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OHIO SOUTH

What's in This Issue

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Technology Development & Agronomy by MONSANTO

Current News and Updates

Wow, I can't believe the number of acres that Ohio growers planted in 5 days. The planting dates of May 2-6 for Central, Western, and Southern Ohio will be an important diagnostic tool later in the season as we evaluate both corn and soybean stands this year. Yes, there was some early corn planted April 9th, and we will see how that stand turns out as we monitor it through May. As I travel through the countryside, I get a good feel for how many acres are actually planted. My number seems to always be higher than the acres reported by the state reporting agencies and the news media. Nonetheless, growers are organized and equipped to make this process happen lightning fast. Every year corn and soybean planting seems to take fewer days.

Did you know a corn seed needs about 110 GDUs, or heat units, to emerge from the soil? In late April that is about 10-14 days. Once the corn plant accumulates about 350 GDU's, the growing point of the seedling begins to rise above the soil surface and is susceptible to frost injury, mechanical injury, or the elusive 4 legged animal eating the tops out of the plant. That is about 25-30 days from planting.

This issue has some good information on Evaluating Corn Stands, Early Growth and Development for Corn and Soybeans, and Early Season Corn Pests.

Be Safe, until next month, I wish you well.

Jeff Rectenwald

Jeff Rectenwald, Technical Agronomist

Evaluating Early Corn Population

Accurately assessing corn stands is one of the first crop scouting exercises to perform. The 1/1000th acre method is commonly used to evaluate emerged corn seedlings. Count the number of seedlings in a length of row equal to 1/1000th of an acre based on row width (Table 1). Multiply the number of plants by 1,000 to get plants per acre. Repeat this at several locations throughout the field to determine an average. An alternative method is to count 150 plants and measure the distance from start to finish with a measuring wheel. Divide the number of feet traveled into the appropriate factor in Table 1 to determine plant population. Because a longer row length is counted, the samples are more representative and fewer locations are required. This should be done randomly at approximately five locations across a field. Concentration on low population areas should be avoided; however, a measurement or two in these areas should be completed and used to compute the overall field average.

If gaps exist in the stand, try to determine the cause by digging up seeds and nearby soil. Insect larvae, such as seedcorn maggot or wireworm, may have fed on the seed and destroyed the germ. Compacted sidewalls within the seed slot could be preventing the seedling root radicle from becoming established. Crusting, dry soils, disease, fertilizer and herbicide injury are other factors that can inhibit emergence. Knowing the cause can help with management decisions should replanting be a consideration.

Replanting can be a tough decision to make; however, economic gain is needed to justify a replant. New yield potential based on planting date and population should exceed the expected yield potential of the current crop enough to cover replant costs, which include removal of the current crop, new seed, fuel, and pest control.

Sources: Brouder, S. et al. 2007. Corn & Soybean Field Guide. Purdue University; Illinois Agronomy Handbook. University of Illinois; Nielsen, R.L. 2003. Estimating yield and dollar returns from corn replanting (AY-264-W). Agronomy Guide. Purdue University.

Table 1. Population Measurement Methods

Row Width (Inches)	Row Length 1/1000th acre (feet, inches)	Factor for Calculating Population Based on Counting 150 Plants
15	34' 10"	5,227,200
20	26' 2"	3,920,400
22	23' 9"	3,564,000
28	18' 8"	2,800,000
30	17' 5"	2,613,600
36	14' 6"	2,178,000
38	13' 9"	2,063,350

Vegetative Corn Growth and Development

A corn plant requires the accumulation of Growing Degree Units (GDUs) to reach maturity, regardless of the number of calendar days it takes to accumulate them. Long-season hybrids require more GDU's to reach maturity than shorter season hybrids. The relationship of GDU accumulation and corn development along with utilizing the estimated number of days to reach a certain growth stage can help predict when important growth stages will occur. This can help growers make timely applications of herbicides and fungicides.

Calculating GDUs. To calculate GDUs, record the minimum and maximum temperatures for the day. Add them together and divide by two. Next subtract the base threshold of 50° F. Because optimum corn growth takes place between 50° and 86° F, the lowest temperature that can be used in the formula is 50° F, and the highest temperature is 86° F.

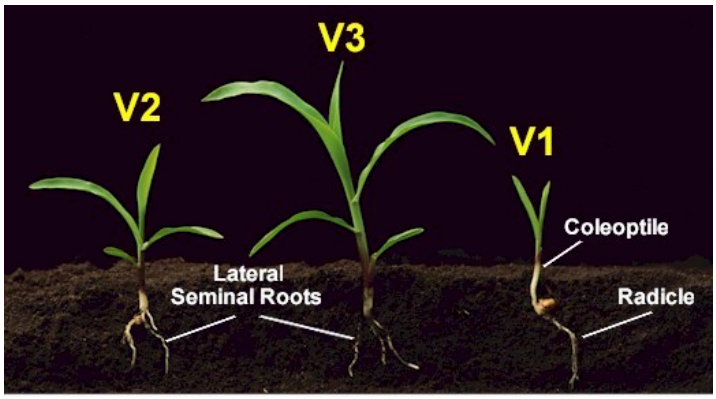

Figure 1. V1 to V3 growth stages of corn.

