Brief facts

- Maize is widely cultivated cereal grain that was domesticated in Central America. A greater weight of maize is produced each year than any other grain.

- Unlike all other major grain crops, the corn plant has separate male and female flowering parts.
Developmental stages (life cycle)

Life Cycle Stages

The staging system divides corn development into vegetative (V) and reproductive (R) stages. V stages are designated VE (emergence), Vn, where n represents the emerging leaf’s order number, and VT (tasseling). Depending on the hybrid each plant develops 20-21 total leaves, silks about 65 days after emergence, and matures about 125 days after emergence.

● seed stage MeSH
  - dormant seed
  - germinating seed
    embryonic shoot (plumule) and embryonic plant roots (radicle) emerge and grow upwards and downwards respectively; seed should be covered by 1-1 1/2 inches of soil to allow for adequate root system to develop

● vegetative
  - emergence
    stage VE; coleoptile leaf (1st) visible; emergence takes from 6-21 days depending on weather conditions
  - seedling MeSH
    V1 - V4 (1-4 collared leaves are visible); until about 2 weeks after emergence; early whorl stage; functions of seminal roots (roots that grew directly from the seedling) are rapidly taken over by permanent nodal root system, which begins development at each progressively higher node on the stalk (up to 7 to 10 nodes total) and becomes the major supplier of water and nutrients to the plant by the V6
  - first internode elongation
    V5-V6; may lost the coleoptile leaf by this time; plant is approx. 8 inches tall; growing point is just below the ground surface therefore hail and freeze are not
that harmful whereas flood, especially in combination with high temperatures, can be deadly; the first internode (~1/2 inch) elongates just below the node of 5th leaf; this is important reference point for crop growth staging; later, when lower leaves will dry up and fall off, the fifth leaf node can be used as a reference for counting to the top leaf collar

- **ear and tassel initiation**

  V6; **early whorl stage**: 3-4 weeks after emergence; lower leaves (1-4) dry up; tassel formation has been initiated; growing point and tassels are above soil surface (increased vulnerability to freeze and hail); **tillers (ear shoots)** begin developing

- **stem elongation**

  stages V7-V17; **mid-whorl** to **late whorl**: 4-6 weeks after emergence; plant grows rapidly; by V10 new leaf stage occurs every 2-3 days; size of ear and number of potential kernels being established; an ear shoot will develop from every above-ground node, except the last six to eight nodes below the tassel; growth of most lower stalk ears eventually slows, and only the upper one or two shoots develop into a harvestable ear; hybrids that produce more than one harvestable ear are termed **prolific**

- **tassel emergence**

  VT; 7.5-8.5 weeks after emergence; tassel fully emerged and pollen shed begins 2-3 days prior to silking; tassel is usually fully emerged and stretched out before any pollen is shed

- **reproductive**

  - **silking**

    R1; **most critical stage**: approx. 8.5-9 weeks after emergence; silks are visible outside the husks; it takes ~24 h for
pollen grain to grow down the silk and fertilize the egg; generally 2 - 3 days are required for all kernels to be fertilized on a single ear; silks continue to grow 2.5-3.8 cm (1 - 1 1/2 inches each day until fertilized

- ripening

  - blister stage

    R2 stage; about 10-14 days after silking; kernels are white, filled with clear fluid and distinct from surrounding cob; kernels are beginning dry matter accumulation; relocation of nutrients from the leaves and stem to the ear begins

  - milk stage

    R3 stage; about 18-22 days after silking; rapid grain filling period; kernels begin to have yellow colour; inner fluid is milky white

  - dough stage

    R4 stage; about 24-28 days after silking; top of kernel begins to firm up; usually four embryonic leaves have formed by this time; the reduced fluid and increased solids within the kernel at this time produce a doughy consistency

  - dent stage

    R5 stage; about 35-42 days after silking; all kernels are dented or denting; starch layer appears shortly after denting as a line across the kernel when it is viewed from the opposite embryo side

