter 1

### Field crops: Identification and Origin

*Let us start by identifying agriculture and what is the difference between agriculture and agronomy.*

**Agriculture**, is the business of food, feed and fiber production. In other words, agriculture includes all procedures and techniques responsible for the production of food either it is grain, legume, sugar, oil, fiber, milk, meat, eggs or any sources used for human consumption.

**Agronomy** is the branch of agriculture that studies the principles and practices of crop production and field management. This is because **the term Agronomy was derived from two Greek words, *agro* that means “field” and *nomes* that means “to manage”.**

The ultimate goal of both agriculturist and agronomist is to produce enough food, and fiber to satisfy the need of human use. In the third world countries, food is produced only through the use of human labor with 75- 80 % or more of the population involved in the farming activities. In contrast, food production in the United States is accomplished by using three percent of their population but heavily depend upon extensive mechanization.

Also, we can define “**Agronomy**” this way: Agronomy is a branch of agricultural sciences which deals with principles and practices of soil, water and crop management. **Agronomy is the successful, sustainable, profitable, nutritionally secured, efficient crop production with least or no environmental degradation.**

*What is the difference between field crops and horticultural crops?*

Field crops are herbaceous plants grown in cultivated field under a more or less extensive system of culture. In contrast, to these crops, “**Horticultural Crops**” may be defined as crops which are grown under systems of intensive

culture in relatively small areas. The distinctions, however, does not always hold true, fruits may be grown over large area, and root crops and tobacco require intensive cultivation. Generally, “**Field Crop**”, has the following characteristics:

- 1- It is often grown in large land areas.**
- 2- It depends mainly upon mechanization.**
- 3- Uniform in harvest, such as wheat, barely and maize.**
- 4- Easy to store since the grains/ seeds contain less moisture. Of course, with some exceptions where cotton can be harvested several times.**

### **Patterns of Agriculture:**

Agriculture all over the world can be classified into two patterns as follows:

#### **1- Extensive Agriculture:**

This pattern of agriculture is followed in countries where large land areas can be planted depending mainly upon mechanization. This is found in the United States, Canada, and Argentina. Field crops such as wheat and barley can be grown in these countries, where one farmer assisted by two other people in agriculture business and services produces enough food for over 70 other people. This means that those 70 others can go about providing the vast array of manufactured goods and professional services which we value and drive to make life more comfortable and enjoyable.

#### **2- Intensive Agriculture:**

In this pattern, agriculture depends mainly upon human labor as it is followed in India, China and Egypt. Field crops such as cotton and rice are grown in these countries which need much more tillage operations. Agriculture did not depend totally on mechanization as in the first pattern.

## ***How to increase the agriculture production?***

There are several factors which might be used to increase agriculture production all over the world but we will emphasize on two factors as follows:

### ***Horizontal expansion in agriculture:***

This term means enlarging the area of land under cultivation by different ways of reclamation. It is possible that the area under field crops could be doubled by means of removing forest lands in tropical and subtropical regions. Also, desert lands might be turned to agricultural lands by means of irrigation projects.

Egypt is now intending to invade the desert which was complexly bare by establishing systems of irrigation therein. Tahreer Province, the New Valley, Toshki and other areas are among the main projects for invading the desert. However, the reclamation of the new lands needs high cost and more irrigation water which were considered crucial factors in this process.

### ***Vertical Expansion in Agriculture:***

This term means the increase of the average yield (per acre, per hectare, per feddan) of the area under cultivation by means of improving the agricultural practices used, i.e., the use of fertilizers, improved crop varieties, supplying suitable crop rotations, and other factors. The use of fertilizers was the main and most successful factor that resulted in yield increase in the present time. The use of improved crop varieties can be observed in growing the newly developed hybrid of corn. These new hybrids and varieties doubled the potentiality of corn crop.

Irrigation is also considered as a main factor for increasing food production and doubling yields. Irrigation is a limiting factor in some regions where rainfall does not meet the water requirements for plants. In other regions, irrigation is considered as additional water supply for crops to obtain higher yields.

## Center of Origin and Diversity of field crops

### **Definition:**

The *center of diversity* of a plant is defined as the geographic area wherein the plant exhibits the highest degree of variation. This variation manifests itself both at the population and genetic levels. That is, the center of diversity is where the highest number of cultivated types and wild relatives, as well as gene variants (alleles), exist. Based on the premise that it is only over time that genetic variation can be accumulated, the center of diversity often corresponds to the area where the plant has existed the longest, which is by definition the center of origin.

