

Chapter 2

Field crop classification

It is well known that there are more than 600 cultivated plant species, From which there are about 100- 200 species play important role in the world trade. However, only fifteen plant species represent the most important economic crops. Therefore, these crop species must be classified or grouped in a convenient way to facilitate communication, dissemination and retrieval of scientific information as well as promotes the conservation, and improvement of certain plants. Generally, classification of these species is important for these reasons:

1. To get acquainted with crops.
2. To understand the requirement of soil & water different crops.
3. To know adaptability of crops.
4. To know the growing habit of crops.
5. To understand climatic requirement of different crops.
6. To know the economic produce of the crop plant & its use.
7. To know the growing season of the crop
8. Overall to know the actual condition required to the cultivation of plant.

The grown field crops are classified according to different stand points as follows:

- 1- Botanical classification.
- 2- Agronomic classification
- 3- Special- purpose classification.
- 4- Classification according to life span.
- 5- Classification according to root depth.
- 6- Classification according to growth habit.

7- Classification according to CO₂ fixation.

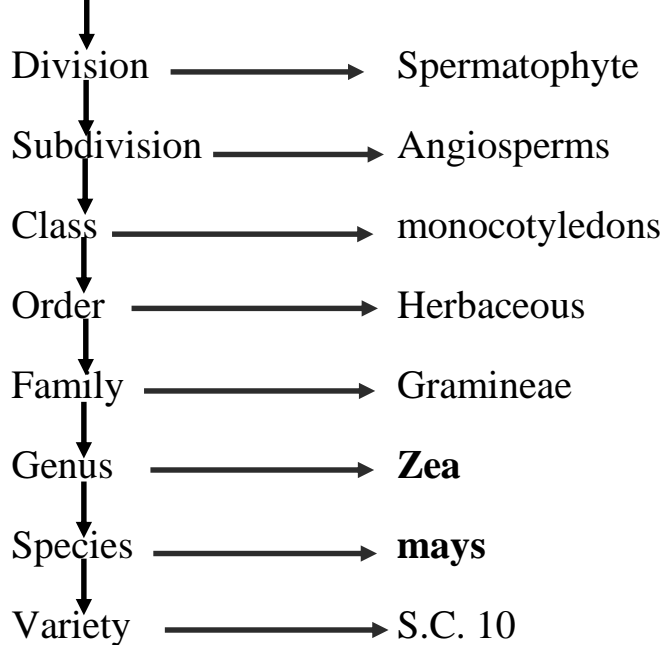
8- Classification according to mode of pollinations.

We will discuss these classifications briefly as follows:

1- Botanical Classification

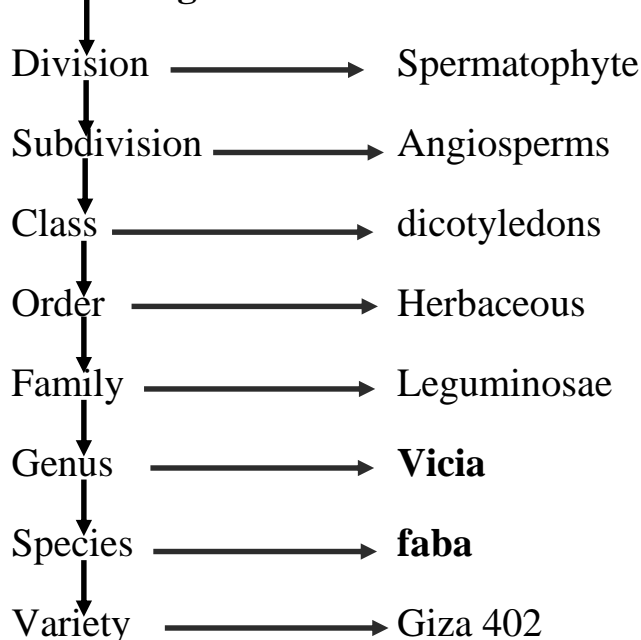
Botanical classification is based upon similarity of plant parts and flower structure. This is the most important way of classification because it determines to what extent the plants are relatives. Field crops belong to the “**spermatophyte**”, or seed plant, division of “**plant kingdom**”, which includes plants reproduced by seeds. Within this division, the common crop plants belong to the subdivision of “**Angiosperm**”, which are characterized by producing seeds with coats (covered seed). The “**angiosperm**”, are then divided into two classes, namely, **monocotyledons** and the **dicotyledons**. All the grasses, which include the cereals and sugar cane are **monocotyledons**. The legumes and other plants except the grasses are classified as **dicotyledons**. Each of these two classes is still further divided into orders, **families, genera, species and varieties**.

