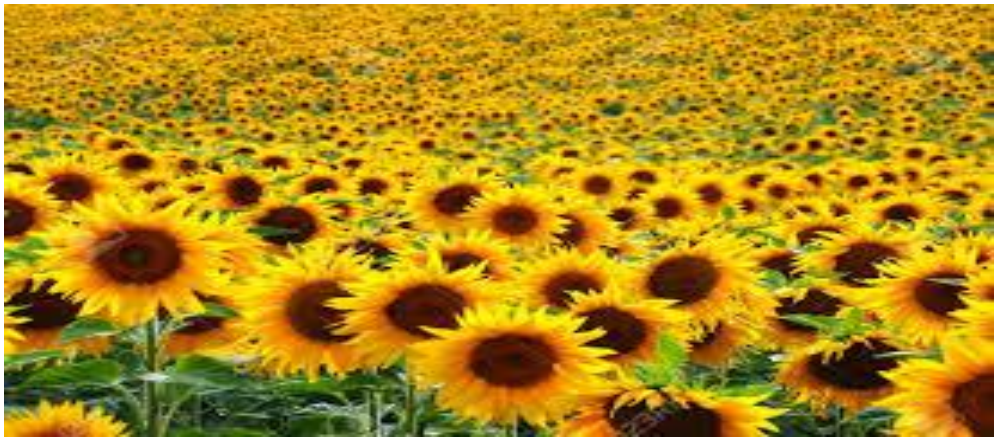
Sunflower

Helianthus annuus L.

Asteraceae

Iodin number(120-136)



Introduction:

Sunflower derived from Greek words (Helios) means sun (Anthos)means flower. Globally, Sunflower production is around 46 million tons, with 26 million ha of production area (FAO, 2016). Global production averaged about (1,200 kg ha^{-1}).

Sunflower oil accounts for 9% of the word plant oil production, the main producers being Russia (20%), Europe (19%), Ukraine (15%), and Argentina (13%).while Russia is the largest producer of Sunflower seed in the world.

Economic Importance

Sunflower plant is planted in the first place to obtain seeds from which the oil is extracted. The oil is used in food, soap manufacturing and dyes used in dyeing leather , it enters in the manufacture of artificial butter and all the pastries. The hay resulted in after oil extraction from seeds is used for cattle feed, which contains 30-35% protein, and may be used as organic manure. While the fresh leaves, the animals feed on them. The rest of the parts is used as fuel. The cellulose necessary for the manufacture of paper is extracted from marrow of the stem. The sunflower fields are used in honeybee production. In addition to the uses previously mentioned, the fields planted sunflower is used for beekeeping. These plants are also considered as ornamental especially in the big gardens. Sunflower plants are used as windbreaks in some cases especially for cotton and vegetables fields.Sunflower has medical properties , Research shows that sunflower oil may reduce both total cholesterol and low-

density lipoprotein (LDL) cholesterol and offer antioxidant proparties. the therapeutic potential of sunflower seeds has been proven medically curative for colds and coughs, as a substitute for quinine, exhibiting anti-malaria efficacy

History of Sunflower Culture

The cultured sunflower is a native of America. It was taken to Spain from Central America before the middle of the 16th century. Its cultivation soon spread into Russia in 1910.

The Canadian Department of Agriculture started sunflower breeding in 1937. Oilseed sunflower has been an economically important crop in the U.S. since 1966 while before 1966, sunflower acreage in the U.S. was devoted primarily to no-noil seed varieties.It was extensively cultivated throughout Kurdistan region

Adaptation

The sunflower is adapted for seed production where corn is successful in the northern two-thirds of the United States. It was formerly grown for silage in cold northern and high-altitude regions where corn does not thrive.

The young plants will withstand considerable freezing until they reach the four to six-leaf stage. The ripening seeds likewise suffer little damage from frost. Between those stages, the plants are more sensitive to frost ,it shows relatively little photoperiodic response.

Nutation or Heliotropism of Sunflower

Sunflower gets both its common and botanical names from the noticeable characteristic of the head that face toward the sun throughout the day. Their heliotropic movement results from a bending of the stem, a process called nutation, which tilts the head to the west in the afternoon. After sunset, the stem gradually straightens until it becomes erect at about midnight.

After that, the stem gradually bends in the opposite direction up to as much as 90 degrees, so that the head faces east by sunrise. Soon afterward, the stem starts to straighten until the head is erect again at noon. The leaves likewise face east in the morning, west in the evening, and upward at noon and midnight. However, at 10 p.m., the leaves are drooping downward. Stripping the leaves from the stalk stops all bending of the stem.