The *center of origin* of a plant is that location where it **is first appeared in a region**. The primary criterion in identifying a center of origin is the **presence of wild relatives**.

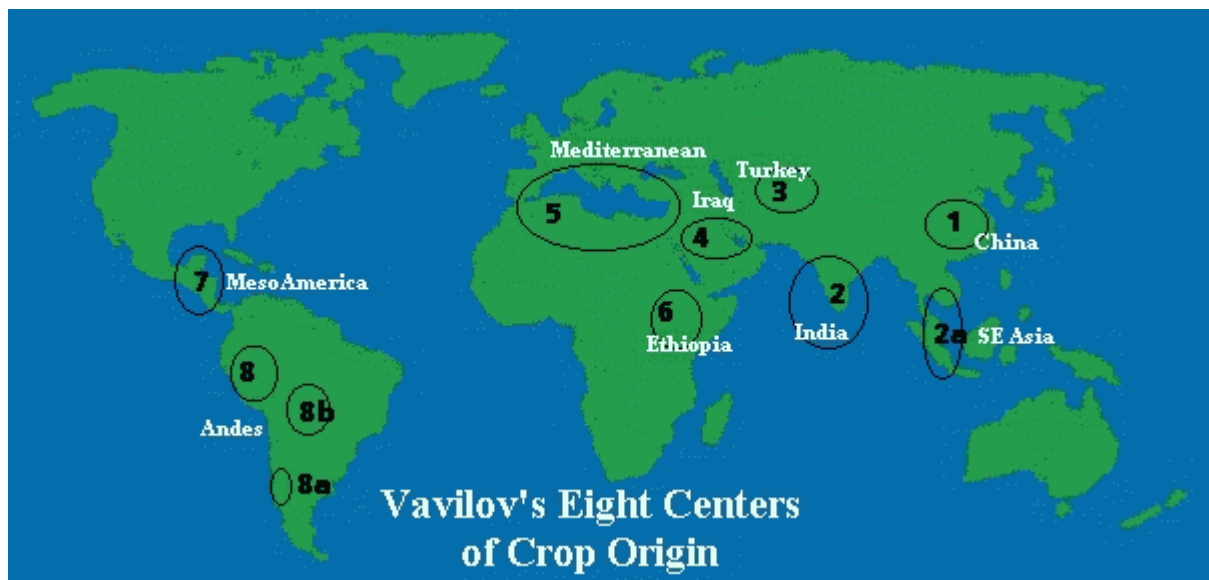
**Nikolai Vavilov**, a Russian scientist, (**Fig. 1**) published his theories in his “**Studies on the Origin of Cultivated Plants**”. He identified eight primary areas of diversity and origin of cultivated plants. These centers for field crops are as follows (**Fig. 2**):

- 1- **The Chinese Center**: for sugar cane, millet, sorghum, six-row barley, soybean and onion.
- 2- **The Indian center**: for sugar cane, Indian cotton, rice, sesame, cowpea, and safflower.
- 3- **The Middle Asia Center**: for bread wheat, rye, peas, lentil, faba bean, linen, and onion.
- 4- **The Inner Asiatic Center**: for durum wheat, bread wheat, two-row barley, lentil, and alfalfa.



**Fig. 1 : N. Vavilov**

- 5- **The Mediterranean Center:** for hard wheat, oats, peas, terms, white clover, and linen.
- 6- **The Ethiopian Center:** for wheat, barley, sorghum, cowpea, sesame, and caster bean,
- 7- **The South Mexican and Central American center:** for maize, upland cotton, potatoes and tomatoes.
- 8- **South America Center:** for potatoes, tomatoes, Egyptian cotton, and peanut.



**Fig. 2: The eight centers of origin of field crops**

Source: <http://oregonstate.edu/instruct/css/330/two/>

### **Why we study center of origin/ diversity?**

The study of centers of origin and diversity is helpful for the following reasons:

- 1- Studying center of origin gives us clear idea about the best environment where the crop can grow and produce maximum yield.
- 2- It represents a rich reserve of genetic material for the improvement of cultivated crops (germplasm).

- 3- It is helpful in designing botanical and cytological studies about different plant species and genera.
- 4- Some plant species can be introduced from the center of origin and planted in new regions which express better adaptability and can be grown as local varieties. This is exactly what happened to corn, soybean and cotton when Egypt introduced them from their center of origin and these three crops grow well under the Egyptian conditions.