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Maize (Corn)

Maize ranks second in Afghanistan. The kernel or seed of maize is rich in starch. Because it contains a low amount of sticky substance or gluten, maize is not suitable for bread-making. From maize kernels, starch, beer, synthetic rubber, oil, medicines, and vitamin E can be extracted.

The stem of maize is used as raw material in the production of paper, cellulose, artificial wood, and insulating materials. The husk or outer layer of maize is used in the production of plastic and glue.

In our beloved country Afghanistan, maize is used in the diet of both humans and animals. However, in developed countries, maize is primarily used for animal feed.

The widespread cultivation of maize in global agriculture is due to two main reasons:

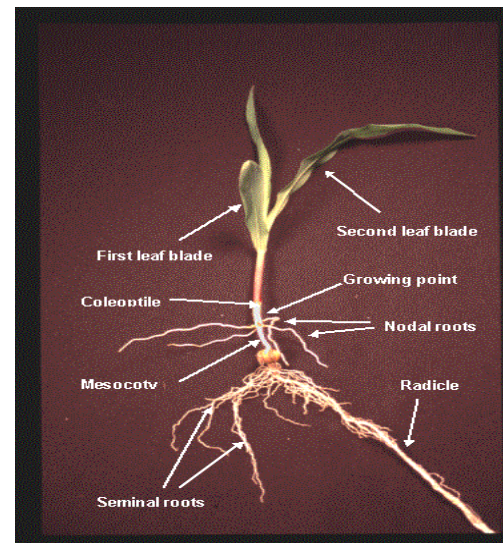
- Maize yields high production.
- It adapts well to all types of soil and climatic conditions.

Botanical Characteristics of Maize:

Maize (corn) is an annual plant that belongs to the *Poaceae* family. It undergoes cross-pollination and is not found in wild form.

Root System:

Maize has a network-like, strong, and fibrous root system with numerous roots. In loose soils, these roots can grow as deep as three meters into the ground, while lateral or secondary roots may spread up to one meter horizontally. During germination, an embryonic root appears. As the plant develops, secondary roots emerge from the underground nodes, with four to six roots typically forming at each node. Above the soil surface, aerial roots develop from the stem nodes. These roots are generally thick, colored, and covered with sticky substances. Aerial roots serve two important functions: they support the plant and help prevent it from lodging, and they assist in transporting nutrients to the upper parts of the plant.



Stem:

The fully mature maize plant has a straight, round, and smooth stem with a diameter ranging from 2 to 7 centimeters. The height of the stem can vary from 60 centimeters to 3 meters. The stem has both nodes and internodes, with each node surrounded by a small leaf. The number of nodes varies among different varieties of maize. The tillers (side shoots) of maize emerge from nodes located below the ground.

Leaves:

Maize leaves are long, narrow, and somewhat smooth. The leaf blade is attached to the stem, and one leaf emerges from each node of the stem. Some maize varieties have leaves covered with fine hair.

Flowering System (Panicle):

Maize produces two types of flowers: the male flower, known as the tassel, and the female flower, known as the ear, which is also commonly referred to as the maize cob. The female organ is located in the middle part of the plant. In maize, around 4–5% self-pollination can occur naturally.

Maize Seed:

The weight of 1,000 kernels in small-seeded maize varieties ranges from 100 to 150 grams, while in large-seeded varieties, it ranges from 300 to 400 grams. On average, a single ear or cob contains approximately 500 to 600 kernels. A maize seed is composed of the embryo, endosperm, and seed coat.

Seed Selection:

- The seed must be purchased from a reliable source.
- The seed should be certified.
- It must be suitable for the region (agro-climatic compatibility).
- It should be free from diseases and pests.
- The seed must have high germination rate, physical purity, and appropriate moisture content.
- Prior to sowing, seeds should be treated with fungicides and insecticides such as Thiram, Vitavax, Benlate, Ceresan, or Confidor. A dosage of 2 grams of treatment per kilogram of seed is sufficient.

Biological Characteristics of Maize:

Maize is a warm-season crop and begins germination at an air temperature of 10–12°C. For uniform germination, it requires a temperature range of 10–19°C, and the seedling emerges from the soil surface within 8–9 days. However, if the temperature reaches 22–24°C, the germination rate significantly increases. Maize growth stops at -3°C, and if the temperature rises to 45–47°C, the plant's growth halts entirely, and it may die. Maize grows best in neutral soils, but it can tolerate a soil pH between 6.5 and 7.5. It is a light-loving, short-day plant, and should not be cultivated in saline or highly acidic soils. Maize performs well in fertile loamy soils and has various types, classified based on maturity:



- Early maturing varieties: mature in about 75 days.
- Medium-maturing varieties: take around 120–130 days to mature.
- Late-maturing varieties: require 130–180 days to reach maturity.

Agrotechnical Practices of Maize Cultivation

Crop Rotation:

Since maize is a heavy feeder and absorbs a large amount of nutrients from the soil, it is important to include it in a crop rotation system.

In crop rotation, maize is usually planted after forage crops, leguminous plants, or row crops. Sometimes, it is also cultivated after rice. In some provinces of Afghanistan, maize is planted after vegetables, where it acts as an effective rotational crop.



Fertilizer Application in Maize:

To produce 100 kilograms of maize grain, the plant absorbs approximately:

- 2.5 to 3 kilograms of nitrogen,
- 1 to 1.2 kilograms of phosphorus, and
- 2.5 to 3 kilograms of potassium from the soil.

The standard fertilizer recommendation (N: P: K) is:

- 150:75:75 kg/ha for varieties, and
- 200:100:100:100 kg/ha for hybrid maize.

Before planting, depending on the soil fertility, around 20 to 30 tons of animal manure can be applied.

Additionally, when the plant reaches the 4 to 6 leaf stage, apply:

- 52.5 kilograms of urea per jerib, and
- 24.5 kilograms of DAP per jerib.

Land Preparation for Planting:

The land allocated for maize cultivation should be plowed in late autumn (fall) to a depth of 28–30 centimeters. In spring, cultivator and harrow operations are carried out to control weeds and prepare the seedbed.

Seed Treatment with Chemicals:

To prevent diseases, the seed should be treated before planting using TMTD (Tetramethylthiuram disulfide), Thiram, or Ceresan at a rate of 1.5 to 2 kilograms per ton of seed.

Sowing of Maize:

Maize can be sown using the following methods:

1. Broadcasting
2. Line Planting
3. Raised Bed Planting
4. Ridge Planting



Broadcasting Method of Sowing Maize

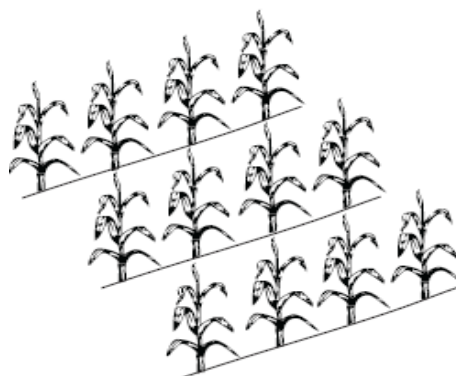
In this method, maize seeds are scattered by hand.

Advantages:

- A large area can be sown in a short time.
- It is simple and does not require special training.

Disadvantages:

- It uses more seeds.
- Seeds are not evenly distributed across the field.
- Germination problems may occur.
- Cost of cultivation increases.



Line Planting Method of Maize:

In spring, maize is planted when the temperature reaches 10–12°C. When using the line planting method, the spacing between rows should be 60 cm, and the spacing between plants within a row should be 20 cm. Two seeds are sown in each planting hole at the required depth.

Row spacing may vary depending on the maize variety. For tall and late-maturing maize varieties, the row spacing should be wider. For short and early maturing varieties, the spacing between rows should be narrower.

In our beloved country, Afghanistan, the standard spacing between maize rows is 60 cm. Unfortunately, many of our farmers are not familiar with the benefits and principles of line planting and continue to sow maize using the traditional hand-broadcasting method.

Advantages of Line Planting:

- Less seed is used.
- Seed is distributed evenly across the field.
- Germination is uniform and appropriate.
- Water reaches all parts of the field evenly.
- Sunlight is distributed evenly throughout the field.
- Fertilizer applications are uniform.
- Pest and disease control is easier.
- Weed control is more manageable.
- In summary, all maize farming activities can be carried out more efficiently with line planting.

Ridge Planting of Maize:

In this method, ridges are formed at a spacing of 60–70 centimeters, and the maize seeds are sown manually at a depth of about 5 centimeters. Chemical fertilizers are applied before planting.

Seed Rate for Cultivation:

The seed rate depends on the region and annual rainfall, but generally, there should be 55,000 to 60,000 plants per hectare, and the number of plants should not be less than 20,000.

If maize is planted using machinery, the seed rate is 15–25 kilograms per hectare (5 jerib). However, in Afghanistan, where farmers mostly use broadcasting, the seed rate is 20–30 kilograms per jerib, due to the inefficiency of manual scattering.

Time of Cultivation:

Maize is generally planted after the wheat harvest.

Seed Depth:

Maize seeds are sown at a depth of 8–10 centimeters. If the soil surface is dry, sowing should be done at a depth of up to 12 centimeters.

Monitoring and Protection After Sowing:

If the soil surface becomes compact after sowing or if weeds are present, the field should be lightly harrowed. This is most effective when done 4–5 days before seedling emergence.

Maize fields should always be loose (well-tilled) and free of weeds. For weed control:

- Manual weeding can be done.
- Herbicides can be applied at the 3–4 leaf stage.
- Additionally, Atrazine and Simazine can be applied before or after planting, but before germination.

Irrigation:

Water deficiency in maize fields causes plant stress and a significant reduction in yield. Studies have shown that on farms where adequate irrigation was provided, yields reached 10 tons per hectare, whereas on farms with insufficient irrigation, the yield was only 3 to 4 tons per hectare.

In our beloved country, Afghanistan, maize is typically irrigated 4 to 5 times during the growing season:

1. First irrigation occurs when the maize plant has developed 4 to 6 leaves.
2. Second irrigation is done when the plant reaches 8 to 10 leaves.
3. Third irrigation is applied during grain formation.
4. Fourth irrigation is given during grain filling.
5. Fifth and any additional irrigations depend on soil conditions and climate, that is, irrigation should be applied as needed.



Harvesting of Maize:

Maize can be harvested using different methods. In our beloved country, Afghanistan, it is mostly harvested manually using traditional sickles or local tools. However, in mechanized agriculture, harvesting is done using tractors or combine harvesters.

The machine commonly used for maize harvesting is called the Chirsonic-7, which can harvest 7 rows at a time and simultaneously separates the kernels from the cob.

Harvesting should take place when the plant moisture content is around 30%. Kernels can be stored along with the cob when the moisture content is 16%. If the kernels are separated from the cob before storage, the moisture content must be reduced to 13% for safe storage.

Maize intended for silage should be harvested during the milk stage of grain development. At this stage, the plant contains high levels of sugar and moisture, which results in high-quality silage.



For animal feed, the maize plant can also be harvested during the flowering stage, allowing animals to be fed directly with the fresh plant material.

Mixed and Successive Cultivation of Maize:

To improve the quality of silage, maize should be cultivated in a mixed cropping system with leguminous crops such as soybean, chickpea, beans, or faba bean. In this method, both crops are sown together and harvested together, which not only enhances the quality of the silage but also plays a significant role in increasing yield and improving soil fertility. In warmer regions, successive planting of maize is also practiced.



Major Diseases of Maize:

1. Brown Stripe Downy Mildew

Cause: *Sclerophthora rayssiae* var. *zeae*

Brown, thick and double lines typically appear on the leaves, stems, and sheaths. This disease spreads rapidly in conditions of humidity, moisture, and warm temperatures.



2. Common Smut (Maize Smut / Head Smut)

Cause: *Ustilago maydis*

Common smut is a widespread disease observed in most maize varieties. The main symptom is the formation of black, swollen masses on the upper parts of the plant, including the tassel, nodes, and grains, as well as on the stem. The disease is encouraged by the presence of moisture and humidity, which creates favorable conditions for its spread.

3. False Head Smut



4. Ustilaginoidea Virens

One of the major diseases of maize affects the upper part of the plant, specifically the male flower (tassel). In this disease, the tassel becomes infected with black lesions, which halt plant growth and reduce yield.

5. Bacterial Stalk Rot

Cause: *Erwinia chrysanthemi* pv. *Zea*

This is also a serious disease of maize. It causes the stem to rot and crack, releasing a dark-colored fluid from the affected areas. The disease spreads quickly from plant to plant, leading to the death of infected plants.



6. Polysora Rust (Maize Rust)

Cause: *Puccinia polysora*

This is a major disease affecting wheat, maize, rice, and other crops. The main symptom is the formation of red lesions on the leaves, which later turn dark brown or black during plant maturity. This disease weakens photosynthesis and reduces yield.



Preventive Measures Against the Above Diseases:

- Selection of disease-free seeds
- Chemical seed treatment before planting:
 - TMTD (*Tetramethylthiuram disulfide*)
 - Thiram
 - Ceresan

(Use 1.5 to 2 kg per ton of seed)
- Timely sowing of seeds
- Destruction of infected plant residues
- Eradication of host plants that may carry disease
- Crop rotation (agronomic rotation)
- Treatment of infected plants using bactericides, fungicides, and nematicides
- Burning of infected crop residues after harvest or collection