Emergence and Stand Establishment: (VE - V8)
Establishing a uniform stand is the first step in growing a high yielding corn crop. Figure 1 shows the corn plant from the V1 to V3 growth stages.

As seedlings emerge and begin their growth process, it is important to know what to look for. The first stand assessment is a good time to evaluate tillage and planting systems. This is best done by close observation as opposed to that done from the seat of a pickup truck or tractor. When trying to get a good feel for the true planting conditions of a field, avoid the end rows due to the compaction created by constant traffic. Be sure to get far enough into the field to ensure the planter was moving at normal speed and remember that areas around windbreaks and field edges may not be typical of the rest of the field. Look at both high and low areas to get a feel for the range of conditions.

When doing a stand count (as described in the article on page one) be sure to sample several areas in the field and average them to get a better sample. Before rolling up the measuring tape, make a note on doubles and skips in the sample. Dig where the skips occur to see if a kernel is present and note its condition.

Measure the planting depth by using a trowel to carefully remove a seedling with the roots intact. Locate the mesocotyl which is the area that extends between the seed and the point where the permanent nodal roots are forming. Adding approximately 3/4" to the length of the mesocotyl gives an estimate of the planting depth as seen in Figure 2.

Table 2. Corn vegetative growth stages, estimated GDUs or timeframe that each stage occurs, and description from VE-V6.

Vegetative Growth Stage	GDUs or Timeframe	Description
VE	100 to 130 GDUs	Plants emerge
V1-V2	7 days after emergence	Second leaf develops, about a week after emergence
V3-V5	280 GDUs	Potential number of leaf and ear shoots are determined
V6-V8	400-650 GDUs	Growing point is above the soil surface

Uneven seeding depth exposes deeper planted seeds to slightly cooler seed zones than shallower placed seeds and can lead to uneven emergence. Measure planting depth in several areas and note the range of depths. Take your observations into consideration when planning for future plantings to help ensure your best chance for top end yield potential.

Figure 2. Depth of corn seedling crown relative to soil surface.
(Photo courtesy: R.L. Nielsen, Purdue University)

Sources: Nielsen, R.L. 2010. The emergence process in corn. Corny News Network. Purdue University. Online: http://agry.purdue.edu/ext/corn/ (verified 4/30/13).

Early Season Corn Pests and Diseases

Throughout the year, different insect pests and diseases pose potential threats to corn health and yield potential. Knowledge of when and where to look for particular pests and diseases is an important part of the scouting process. Several pests and diseases are commonly found in corn from emergence through V2.

Early Season Insect Pests. Cool, moist soil conditions favor the development of many soil insects. These conditions can also retard corn growth allowing soil insects a longer time to feed on tender plant tissue.

Seedcorn maggot (*Delia platura*) can be a problem in soils that are high in organic matter (manure, clovers, etc.) as the adult flies are attracted to the material to lay eggs. The yellowish white maggot is about 1/4 inch long when mature and feeds on seed contents.

Several species of white grubs can be a potential problem in corn. True white grubs, the immature stage of May or June Beetles (*Phyllophaga spp.*), can kill seedling plants by feeding on the roots. They have a three year life cycle and may cause stand loss during two of their three years. The masked chafer beetle (*Cyclocephala spp.*) larvae will have finished feeding by the time corn is planted, and the Japanese beetle (*Popillia japonica Newman*) larvae emerge later in the season. Therefore, these insects are usually not a root-feeding problem despite their one-year larval stage. All three grubs are C-shaped, creamy white, and covered with tiny bristles. True white grubs can be identified by the zipper pattern of hairs on the underside of the last tail segment (Figure 3).

Figure 3. Masked chafer beetle grub (left); Japanese beetle grub (center); June or May beetle-true white grub (right).

Wireworm (*Elateridae spp.*) larvae are hard, smooth, slender, and wire-like (Figure 4). The larvae vary from 3/4 (when young) to 1 1/2 inches long when mature and are yellowish-white to coppery colored with three pairs of small, thin legs behind the head. The last body segment is forked or notched. The larvae feed on seed and roots and can bore into the stalk just above the roots killing the growing point. Injured plants may show "dead heart," the death of the center leaves and stem, and may develop non-functional tillers. Damage may be more prominent in corn fields that were previously planted to small grains two to four years prior. As soil temperatures increase, the larvae move lower into the soil profile and become less of a feeding threat.