A team of plant biologists say that sunflowers use internal circadian clocks, acting on growth hormones, to follow the sun. Nutation ceases when anthesis (pollen shedding) begins, or shortly after that. Fully 90 percent of the heads are facing east or northeast as they hang at maturity except where strong winds occur. By already facing that direction as the sun rises, that gives the flower a head start on warming up, which will, in turn, attract more pollinating insects, like bees. When researchers compared mature flowers facing east all day to those that turned west, they found that the stationary blooms attracted upwards of five times more pollinators. Growers of tall varieties have taken advantage of this eastward nodding habit by planting the rows north and south. At harvest time, they drive along the east side of each row and cut off the overhanging heads.

Which causes the nutation in sunflower ??

The cells on the plant that are farthest from the light contain a hormone called auxin that reacts when phototropism occurs. This causes the plant to have

Why does the final flower face east?

1.Warming

Warm flowers got more visits from pollinators. (and provide a comfortable hotspot for visiting pollinators).

2. Visibility

If sunflowers face east, then their heads are illuminated by the morning sun. The sunlight on the gold of the flowers simply makes them for striking to insect eyes, attracting pollinators to the newly opened flowers of a plant.

3. Hygiene

It’s not just pollen in the flowerheads, later there will be seeds and with a food source like that, there could also be unwanted visitors. Facing the east means the flower will dry out faster from any dew it gathers overnight, reducing the danger from fungal infection.

4. Cooling

This might seem odd to suggest that the flower could be warmed and cooled, but the sun moves during the day. Afternoons tend to be hotter than mornings and during this higher temperature period an east-facing flower is a facing away from the sun. This means the bulk of the flowerhead is between the sun and the pollen, preventing the sun's rays from striking the pollen when the heat is high.

Sunflower seeds:

Sunflower seeds are the fruits (achenes) of the sunflower. The seeds are 10-15 mm long and 4 mm broad, cylindrical, or drop-shaped. The sunflower seed consists of a hard hull (pericarp) and a kernel, which is the actual seed.

Sunflower Types

Oilseed:

Sunflowers grown for vegetable oil production are usually black-seeded and have a thin hull that adheres to the kernel. The seed of the oilseed varieties contains 38 percent to 50 percent oil and about 20 percent protein. The fatty acid composition of sunflower oil is primarily palmitic acid (5 %), stearic acid (2 %), oleic acid (35 %), and a large portion of linoleic acid (57 %).

Non-oil or Confectionary:

The confectionary type is consumed as whole roasted seed and bird-food market, and is usually white striped and comes in large-seeded varieties. Non-oilseed sunflower generally has a relatively thick hull that remains loosely attached to the kernel, and the seed is larger than that of the oilseed types and has a lower oil percentage and test weight. This type of sunflower represents less than 10% of the total sunflower production.

Note :

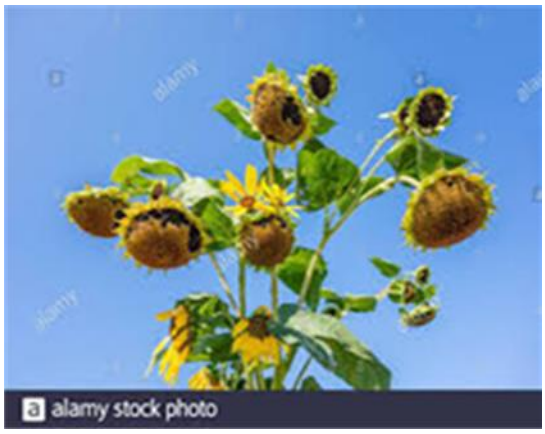
There are semi-dwarf sunflower between 25-35 % shorter than normal, researches show that seed yield and oil content is similar in some year but not always, it seems that dwarf sunflower has early maturity rating

Sunflower Branching

Sunflower branching is an undesirable trait in commercial sunflower production. What causes sunflower branching ???

1-It can be caused by the genetics of a hybrid, 2- environmental influences, and 3- herbicide injury.

Branching of various degrees can occur in sunflower, ranging from a single stem with a large single inflorescence in cultivated types to multiple branching from axils of most leaves on the main stem in the wild species. Branch length varies from a few centimeters to a distance longer than the main stem. Branching may be concentrated at the base or top of the stem or spread throughout the entire plant.



Generally, heads on branches are smaller than heads on the main stem.Occasionally, some first-order branches have a terminal head almost as large as the main head. In most wild species, the head on the main stem blooms first but generally is no larger than those on the branches.

