



Unit D: Production of Field Crops

Lesson 1: Cereal Crops: Maize

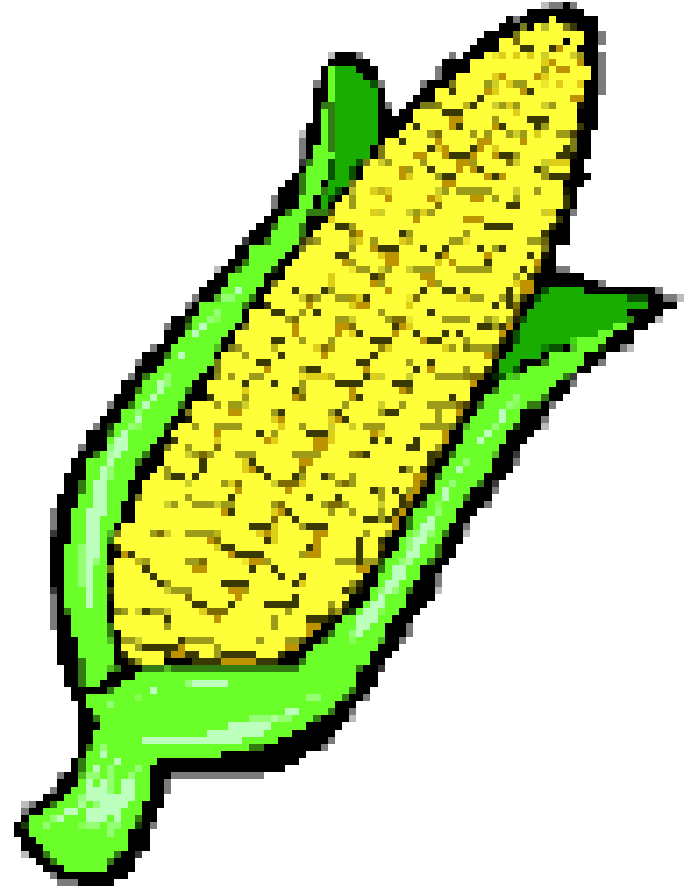


Terms

- Aflatoxin
- Climate
- Crown
- Cultural practices
- Embryo
- Endosperm
- Fertilizer
- Grain
- Grain marketing
- Grain technology
- Growing degree day
- Hilum
- Husk
- Hybrid
- Integrated pest management

Terms

- Kernel
- Palatable
- Plant population
- Prop roots
- Seed coat
- Silk
- Tassel
- Variety



What is maize
and what are its
uses?



I. Maize is one of the most valuable cereal grain crops grown in the world.

- It was domesticated in Mexico around 9000 B.C.
- A ***grain*** is a seed of the cereal grain plant.
- maize, or *Zea mays*, is a versatile crop.
- It is used for both human and animal consumption and its by-products can be used to make numerous non-food products.

