



# Corn Growth and Development Stages

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## Summary

Corn growth and development are classified into vegetative (V) and reproductive (R) stages. Accurate identification of these stages is essential for optimizing nutrient management, irrigation scheduling, pest control, and yield potential. This manuscript outlines the major corn growth stages and discusses their significance. Special emphasis is placed on the management implications at each developmental phase to promote effective and sustainable corn production. Vegetative stages are designated as V1, V2, V3, etc., based on the number of visible leaf collars. Reproductive stages begin with silking (R1) and continue through physiological maturity.

## Seedling Emergence

### VE Stage (Emergence)

The VE stage occurs when the coleoptile emerges from the soil. At ideal temperatures (50-55 degrees Fahrenheit), emergence typically occurs within 4–5 days after planting. However, in cool or dry soils, emergence may take up to two weeks or longer. The emergence of the coleoptile through the soil surface during the VE stage is shown in Figure 1.



Figure 1. (Image Credit: Bhupinder Singh)

### V1 (First Leaf)

The first round-tipped leaf with a visible collar marks the V1 stage. Nodal roots begin to elongate, although the plant still relies primarily on seed reserves (Figure 1).

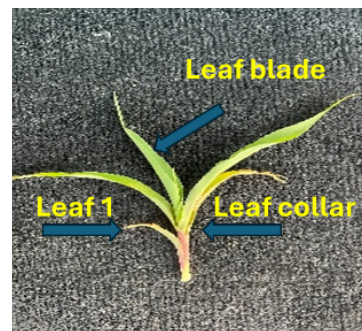


Figure 2. (Image Credit: Bhupinder Singh)

### V2 (Second Leaf)

At V2, the plant reaches a height of approximately 2–4 inches. Additional nodal roots develop, increasing nutrient uptake capacity. The early leaf collar and leaf blade are illustrated in Figure 2.

### V3 (Third Leaf)

Approximately 2–4 weeks after VE, the V3 stage marks a transition to increased photosynthetic activity. The plant becomes less dependent on seed reserves and more reliant on root uptake. Broadleaf and other weeds should be controlled by V4 to prevent early competition.

### V4–V5

Nodal roots are dominant at stage V4. The corn reaches 8–12 inches tall by V5. Importantly, the growing point remains below the surface of the soil, offering some protection from environmental damage (Figure 3).



Figure 3. (Image Credit: Bhupinder Singh)

## V6–V8 (Rapid Structural Development)

**V6:** Beginning 4–6 weeks after emergence, the growing point moves above the soil surface. This increases susceptibility to environmental stress and mechanical damage. The nodal root system becomes dominant, and established nodal roots are established in the lowest, below-ground nodes of the plant. **V7:** Rapid stem elongation begins. The kernel number per row begins to be determined and continues to develop through V15–V16.

**V8:** The plant reaches approximately 24 inches in height and enters a period of accelerated growth.

## V9–V11 (Rapid Growth Phase)

Approximately 6–8 weeks after emergence, corn enters a phase of rapid biomass accumulation.

Key features at V9:

- Tassel structures are developing internally
- Leaves appear every 2–3 days
- Ear shoots continue differentiation

Growth patterns during V10 and V11 are similar to V9, characterized by rapid leaf expansion and stem elongation. The number of potential leaves and ear shoots is genetically determined. Brace roots begin to develop in the lower above-ground nodes of the plants. Rapid vegetative growth and internal tassel development characteristics of this stage (Figure 4).



Figure 4. (Image Credit: Bhupinder Singh)

## V12–V18 (Pre-Tassel Development)

- At V12, the plant exceeds 4 feet in height and requires higher nutrient and water levels. All leaves have reached full size, with about half exposed to sunlight. Corn is highly sensitive to heat and drought stress. Brace roots develop, and kernel number and ear size are still being determined. Insect and hail damage can reduce kernel development. V13-14 Plant continues the same pattern as 12.
- V15, silking is about two weeks away, and the tassel is nearly full size but not yet visible. Moisture or nutrient deficiencies at this stage can reduce kernel numbers per row, leading to shorter ears and lower yield potential. V16, V17, and V18 have similar growth patterns.