Figure 4. Wireworm

Black cutworm (*Agrotis ipsilon Hufnagel*) larvae are about 1/8 inch long at hatch and grow to about 2 inches long (Figure 5). Their color ranges from gray to nearly black and their skin consists of convex, rounded, coarse granules with smaller granules interspaced between. Black cutworm larvae feed below ground and sever corn plants from their roots near the soil line. Fields with a lush growth of winter annual weeds provide an attractive egg laying environment for the adult cutworm moths that migrate from southern states.

Figure 5. Black Cutworm

Armyworm larvae vary in color from dark greenish-brown to black. On each side, there are long, pale white, orange, and dark brown stripes along the length of the abdomen. Mature larvae are approximately 1 1/2 inches long. Larvae feed on leaf margins and can consume entire leaves except for the midrib when populations are very large.

Corn flea beetles (*Chaetocnema pulicaria*) are shiny, black beetles that are approximately 1/16 inch long and jump like fleas on a dog. Their feeding on corn leaves creates white streaks on leaves as tissue is scraped away. If populations are extreme, their direct feeding can kill leaves and seedlings. Bacteria that causes Stewart's Wilt can be passed along to the corn plant when the insect is feeding.

Early Season Diseases. Seedling diseases, such as *Pythium* and *Fusarium*, can be common in moist, cool spring soils when emergence and early growth are delayed. Identification of individual diseases may be difficult because of similar symptoms and potential deterioration before diagnosis. *Pythium* infected seedlings tend to become yellow, wilt, and die. *Fusarium* symptoms tend to be tan -to-reddish brown leathery lesions that may cause the root or mesocotyl to shrivel (Figure 6).

Figure 6. *Fusarium* infection in corn

As soil and air temperatures increase, the potential for *Rhizoctonia* infection becomes a greater risk. Seed treatments such as Acceleron® Seed Treatment Products can help protect corn seedlings from *Pythium*, *Fusarium*, and *Rhizoctonia*.

In corn, anthracnose lesions can be found on leaves of very young plants soon after emergence if the fungus has overwintered in the field. Leaf lesions are generally brown, oval to spindle shaped, and 1/4 inch wide by 1/2 inch long. Dark, hair-like structures called setae may be present in the middle of necrotic lesions.

Corn plants may become diseased by common corn smut at any time in the early stages of growth. Wounds caused by insects, hail, or blowing soil/sand can provide fungal growth points for smut. Small smut galls that develop soon after infection become larger and they may cause leaf distortion or they may kill the plant if infection occurs very early at the soil line.

Sources:
Corn & Soybean Field Guide. 2007 Edition. ID-179. Purdue University; White grubs. Field crops IPM. Purdue University. http://extension.entm.purdue.edu (verified 4/30/13); Black cutworm. Field crops IPM. Purdue University. http://extension.entm.purdue.edu (verified 4/30/13); Ohio State University Extension Plant Pathology Factsheets. http://ohioline.osu.edu; and Plant Diseases. University of Illinois Extension. http://ipm.illinois.edu/.

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Early Soybean Growth and Development

When discussing soybean growth and development it is not as easy to use Growing Degree Units (GDUs) to track soybean growth stages. This is because many factors affect the number of GDUs needed to reach a soybean growth stage. Table 3 lists the early growth stages of a soybean plant. Soybean growth stage should be determined when 50% or more of the plants have reached the growth stage in question. Understanding how to distinguish the different soybean growth stages can help predict when growers should make timely applications of herbicides and fungicides.

Vegetative Growth Stages (V(n))

The soybean vegetative growth stages are numbered according to how many fully developed trifoliate leaves are present (Figure 7).

Figure 7. Soybean plant at V1 growth stage.

Beginning Bloom (R1)

During this first reproductive growth stage, at least one flower is located on the plant. Soybean flowering starts on the third to sixth node of the main stem. The initial flowering node depends on the vegetative growth stage when flowering begins. Flowering will continue up and down the main stem and then eventually move to the branches. Each raceme, or group of flowers, will occur from the base to the tip. Consequently, the pods at the base of the plant are usually more mature than those at the tips. The vertical roots are rapidly growing along with secondary roots and root hairs. Stress that occurs during the early reproductive stages can affect growth rate and may have an impact on yield potential.

Table 3. Soybean growth stages and description from VE-R1.

Growth Stage	Description
VE (Emergence)	Cotyledons have been pulled through the soil surface. Takes place from 5 to 21 days after planting
VC (Unrolled unifoliate leaves)	Unifoliate leaves unfold
V1 (First trifoliate)	One set of trifoliate leaves unfold
V(n) (Nth trifoliate)	V stages continue with unfolding of trifoliate leaves - the final number depends on product and environmental conditions
R1 (Beginning bloom)	Plants have at least one flower on any node

Sources: Naeve, S. 2005. Growth and development (Soybean). University of Minnesota Extension. http://www.soybeans.umn.edu; Pedersen, P. 2007. Soybean growth and development. Department of Agronomy. Iowa State University Extension. http://extension.agron.iastate.edu.