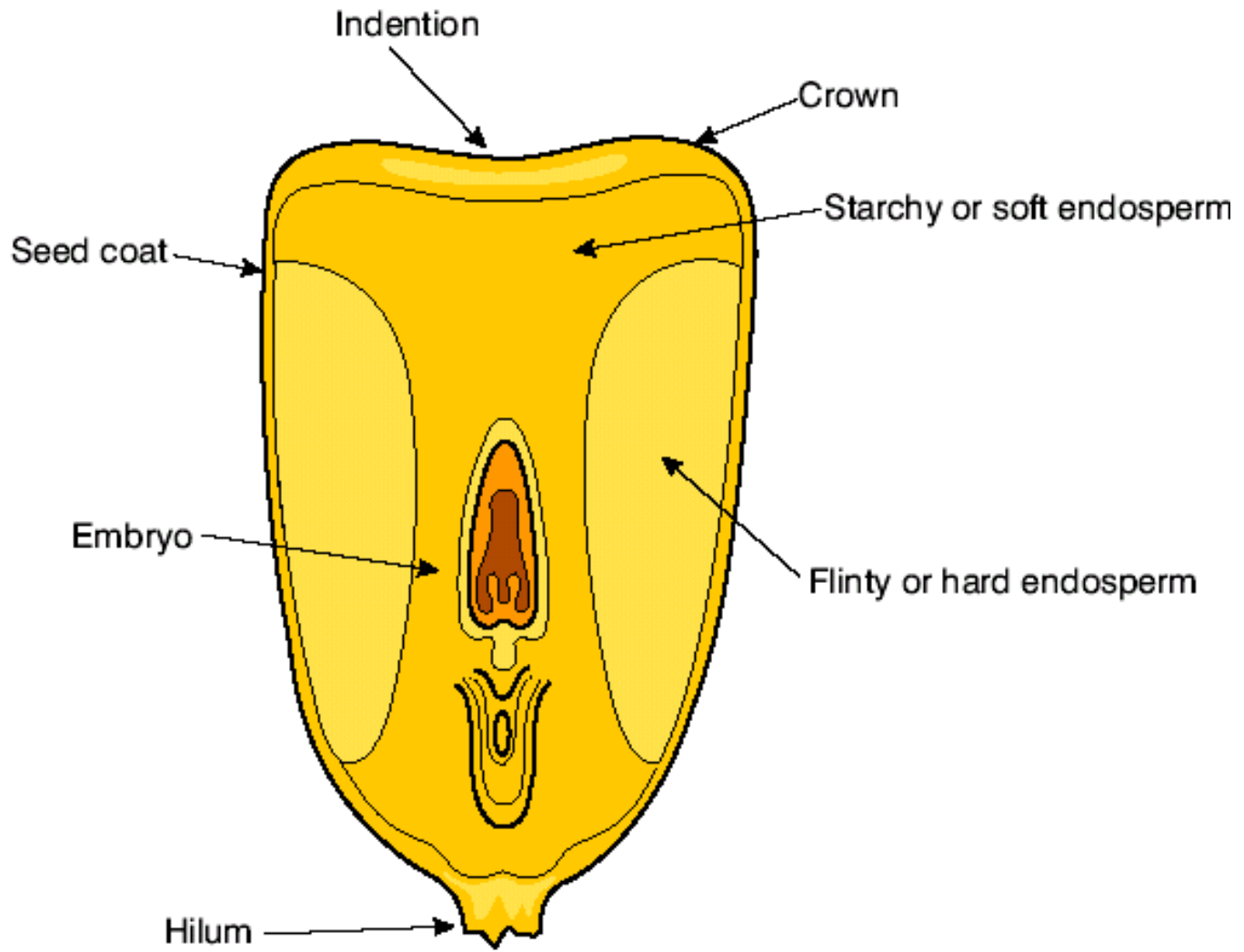
A. As a livestock feed, maize is used for fattening.

- Maize is the most ***palatable***, or good tasting, of the cereal crops.
- Maize can be used in high concentrations in dairy cattle feed and is also used in poultry mash.
- The kernel is high in starch, which is a carbohydrate, and a good source of energy.

B. A *kernel* is the part of the individual grain within the seed coat.

- Maize kernels are enclosed in a seed coat.
- A ***seed coat*** is the outer covering of a seed.
- Inside the seed are the embryo and endosperm.
- An ***embryo*** is an undeveloped seedling.

PARTS OF A CORN KERNEL



C. Maize kernels contain two types of endosperm: starchy and flinty.

- The ***endosperm*** is the food for the seedling inside the seed.
- Starchy endosperm is soft.
- Flinty endosperm is hard.
- The amount of each type determines how the maize can be used.

D. The ends of the maize kernel are referred to as the crown and the hilum.

- The ***crown*** is the outer end of the maize kernel.
- The ***hilum*** is the point of attachment on the seed.

E. Humans are also consumers of maize and maize/corn products.

- Common human food products include corn meal, corn hominy, corn flakes, corn chips, corn starch, corn oil, corn syrup, and corn sugar.
- And don't forget about popcorn!