For example, maize crop (corn) which is monocotyledons belongs to the order “**herbaceous**”; family “**Gramineae**”; genus **Zea**; species **mays**; varieties; **S.C. 10** as follows:

Plant Kingdom

The scientific name of maize crop is *Zea mays*, L. Single cross (S.C.) 10 is a variety of maize. Note that each crop has distinct scientific name.

Also, field bean crop belongs to the family **leguminosae**: genus: **Vicia**; species: **faba**; variety: **Giza 402** as follows:

Plant Kingdom

The scientific name of field bean is *Vicia faba*, L.

Binomial system

Each crop plant has two names; the genus and the species. The genus starts with capital letter, whereas the species name is small. The name of the man who first gave the accepted name is indicated by a letter or abbreviation. For example, the scientific name of wheat is *Triticum aestivum* L. The letter L. signifies that the Swedish botanist Carl Linnaeus name dit.

Sometimes a crop can be renamed by another scientist. Therefore, the crop name is followed by the initial of the first person (between brackets) followed by the initial of the second scientist as in soybean. The scientific name of this crop is *Glycine max* (L), Merr.

The scientific name must be underlined or italic to be differentiated from any other words.

Crop Plant Families:

According to the botanical classification we can summarize the families of the most important field crops as follows:

1- Monocotyledons:

- **Gramineae:** includes the following crops: wheat, barley, rice, maize, oat, sugar cane, sorghum, rye grass, and sudan grass.
- **Liliaceae:** includes onion and garlic.

2- Dicotyledons:

- **Leguminosae:** includes: field bean, lupine, chick pea, lentil, fenugreek, Egyptian clover, alfalfa, soybean, peanut, grass pea, castor bean, red clover and white clover.
- **Malvaceae:** includes: cotton.
- **Linaceae:** includes: flax.

- **Solanceae**: includes: potato, tomato, and tobacco.
- **Pedaliaceae**: includes: sesame.
- **Composite**: includes: sunflower, and safflower.

Herein, a list with the scientific names for the most important field crops:

Scientific name	English name	الإسم العربى
<i>Triticum aestivum</i> L.	Wheat	القمح
<i>Hordium vulgare</i> L.	Barley	الشعير
<i>Oryza ativa</i> L.	Rice	الأرز
<i>Zea mays</i> L.	Maize, Corn	الذرة الشامية
<i>Sorghum bicolor</i> (L.), Moench	Sorghum	الذرة الرفيعة
<i>Saccharium officinarium</i> L.	Sugar cane	قصب السكر
<i>Pennisetum typhoides</i> L.	Egyptian Millet	الدخن
<i>Avena sativa</i> L.	Oats	الشوفان
<i>Secale cerale</i> L.	Rye	الشيلم
<i>Vicia faba</i> L.	Faba bean	القول البلدى
<i>Trifolium alexandrinum</i> L.	Egyptian Clover	البرسيم المصرى
<i>Medicago sativa</i> L.	Alfalfa	البرسيم الحجازى
<i>Trigonella foenum-groecum</i>	Fenugreek	الحلبة
<i>Vigna sinesis</i> L.	Cow pea	لوبيا العلف
<i>Lathyrus sativus</i> L.	Grass pea	الجلبان
<i>Cicer arietinum</i> L.	Chick peas	الحمص
<i>Lupins termis</i> L.	Egyptian lupin	الترمس
<i>Glycine max</i> (L.), Merr.	Soy bean	فول الصويا
<i>Arachis hypogaea</i> L.	Peanut	القول السودانى
<i>Gossypium barbadense</i> L.	Cotton	القطن
<i>Linum usitissimum</i> L.	Flax	الكتان
<i>Hibiscus cannabinus</i> L.	Hemp	التيل

<i>Corchorus sp.</i>	Jute	الجوت
<i>Agava sisalana Perrive</i>	Sisal	السيزال
<i>Boehmeria nivea L.</i>	Ramie	الرامى
<i>Sesamum indicum L.</i>	Sesame	السمسم
<i>Ricinus communis L.</i>	Caster bean	الخروع
<i>Helianthus annus L.</i>	Sunflower	عباد الشمس
<i>Carthamus tinctorius L.</i>	Safflower	القرطم
<i>Beta vulgaris L.</i>	Sugar beet	بنجر السكر
<i>Beta vulgaris L.</i>	Foder beet	بنجر العلف
<i>Nicottiana tabacum L.</i>	Tobacco	الدخان

It is well known that the most important field crop families belong o two botanical families, the grass family (**gramineae**) and the legume family (**Legumioseae**). Therefore, we have to get an idea about the characteristics of both families.

Characteristics of grass family:

This family includes about three fourths of the cultivated forage crops and all the cereals. They have the following characters:

- They are winter annuals or perennials.
- They are almost herbaceous plants.
- Stems are usually hollow, cylindrical and made up of nodes and internodes.
- Leaves are alternative with parallel veins. The basal portions of the leaf sheath, encloses the stem, the sheath being open on the side opposite the blade. Where the blade of the leaf joins the sheath, there is usually found a peculiar appendage known as the “ligule”.

- The roots are fibrous and new roots are formed each year.
- The flowers are perfect and collected in inflorescence at the top of plant.
- The grain may be free (wheat) or enclosed (oats).

Characteristics of legume family:

- It ranks next in importance to grass family.
- Legumes may be annual, biennial, or perennial.
- The leaves are alternate compound, stipulate, with netted veins.
- The flowers are butterfly- like.
- The fruit in a pod that contains one to several seeds. The seeds are usually without an endosperm, the two cotyledons being thick and full of stored food.
- Legumes have relatively large taproot. The roots bear enlargements called “nodules” caused by the activities of a bacterium *Rhizobium*, which has the ability to fix atmospheric nitrogen in their bodies and eventually in the plant residues. The activity of these organisms accounts for the great agricultural importance of legumes. It is well known that the amount of nitrogen fixed from the air by legume bacteria ranges from 40- 194 pounds per acre for beans and alfalfa, respectively. Legumes must inoculated effectively or they will remove more nitrogen from the soil than nonlegume crop. The strain of nodule bacteria vary in their ability to gather atmospheric nitrogen. It is worth noting that there are seven groups of bacteria strains and it is important to obtain the right kind for each crops (Martin *et al.*, 1976).

2- Agronomic classification

Field crops can be classified according to their economic importance as follows:

- 1- Cereal or grain crops: Cereals are grasses grown for their edible seeds such as wheat, oats, barley, rye, rice, maize, and grain sorghum,
- 2- Legumes of seeds such as faba bean, pea nuts, fenugreek, lupine, cowpea, soybean, chick pea, and lentil.
- 3- Sugar crops: they include sugar beet and sugar cane.
- 4- Oil crops: they include: flax, soybean, peanut, sunflower, safflower, sesame, castor bean and rape.
- 5- Fiber crops: they include cotton. Flax, jute, sisal, and ramie.
- 6- Fodder crops: they include alfalfa, Egyptian clover, sorghum, Sudan grass, grass pea, lablab, Napier grass, millet, white clover, and red clover.
- 7- Rubber crops: including para rubber, Castilla rubber, and guayule.
- 8- Tuber crops: such as potatoes and Jerusalem artichoke.
- 9- Root crops: such as sweet potatoes and sugar beet.
- 10- Medical plants: such as castor bean and others.
- 11- Stimulants such as tobacco, tea and coffee.

3- Special- purpose classification

These classifications are used to refer to plants having special advantages to the farmer himself in relation to his farming practices, and include:

- 1- **Catch or emergency crops:** These crops are used to substitute crops that have failed on account of unfavourable conditions. They are usually quick-growth crops, such as rye, millet and clover. In Egypt. Clover can be grown and one cut can be obtained before planting cotton crop.
- 2- **Cash crop:** any short maturing crop which is grown to generate income while the main crop is still in its vegetative stage of growth; any crop grown to generate cash rather than for subsistence. Some crops may be cash crops one year but not the next, or for one farmer but not another.
- 3- **Cover crops:** these crops are planted to provide a cover for the soil and to prevent erosion such as clover and rye.
- 4- **Green manure crops:** these crops are turned under while still green in order to improve the soil properties and increase organic matter content. Several field crops can be used such as Egyptian clover, lupine and cowpea.
- 5- **Companion crops:** in this case a crop can be intercropped with another one and each crop is harvested separately. For example, onion and garlic can be intercropped with cotton crop, or soybean with maize.
- 6- **Silage crops:** these crops are preserved in a succulent condition by partial fermentation in a tight receptacle. They include corn, sorghum, forage grasses and legumes.

4- Classification according to life span.

All field crops can be divided into three categories according to the length of their life cycle as follows:

- 1- **Annual crops:** plants of this category complete their entire life cycle from seed to seed in a single growing season and then die. Most field crops are considered annual crops such as wheat, barely, rice, maize, sorghum, faba bean, lentil, chick pea, lupine, flax, soybean, sesame, sunflower, safflower, and others.
- 2- **Biennial crops:** these plants complete their life cycle in two seasons. Vegetative growth occurs during the first season resulting in a rosette form but plants don't start flowering (blooming). In the second season, the green plants give flowers and seeds. The crops of this category are onion, sweet clover, and sugar beet. If you expose sugar beet plants, grown in the first year to low temperature they can start blooming and flowering and behaved as annual crops.
- 3- **Perennial crops:** these crops are grown in the soil for more than two years (they can persist for more than two years). They may either produce seed or not every year. In other words, they have an indefinite life period. They do not die after reproduction but continue to grow indefinitely from year to year. Sugar cane, white clover, and alfalfa are examples of perennial crops.

