

HOW A CORN PLANT GROWS

Corn plants increase in weight slowly, early in the growing season and quicker as the season progresses and sunlight exposure becomes more intense, increasing the amount of dry matter accumulation. The leaves of the plant are produced first, followed by the leaf sheaths, stalk, husks, ear shank, silks, cob and finally the grain.

Unfavourable growing conditions in early stages of growth may affect the leaves (the photosynthetic factory) or root development, leading to decreased yield potential. In later stages, similar conditions can reduce the number of silks produced, resulting in poor pollination of the ovules, decreasing kernel numbers and size.

IDENTIFYING STAGES OF DEVELOPMENT

There are several methods of counting leaves to determine crop staging. 2 common methods are:

Leaf Tip Method: Count all leaves, including any leaf tip, that have emerged from the whorl at the top of the plant.

Leaf Over Method: Count only fully emerged leaves that are arched over with the next leaf visible in the whorl, but standing straight up.

This manual uses a common staging system which involves dividing plant development into vegetative (V) and reproductive (R) stages.

Vegetative	VE	emergence
	V1, V2, V3, etc	1, 2, 3 leaves fully emerged, leaf collar visible
	VT	tasseling, final vegetative stage
Reproductive	R1	silking
	R2	blister
	R3	milk
	R4	dough
	R5	dent
	R6	physiological maturity

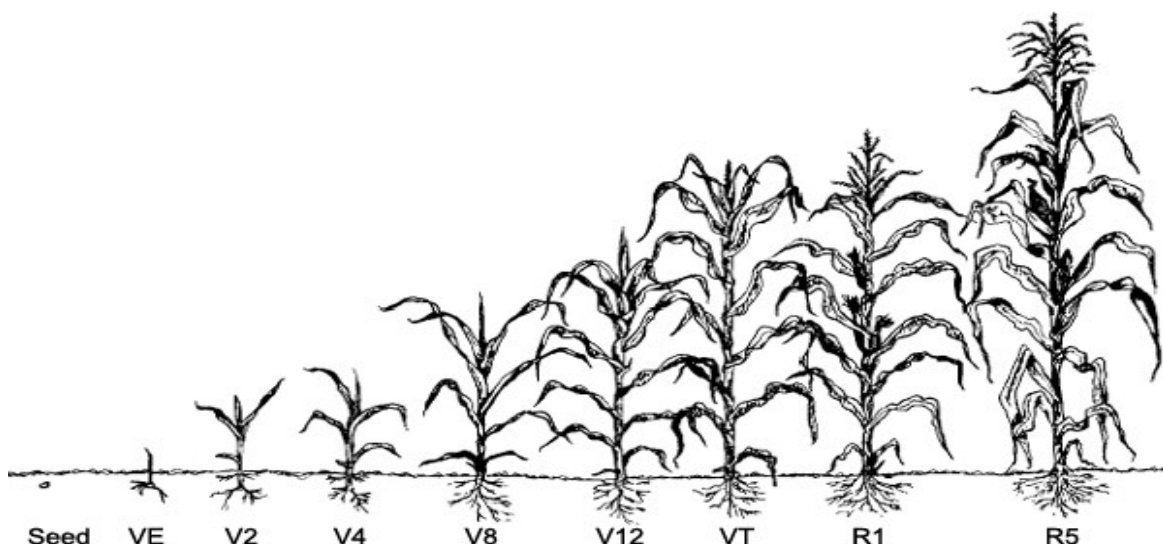


FIGURE 4. Corn growth stages. Provided by Iowa State University

VEGETATIVE DEVELOPMENT (VE-VT)

Germination and Seedling Development (VE), key points:

- 10°C soil temperature to germinate
 - 3-5 days to germinate under optimal conditions
 - You should see the corn twice in the first week: Once at planting, and again at emergence (~7 d to emergence)
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Early Vegetative Development:

1-4 Leaf Stage (V1 – V4)

- Growing point still remains below soil surface for the first 3-4 weeks after emergence, which is where the leaves are produced \implies early frost will damage only the leaves and the plant will recover since the growing point is not damaged. All of the leaves and ear shoots that the plant will produce are starting to be formed at this stage.
 - Once the seedling is established, the first set of nodal roots begin elongation from the first node. The nodal root system is the major supplier of water and nutrients.
 - Fertilizer is needed in relatively small amounts at this stage. Fertilizer applications in amounts adequate to supply those nutrients that are deficient in the soil will be beneficial at this stage. The most effective use of fertilizer is band-placement as roots are not attracted to this band so the fertilizer must be placed where the roots will be.
 - First in-crop herbicide application can be made as early as the V1 stage, when the first leaf collar is visible. Evaluate weed populations \implies there is no need to make a herbicide application before it is needed.
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Mid Vegetative Development

5-8 Leaf Stage (V5 – V8)

All the leaves are formed by the time the seedling reaches the 5 to 6-leaf stage. The number of leaves produced depends on the hybrid.

At approximately V6, the growing point and tassel are above soil surface, stalk is elongating, and the ear shoots and tillers may be visible here also, though tillers may never fully develop.