F. In many countries, a number of by-products can also be made from the maize plant.

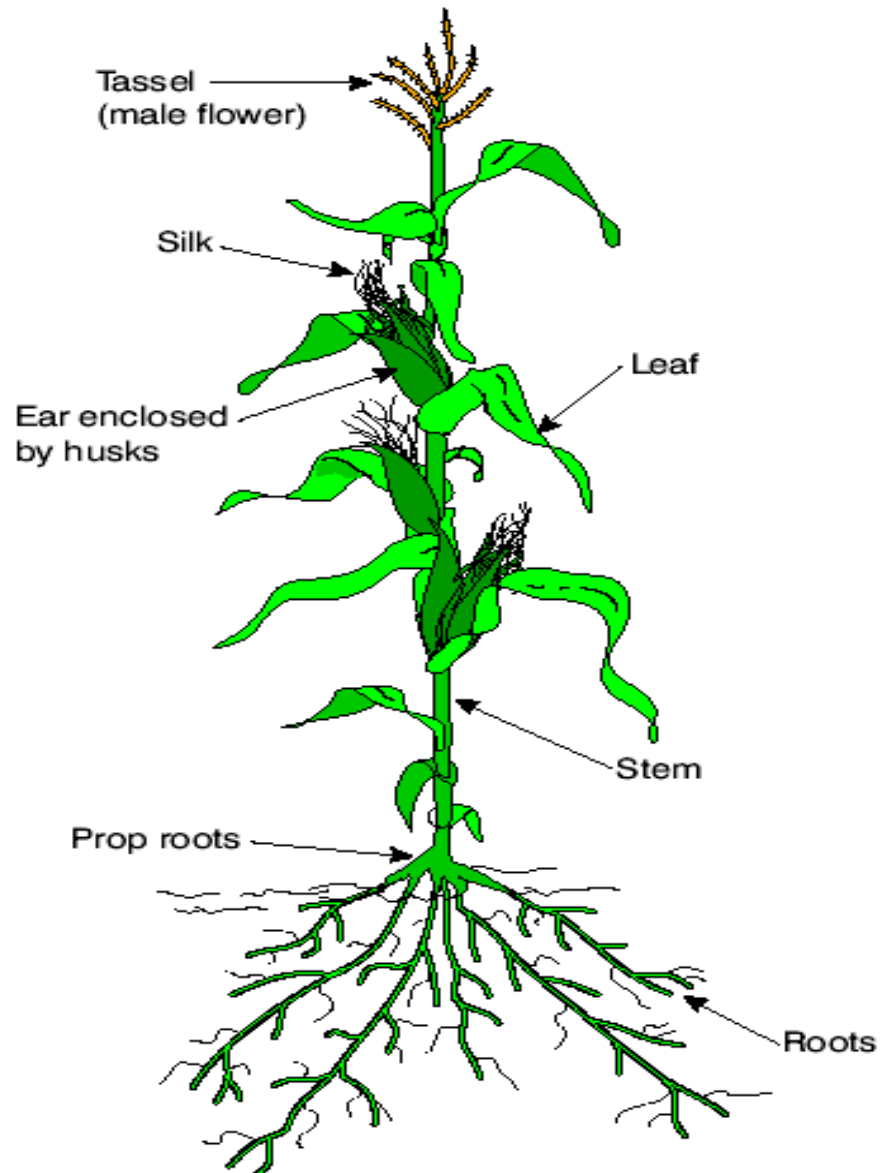
- The stalks can be processed into paper, insulation, and cardboard.
- The cobs can be processed into pipes, methanol, tar, and plastic.
- The cob grit can be used to clean and polish buttons and jewelry.
- maize cob dust can be made into face powder.


G. Cereal grain plants are members of the grass or *Gramineae* family.

- Maize plants have fibrous root systems and are supported by smaller roots called prop roots.
- ***Prop roots*** are above ground roots that aid in keeping plants erect.
- The maize kernels grow on ears that vary in size, shape, and color dependent on variety.

- Maize ears are enclosed in husks.
- A ***husk*** is the leafy, protective covering that surrounds ears of maize on the plant.
- The silk and tassel are the female and male reproductive parts of the maize plant.
- The ***silk*** is the female reproductive part of the maize plant.
- The ***tassel*** is the male reproductive part of the maize plant.

THE GROWING CORN PLANT





What are the
different types of
maize?

What are the different types of maize?

II. There are six common types of maize.

- Maize types are classified based on kernel characteristics.
- These characteristics are amount, quality, and arrangement.

The six most common types of maize are:

1. dent maize
2. flint maize
3. floury maize
4. popcorn
5. sweet maize
6. pod maize.