5- Classification according to root depth

It is clear that the root system of field crops differ in structure, function and extent. Therefore, field crops can be classified according to the depth of their roots as follows:

- 1- **Hallow root crops:** the root system of these crops extends in the soil to a depth of one meter such as wheat, barley and rye.
- 2- **Intermediate crops:** the depth of the root system of these crops ranges from 1- 1.5 meter in the case of faba bean and sugar beat.

- 3- **Deep root crops:** the root system of these plants extends in the soil to a depth more than 1.5 meter as in alfalafa.

6- Classification according to growth habit

Determining the best time of planting of any field crop is a very important task. That is because planting date must be in suitable time which ensure the best environmental conditions throughout the growing season of the crop. Crops need optimum levels of light, temperature, moisture and other environmental conditions to grow well and produce the highest productivity. Therefore, when field crops are classified according to growing season this means that the environmental requirements of such crop are prevail in such season. Accordingly, field crops can be classified as follows:

- 1- **Winter crops:** these crops are usually planted in October and November and most of their life cycle occurs in the winter and spring season. They are often harvested on April and May. Examples of these crops are wheat, barley, faba bean, Egyptian clover, fenugreek, lentil, chick pea, lupine, flax, rye grass and grass pea.
- 2- **Summer crops:** these crops are usually planted in the beginning of spring season and most of their life cycle occurs in the summer season. They are often harvested on September. Examples of these crops are maize (corn), rice, grain sorghum, Sudan grass, sweet sorghum, cotton, peanut, sesame, sunflower and soybean.
- 3- **Late summer crops:** in Egypt, there was a late summer season or Nily season where rice and maize are planted late in the summer season. But the planting in late summer season caused great loss in the yield of these crops

as a result of the attack of stem borers and other pests. Therefore, farmers do not plant their crops in that season in the present time.

7- Classification according to Co2 fixation

1. **C3 Plants:** Net assimilation rate in these plants is low (15- 40 mg CO₂/ d²) but compensation point is high (30-70 ppm). Stomata are open during the day. Photo respiration is high in these plants C3 Plants have lower water use efficiency. The initial product of C assimilation is the three 'C' compounds. The enzyme involved in the primary carboxylation is ribulose-1,5-Biophosphate carboxylose. E.g. Rice, soybeans, wheat, barley cottons, potato. C3 plants include more than 95 percent of the plant species on earth. (Trees, for example, are C3 plants.)
2. **C4 plants:** Net assimilation rate in these plants is high (40- 80 mg CO₂/ d²) but compensation point is low (0- 15 ppm). Stomata are open during the day. The primary product of C fixation is four carbon compounds which may be malice acid or acerbic acid. The enzymes responsible for carboxylation are phosphoenol Pyruvic acid carboxylose which has high affinity for CO₂ and capable of assimilation CO₂ event at lower concentration, photorespiration is negligible. These are said to be drought resistant & they are able to grow better even under moisture stress. C4 plants translate photosynthates rapidly. E.g. Sorghum, Maize, sesame etc.
3. **Cam plants:** (CAM stands for Crassulacean Acid Metabolism) the stomata open at night and large amount of CO₂ is fixed as a malice acid which is stored in vacuoles. During day stomata are closed. There is no possibility of CO₂ entry. CO₂ which is stored as malice acid is broken down & released as CO₂. In these plants there is negligible transpiration. C4 & cam plant have

high water use efficiency. These are highly drought resistant. E.g. Pineapple, sisal & agave.

8- Classification according to mode of pollination

- 1. Naturally self-pollinated crops:** - the predominant mode of pollination in these plants is self-pollination in which both pollen and embryo sac are produced in the same floral structure or in different flowers but within the same plant. Examples: rice, most pulses, okra, tobacco, tomato.
- 2. Naturally cross-pollinated crops:** pollen transfer in these plants is from the anther of one flower to the stigma of another flower in a separate plant, although self-pollination may reach 5 percent or more. Examples: corn and many grasses, avocado, grape, mango, many plants with unisexual or imperfect flowers.
- 3. Both self- and cross-pollinated crops:** these plants are largely self-pollinated but varying amounts of cross-pollination occur. Examples: cotton and sorghum.