Sunflower oils

Sunflower (*Helianthus annuus L.*) is an important oil crop in the world. Triacylglycerols, the main constituents of sunflower oil, are liquid at room temperature and have a low melting point. It produces high-quality edible oil. The oil extracted from the seeds of sunflowers is known as sunflower oil. It has

a high quantity of vitamin E more than safflower oil or any other oils, which makes it excellent for being used in and cosmetic products. Sunflower oil is a mixture of monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids. 100 g seeds contain 24 g protein , 47.3 fat, 19.4 total carbohydrates, 3.8 g fiber ,considerable Ca , P, Fe, Na, K , Carotene ….etc

Oil properties:

It has a high smoking point, which means that sunflower oil holds onto its nutritional content at higher temperatures, which is probably why this oil is widely used in deep-frying chips, and vegetables and high levels of linoleic acid and absence of linolenic acid .

Besides food, sunflower oil is the main feedstock for the oleochemical and cosmetics industries, for the synthesis of polyester films, modified resins, lacquers, copolymers, plasticizers, etc. Also, the high-oleic acid sunflower variety is used for biodiesel production.

Are sun flower allelopathic??

However, the beautiful bright blooms do hide a nasty secret: sunflowers are allelopathic, that is, they give off toxins (terpenes and various phenolic compounds) from all their parts (roots, leaves, stems, flowers, seeds, etc.) that impede the growth of other plants or even kill them.

allelopathic interactions between crops, whether negative or beneficial, in a crop rotation or mixed cropping system may have direct bearing on the crop.

Environment requirements (Climate):

Temperature :

Sunflower is grown in many semi-arid regions of the world from Argentina to Canada and from central Africa into the Soviet Union . It is tolerant of both low and high temperatures but more tolerant to low temperatures. Sunflower seeds will germinate at 3.9 °C, but temperatures of at least 7.8 °C to 10 °C are required for satisfactory germination. Seeds are not affected by vernalization in the early germination stages. Seedlings in the cotyledon stage have survived temperatures down to -5 °C. At later stages, freezing temperatures may injure the crop. Temperatures less than -2.2 °C are required to kill maturing sunflower plants.

Optimum temperatures for growth are (21.1 to 25.5)°C, but a wider range of temperatures (17.7°C to 32.7°C) show little effect on productivity. Extremely

high temperatures have been shown to lower oil percentage, seed fill, and germination.

Light and water requirement

Sunflower is often classified as insensitive to daylength, and photoperiod seems to be unimportant in choosing a planting date or production area in the temperate regions of North America. Oil from the northern areas tends to be higher in linoleic acid and has a higher ratio of polyunsaturated to saturated fatty acids than oil produced in southern latitudes.

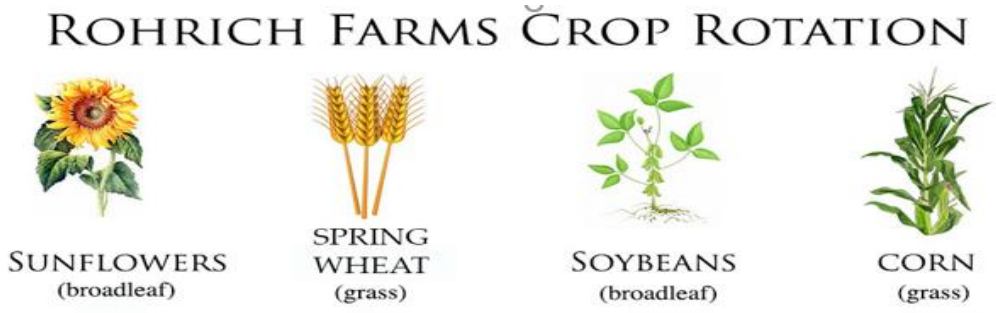
Sunflower is not considered highly drought tolerant but often produces satisfactory results when other crops are damaged during drought. Its extensively branched taproot, penetrating to 1.98m, aids the plant during water stress. A critical time for water stress is the period 20 days before and 20 days after flowering. If stress is likely during this period, irrigation will increase yield, oil percentage, and test weight, but decrease protein percentage.

Suitable soil

Sunflower is grown in different soil types, but it grows well in fertile soil enriched with organic matter, and it does not prefer heavy clay and sandy soils poor in organic matter and salts necessary for the growth and development, besides it does not tolerate acidic soils but it prefers neutral acidity where pH is 6-7.

Crop rotation

Since the crop being of summer crops, then it can be grown after winter legume crops like clover, broad bean or after wheat and barley. Considering sunflower staying in soil for 90-120 days, then it is possible to plant some of summer crops afterwards as well such as maize which is planted in fall or spring, then sunflower planting is followed.



Corn

Sugar Beets

Soy

Sunflower

Rapeseed

Wheat

Barley