Agronomic Spotlight

Seminis grow forward

Sweet Corn Growth Stages and GDUs

- Corn plants all have the same general growth stages, but the speed of their progression through them can be affected by product and environmental differences.
- Growth stages can be used to help growers make timely applications of fertilizer, herbicides and fungicides.
- Growing degree units (GDUs) represent the daily accumulation of heat needed for corn growth and development and can be used to schedule sweet corn plantings to help plan for a steady harvest.

Corn Growth Stages

Corn plants all have the same general development steps; however, the time between stages and the total number of leaves on a plant can vary. For example, an early-maturing product may produce fewer leaves or develop through growth stages faster then a slower paced late-maturing product. Variation in the time of development may be due to differences in corn products, locations, planting dates, seasons, and environmental stresses.

Germination

Once corn seed is planted, metabolic reactions begin to take place within the seed. The radicle begins to elongate from the seed when adequate moisture is available and soil temperatures are above 50° F. Emergence of the radicle from the seed is called germination, which may occur as quickly as 2 to 3 days after planting. Germination may take several days longer depending on soil temperature, soil moisture, surface residue, and planting depth of the seed.

VE to V8: Emergence and Stand Establishment

When the coleoptile is exposed to sunlight at emergence, elongation of the coleoptile and mesocotyl stop. At this time, the growing point of the plant is approximately 1 to 1.5 inches below the soil surface.

VE Stage - Corn emergence occurs when the coleoptiles reach and break through the soil surface. If cool or dry conditions exist, emergence may be delayed several weeks. At the VE stage, growth is also taking place below the soil surface as the nodal root system begins to grow.

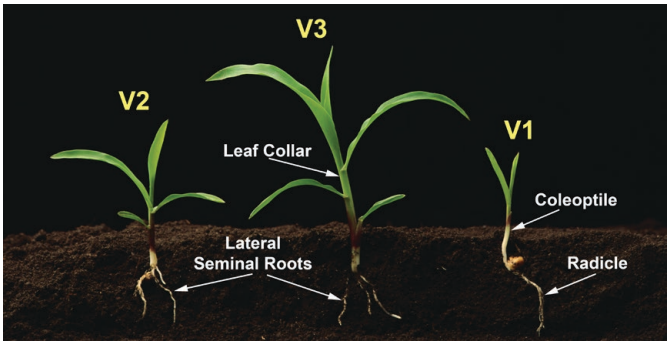

Figure 1. Corn seedlings at V1-V3 growth stages.

Table 1. Sweet corn growth stages.

	Stage	Common Name
Vegetative	VE	Emergence
	V1	First Leaf
	V2	Second Leaf
	V3	Third Leaf
	Vn	Nth Leaf
	VT	Tasseling
Reproductive	R1	Silking
	R2	Blister
	R3	Milk

Adapted From: Abendroth, L.J., Elmore, R.W., Boyer, M.J., and Marlay, S.R. 2011. Corn growth and development. PMR 1009. Iowa State University Extension.

V1 Stage - The V1 stage occurs when the first leaf has fully emerged and the leaf collar is visible. The first leaf to emerge will have a rounded tip; later emerging leaves will have more pointed tips.

V2 Stage - The V2 stage is reached when 2 leaves are fully emerged with collars visible.

V3 Stage - The V3 stage marks the beginning of the photosynthetic process and the end of the seed acting as the primary food source. At the V3 stage, the plant begins to rely on the nodal root system as these roots increase in size and begin to form root hairs. Growth of the seminal root system has stopped.

V5-V6 Stage - During these stages the uppermost ear and tassel is initiated and kernel row numbers are determined. The growing point of the corn plant is near the surface.

V7-V9 Stage - A period of rapid growth begins during these stages. If the corn plant is stressed, lower leaves may die.

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Sweet Corn Growth Stages and GDUs

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V10 to V17: Rapid Growth and Dry Matter Accumulation

During the V10 to V17 growth stages, any management practice that helps reduce plant stress and allows for adequate nutrient levels can help maximize yield potential. The number of kernels per row is determined by V17, or approximately 1 week before silking.