A. Dent maize

- Dent maize, *Zea mays indentata*, is referred to as field maize.
- The crowns of the kernel are dented, giving the maize its name.
- This denting occurs when the starch at the end of the crown shrinks during drying.

- Dent maize can be yellow, white, or red in color.
- The length of the growing period varies by cultivar.
- Dent corn provides corn starch and other byproducts which can be processed into an assortment of things from biodegradable plastics to fuels.

B. Flint maize, *Zea mays indurata*

- A popular source of maize meal.
- Most cultivars mature fairly quickly, even under poor conditions.
- Flint maize is resistant to many insects and can be shipped overseas because of its kernel hardness.

- This hardness is due to the makeup of the kernel.
- The center is made up of only a small amount of soft starch surrounded by a thick layer of hard starch.
- Flint maize comes in many colors, including: White, yellow, red, and blue.

- When used as a decorative corn, flint corn is sometimes called Indian corn.
- The corn also has food use as well, however, and it is grown on several continents

C. Floury maize, *Zea mays amylacea*

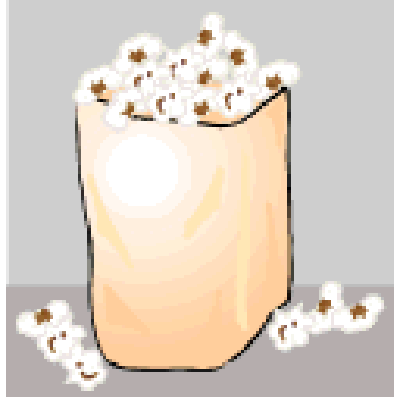
- Also called soft maize.
- Soft maize kernels are made up primarily of soft starch with a thin covering of hard starch.

- The lack of a thick hard starch layer makes this type of maize a good choice for flour production.
- Flint maize comes in several colors, including white and blue.

D. Popcorn, *Zea mays everta*

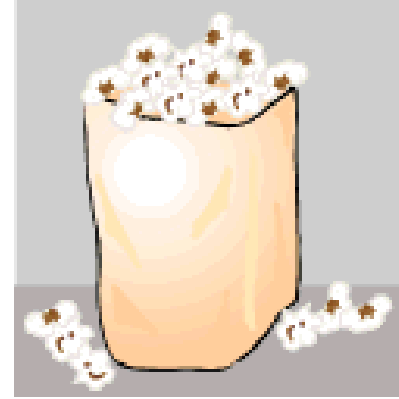
- Cultivars are divided into two classes, pearl and rice.
- This division is based on the shape of the kernel.
- Popcorn kernels are smaller than flint maize kernels and are made up of a hard, flinty starch.

- Some cultivars have a soft starchy center.
- The kernels are usually white or yellow but may be red, blue, or brown.



Popcorn

Zea mays everta



- When popcorn is “popped” the moisture inside the kernel is heated until it becomes steam.
- This causes pressure that causes the kernel to explode.
- The white or yellow flaky material is the starch from inside of the kernel, and is good for human consumption.

E. Sweet maize, *Zea mays saccharata*

- Is most commonly grown for human consumption.
- Sweet maize is picked while still immature to retain the high sugar content.



- Sweet maize kernels are white or yellow and may be wrinkled or become caramelized in color when fully mature.

F. Pod maize, *Zea mays tunicata*

- Has little commercial importance
- Is commonly grown as a specialty item.
- Pod maize kernels are enclosed in a husk or pod and the ear is surrounded by a large husk.

**What soil and climatic
conditions do maize plants
require?**

Soil and Climatic Conditions

III. ***Climate*** is the average weather condition over a long period of time.

- Grain crops, such as maize, require moderate rainfall, frost-free temperatures, warm weather, and sunshine.
- Medium textured soils will also help to provide optimum maize yields.

- A. The variety of maize grown should match the climate of the area.
- The optimum temperatures for maize growth are 21.1 °- 30° Celsius. Adequate rainfall is also important.

- In some parts of the world frost is an issue. Frosts are detrimental to the production of a quality maize crop.
- Early frosts cause damage to the plant by damaging leaves and delaying growth.
- Late season frosts may cause more damage by causing severe leaf injury or death.

- B. Cereal grains require fertile soil for growth.
- Specific nutrient requirements vary by cultivar.
 - Soil pH should be between 5.0 and 8.0.

**What are the cultural
practices of maize
production?**

IV. *Cultural Practices*

- ***Cultural practices*** are the procedures used in producing a crop.
- Cultural practices include selecting a variety, planting, fertilizing, pest control, and harvesting.

- Irrigation is also considered a cultural practice.
- These practices will vary with the crop being produced; they may also vary with the type and variety of the crop.

A. Some parts of the world use hybrid maize.

- A **hybrid** is an offspring from genetically different parents.
- Hybrids are produced through human manipulation.
- 100's of hybrids are available for planting
- A **variety** is a plant cultivar that is cultivated and retains its features when reproduced.

B. A variety should be chosen that matures according to the date of the first local frost.

- Days to maturity range from 50 to 330 days.

C. Besides days to maturity, maize varieties also vary in height and number of ears per stalk.

- Maize plants are commonly 1.8 to 2.4 meters tall but can grow from .6 to 6.1 meters tall.
- On the average, maize plants will produce 1 to 3 ears.

D. If frost is a factor, planting should occur after the danger of frost has passed.

- Soil temperature should be above 10° Celsius at 5 centimeters deep.
- In Afghanistan most people try to plant maize between the middle of April up until the end of June, depending on the region.
- Germination and rapid growth is related to the amount of growing degree days.

E. A *growing degree day (GDD)* is a measure of the temperature requirements for best maize growth.

- The GDD is figured by adding the maximum temperature and the minimum temperature in a day, divided by two, and subtract 10.

- 10 is a constant because maize grows very little at 10° C. The maximum temperature used is 30. This is because temperatures above 30° C do not increase the rate of growth. Temperatures above 30 are counted as 30.

F. Maize should be planted in a prepared seedbed.

- This can be done by working up the land until the soil clods are at a minimum. In some parts of the world, a seedbed can be prepared by plowing with a chisel or moldboard plow followed by a disk harrow or do-all.
- Plowing and disking reduces soil clods and prepares a fine seedbed.

G. Maize is planted in rows 50.8 to 101.6 centimeters apart and 2.5 to 5 centimeters deep.

- Yields per acre increase with narrower rows.
- A planter is used to open the seed drill and place the seed.

H. Planters can be set to achieve a desired plant population.

- ***Plant population*** is the number of plants growing in one hectare.
- Plant populations may range from 24,000 to 32,000 plants per 0.4 hectare.

I. Plant population is easy to calculate.

- First, determine the row width.
- Divide the width in meters into 10,000 (square meters per hectare) to determine the total length of all rows in an hectare.
- Divide the number of plants into the row length to calculate the distance between seed.

J. No-till planting requires different techniques and different equipment than a prepared seedbed.

- Vegetation is cut and often controlled with chemicals.
- Seeds are planted deeper in no-till planting; however, there is less soil covering the seed.

K. A healthy maize plant requires a good fertilizer.

- A ***fertilizer*** is a material added to the soil to provide nutrients to increase plant growth, yield, or nutritional value of the plant.

- L. *Integrated pest management (IPM)* is a pest management strategy that uses a combination of measures to reduce pest damage with the least disruption to the environment.
- Common maize pests include weeds, insects, nematodes, and diseases.
 - Besides IPM, planting resistant varieties can help reduce pest and disease problems.

M. Maize can be harvested by hand

- They will then need to have the husks removed.
- In some parts of the world harvesting corn is done with a picker or a combine.
- Maize harvesting should be timed for maximum yield.
- Harvest dates in Afghanistan can run from anywhere from the beginning of August to the end of October, depending on the region.

Corn Combine



- Grain maize should be harvested at 20 percent to 28 percent moisture.
- Higher moisture maize requires increased artificial drying.
- Maize should be dried to approximately 15.5 percent.
- However, maize in more humid areas may need to be dried to 11 percent.

- The increased drying should help avoid aflatoxin buildup.
- An ***aflatoxin*** is a highly poisonous substance caused by the fungi *Aspergillus flavus* in grain.
- Aflatoxins in animal feed can be deadly.

Review

1. Identify maize and its uses.
2. Identify areas where maize is grown.
3. Describe the different types of maize.

Review

4. Describe the soil and climatic requirements of maize plants.
5. Explain the cultural practices of maize production.