  - 1/2 maturity

    a hard white layer of starch reaches half way down the kernel

- black layer

  R6 stage; plant reached physiological maturity; all kernels on the ear have attained their maximum dry weight or maximum dry matter accumulation; hard starch layer has advanced completely to
the cob now and a black or brown abscission layer has formed

Corn seed anatomy

Maize flowers
Plant Components

Corn plant terminology

- **tassel**
  - inflorescence of male flowers; the tassel consists of several long, indeterminate branches bearing short determinate branches (spikelet pairs) that bear two spikelets (compact auxiliary branches of grass inflorescence that in maize consists of two bracts subtending one reduced male flower)

- **stamen**
  - pollen-producing reproductive organs which are collectively referred as androecium

- **stalk**
  - also filament; the part of the stamen on which anther develops

- **anther**
  - the terminal part of a stamen in which the pollen grains are produced
- **microspore**
  smaller of the two types of spore produced in heterosporous plants; develops in the pollen sac into a male gametophyte

- **male gametophyte**
  microspores divide twice to produce 3 celled pollen grain/tube (a male gametophyte); two of the cells are sperm; other is called **vegetative cell**, or **tube cell**

- **sperm cell**
  two sperm cells are produced; one sperm cell fuses with the **egg** resulting in **zygote**; other sperm cells fuses with **central cell** giving start to development of triploid tissue called **endosperm** which surrounds the embryo and serves an absorptive/nutritive function in seed

- **tube cell**
  haploid cell that comprises two sperm cells and facilitates delivery of the sperm into ovary
ear

inflorescence of **female flowers**; it consists of a single spike with short branches each producing two single-flower spikelets

- **pistil**
  - **style**
    slender part of a pistil, situated between the ovary and the stigma (main part of **silk**)
  - **stigma**
    the receptive apex of the pistil of a flower, on which pollen is deposited at pollination
  - **ovary**
  - **ovule**
    - **megaspore**
      also called **macrospore**; gives rise to **female gametophyte**
    - **female gametophyte**
      also called **megagametophyte** or **embryo sac**; the female gametophyte consists of 7 cells
    - **egg**
      one of small 6 cells, which fuses with the sperm cell giving rise to the plant embryo
    - **central cell**
      large cell, which has 2 haploid, or polar nuclei; it
fuses with the second sperm cell giving rise to triploid tissue called **endosperm**

- **leaf MeSH**
  - leaf blade
  - sheath part of the leaf originating from the node and running parallel to the culm or stem itself
  - ligule a membrane that is located between the culm and the leaf blade

- **seed MeSH**
  - corn seed is also called **kernel** and known botanically as a **caryopsis**
  - pericarp the tissue surrounding a seed that develops from the ovary wall of the flower; in corn is also called **husk, hull**, or **bran**
    - epidermis
    - mesocarp
    - cross cells
    - tube cells
    - seed coat a **testa**; outer coat of a seed
- **endosperm**
  the triploid nutritive tissue formed within the embryo sack of seed plants; the endosperm provides about 83 percent of the kernel weight

- **soft endosperm**
- **horny endosperm**
- **aleurone**
  a granular protein found in the endosperm of many seeds or forming the outermost layer in cereal grains

- **embryo**
  also called a **germ**

- **plumule**
  the rudimentary terminal bud of a plant embryo situated at the end of the hypocotyl, consisting of the epicotyl and of immature leaves (3rd and 4th leaves)

- **epicotyl**
  the stem of a seedling or embryo located between the cotyledons and the first true leaves

- **coleoptile**
  a protective sheath enclosing the shoot tip and embryonic leaves of grasses

- **cotyledon**
  seed leaf (as opposing to the true leaf); also called scutellum

- **hypocotyl**
  the part of the axis of a plant embryo or seedling plant that is below the cotyledons

- **radicle**
embryonic root

- **coleorhiza**
  a protective sheath enclosing the embryonic root of grasses

- **tip cap**
  dead tissue found where the kernel joins the cob

References

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Websites
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- Corn Development and Key Growth Stages