Ears can be initiated at several nodes along the growing point, but only the upper one or two ear shoots develop into harvestable cobs.

V8 is when ear size is determined and the number of ovules that will produce silks. Losses at this time cannot be completely compensated for by good growing conditions later on. Adverse growing conditions, such as drought, nutrient deficiency, flooding, herbicide damage, or very high temperatures can limit the number of ovules formed.

At V8, the roots will have reached the middle of the corn rows, to a depth up to 18", so cultivation would do great damage at this stage.

Removal of all of the unfurled leaves at this stage (frost or hail) may result in 10-20% reduction in final grain yield

Spraying with 2,4-D and/or Banvel (dicamba) may cause the developing stalk to become temporarily brittle, and the stalks can easily be broken at the soil surface.

Late Vegetative Development:

9-12 Leaf Stage (V9 – V12)

- At V9, many ear shoots are now visible, generally 6-8” below tassel. Tassel is developing rapidly and the stalk continues to develop.
- Brace roots begin to emerge and enter the soil. They serve as support and absorb phosphorus and other nutrients from the soil.
- Plant available moisture is critical at this stage because stress conditions can reduce seed set.
- Hail &/or frost will create greatest yield losses at this stage in comparison with previous stages.

TABLE 1. Comparative growth stages using three different leaf-counting methods

Collars Visible	Leaf Tips	Leaf Over
1	3	2
3	5-6	4
4-5	7-8	6
5-6	9-10	8
8	12	10
10	14-15	12

Note: It is important when reading pesticide labels or other information to know which leaf counting method is being referred to.

Tasseling Stage (VT)

- Tasseling begins just prior to silking
- Last vegetative stage of growth; tassel has completely emerged.
- Pollen shed normally begins 2-3 days after the tassel has fully emerged from the whorl, continuing for several days. Pollen will not be released if tassel is too wet or too dry, but will continue again when conditions improve or when more pollen has matured.
- Complete leaf removal via hail at tasseling and/or silking will result in, essentially, complete loss of grain yield because the tassel and all the leaves are exposed.

REPRODUCTIVE AND GRAIN FILLING STAGES (R1 – R6)

Silking Stage (R1) \implies official when any silks are visible outside the husk

- Silks are pollinated within 4 – 10 days after tassel emergence. Each silk is attached to an individual ovule, or potential kernel.
 - Pollen lands on a silk and germinates to produce pollen tube, which must grow down the entire length of the silk before fertilization can occur.
 - Good growing conditions are vital for successful silking and pollination.
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Blister Stage (R2)

- Kernels are white on the outside and resemble a blister in shape.
 - Starch is beginning to accumulate and the kernels are starting a period of rapid dry matter accumulation, lasting 30 – 40 days.
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Milk Stage (R3)

- Kernels are yellow in colour and inner fluid is milky white, due to starch accumulation.
 - Grain filling and dry matter accumulation is still occurring at a rapid rate.
 - Kernel moisture is ~80%.
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Dough Stage (R4)

- Starch accumulation in the endosperm has caused the milky inner fluid to thicken to a paste.
 - Kernels begin to dent.
 - Kernel moisture ~70%.
 - Kernels have accumulated almost half their dry matter weight.
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Dent Stage (R5)

- Milk line will be visible near the top of the kernels.
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Physiological Maturity (R6)

- All kernels have reached their max dry weight \implies noticeable when black layer is visible at the base of the kernel. Occurs when moisture content of grain is 31 – 35%.
- Black layer formation can occur at higher moisture content if kernel development is stopped by frost or disease.
- Not ready for harvest just yet. Desirable moisture content of grain for harvest is about 20-27%.

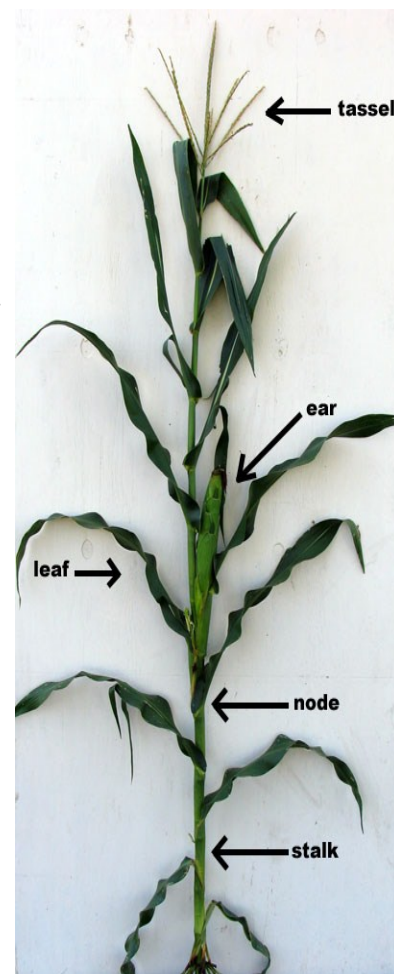


Figure 5. Primary parts of a corn plant. Photo courtesy of University of Nebraska-Lincoln