## VT (Tasseling Stage)

The VT stage occurs when the tassel is fully visible at the top of the plant. (Figure 5). This stage begins approximately 9–10 weeks after emergence and marks the transition from vegetative to reproductive growth. Successful pollination during this period is critical for converting potential kernels into developing grain. Key characteristics:

- The plant has reached maximum height
- Tassels are fully visible
- Silks will emerge within 2–3 days
- Pollen shed begins and continues for 1–2 weeks



Figure 5. (Image Credit: Bhupinder Singh)

## Reproductive Growth Stages of Corn

### R1 – Silking

- The R1 stage begins when silks emerge from the ear shoot (Figure 6). Each silk represents a potential kernel and must receive pollen for fertilization to succeed. Pollination occurs when pollen grains land on silks and grow down to fertilize ovules.

- This stage is one of the most yield-sensitive periods in corn development. Environmental stress (heat, drought, nutrient deficiency) during R1 can significantly reduce kernel number and overall yield.



Figure 6. (Image Credit: Bhupinder Singh)

## R2 – Blister Stage

Approximately 10–14 days after silking, kernels enter the R2 stage (Figures 7 and 8). Kernels appear white and resemble small blisters filled with clear fluid. Severe stress at this stage may cause kernel abortion. Key features:

- Rapid cell division is occurring
- Ear size is largely determined
- Moisture content is approximately 85%



Figure 7. (Image Credit: Bhupinder Singh)



Figure 8. (Image Credit: Benjamin Pierce)

## R3 –Milk Stage

Around 18–22 days after silking, kernels contain a milky white fluid when squeezed (Figure 8). Water and nutrient stress during this stage can reduce final kernel weight. Key features:

- Kernel moisture is about 80%
- Starch accumulation begins
- Kernel weight increases rapidly

## R4 – Dough Stage

At R4, kernels contain a dough-like consistency as starch continues to accumulate (Ciampitti et al., 2011). Yield losses from stress decline compared to earlier stages, but prolonged drought can still impact kernel fill. Key characteristics:

- Moisture content is approximately 70%
- Kernel dry matter increases rapidly
- Cob color may begin changing

## R5 – Dent Stage

The R5 stage begins when a visible dent forms at the top of each kernel (Nielsen, 2002). The position of the milk line is commonly used to estimate grain maturity and silage harvest timing. Stress during early R5 can still reduce test weight. Important points:

- Kernel moisture ~55–60%
- A “milk line” becomes visible and progresses downward as starch accumulates
- Grain filling continues

## R6 – Physiological Maturity (Black Layer): e

The R6 stage marks physiological maturity (Nleya, et al., 2016). Key characteristics:

- A black layer forms at the base of the kernel
- Kernel dry weight is maximized
- Moisture content typically 30–35%
- No further dry matter accumulation occurs
- Harvest may occur later as the grain dries to the appropriate moisture levels.

## Harvest Timing

- **Grain Harvest** Corn grain is typically harvested when moisture declines to approximately 15–20%. Delayed harvest may increase lodging risk, ear drop, and weather-related losses.
- **Silage Harvest:** Optimal corn silage harvest occurs at 60–70% whole-plant moisture. Milk line approximately  $\frac{1}{2}$  to  $\frac{2}{3}$  down the kernel. Harvesting at the proper milk line ensures maximum digestibility, proper fermentation, and high feed quality

## Conclusion

- Corn growth and development follow a predictable sequence of vegetative (V) and reproductive (R) stages. Accurate identification of these stages allows producers to optimize nutrient management, irrigation scheduling, pest control, and harvest timing.

- Vegetative stages determine structural potential, including leaf number, ear-shoot initiation, and kernel-row establishment. Reproductive stages determine kernel number, kernel weight, and final yield.
- Among reproductive phases, R1 (silking) is the most yield-sensitive stage because it directly influences fertilization and kernel set. Later stages, such as R5 and R6, are critical for determining harvest timing and grain quality.
- Understanding the physiological processes at each stage enables better decision-making, reduced yield risk, and enhanced crop performance.

## References

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