V10 Stage - At V10, ten leaves have formed, the corn stalk elongates, and the tassel rapidly grows during this phase.[2]

V12-V15 Stage - At V12, kernel row determination is almost complete. As the plant nears pollination, soil moisture and nutrient availability becomes increasingly critical for yield determination.

V18 to R1: Pollination

Pollination in sweet corn can begin as early as 45-50 days after corn emergence in early products, and up to 9-10 weeks after emergence in full season products. Moisture and heat stress during pollination can result in barren tips or loss of entire ears, which may cause significant yield reduction.

VT Stage - Tassel stage begins when the last branch of the tassel is visible, but silks have not yet emerged (Figure 2). Tassels normally appear 2-3 days before silk emergence. Pollen shed typically occurs in the morning or evening.

Figure 2. Corn plant at tassel or VT stage.

R1 Stage - Silking stage begins when the silk is visible outside the husk (Figure 3). Pollen falls onto the silks to potentially fertilize the ovules. Each ovule can produce an individual kernel. Moisture stress at this time can cause the desiccation of silks and/or pollen grains, which could reduce seed set.

Figure 3. Corn plant at silking or R1 stage.

R2 to R3: Kernel Fill

During the kernel filling stages, the plant now provides nutrients for reproductive growth rather than vegetative growth. While the number of kernels has already been determined in earlier stages, the size of the kernels is set during fill stages.

R2 Stage - During the blister stage, the kernel is white and shaped like a blister.

R3 Stage - During the milk stage, the kernel is yellow with a white milky inner liquid. Accumulation of sugars is very rapid at this stage.

Sweet corn will be ready for harvest at the R3 stage,

Figure 4. Dry, brown silks at R3.

Figure 5. Kernels at the milky stage, R3.

approximately 18-21 days after the initial emergence of silks depending on environmental conditions. At harvest, silks on the ear should be brown and dry (Figure 4). When a thumbnail is pressed into a kernel, a milky liquid should emerge indicating the crop is ready for harvest (Figure 5). It is very important to harvest quickly at the proper stage because the sugars in sweet corn can rapidly convert to starch, making the corn undesirable.[3]

Corn Growth and GDUs

The daily accumulation of heat needed for corn growth and development is represented by Growing Degree Units (GDUs). Each corn product has a certain number of GDUs needed to reach harvest maturity. GDU tracking can be used to schedule sweet corn plantings to help plan for a steady harvest.[4] Growing degree day accumulation is calculated for each day throughout the growing season, starting the day after planting through harvest. The sum of daily GDUs from planting date is used to determine the accumulated total units for the growing season. The equation used to calculate GDU is:

GDU = ((high °F + low °F)/2) - 50

If the low temperature is below 50° F, use 50° F in the equation. If the high temperature is above 86° F, use 86° F in the equation. Example: High of 95° F, low of 72° F.

GDU = ((86+72)/2) - 50 = 29 GDU.

Sources:

[1] Abendroth, L.J., Elmore, R.W., Boyer, M.J., and Marlay, S.R. 2011. Corn growth and development. PMR 1009. Iowa State University Extension. [2] Neild, R.E. and Newman, J.E.. 1990. Growing season characteristics and requirements in the Corn Belt. National Corn Handbook, Purdue University, Cooperative Extension Service, West Lafayette, IN. [3] Li, C., Boyhan, G., Sumner, P. et al. 2011. Commercial sweet corn production in Georgia. Bulletin 1388. University of Georgia Cooperative Extension. [4] Ashley, R.A. 2012. Scheduling sweet corn plantings. Integrated Pest Management Program, University of Connecticut Cooperative Extension. http://ipm.uconn.edu. Websites verified 5/7/15.

For additional agronomic information, please contact your local seed representative.

Performance may vary from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about sweet corn production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop.