Corn Planting Depth

How deep should corn be planted? The rule everyone knows is to plant corn at a depth equivalent to the second knuckle on their index finger. But since everyone's fingers are not the same length, a more precise measurement should be used for this critical decision in corn stand establishment.

Most university extension publications recommend a corn seeding depth of about 1.5 to 2 inches for two important reasons. The first is to achieve good seed-to-soil contact. A corn seed needs to imbibe (absorb) about 30 percent of its weight in water to germinate. To accomplish this dependably throughout the seedbed, the seed needs to be pressed down into the soil where the moisture levels are more consistent in order to immediately germinate. The second reason is to establish a strong nodal root system. Corn nodal root development normally starts about 3/4 inches below the soil line (Figure 1).

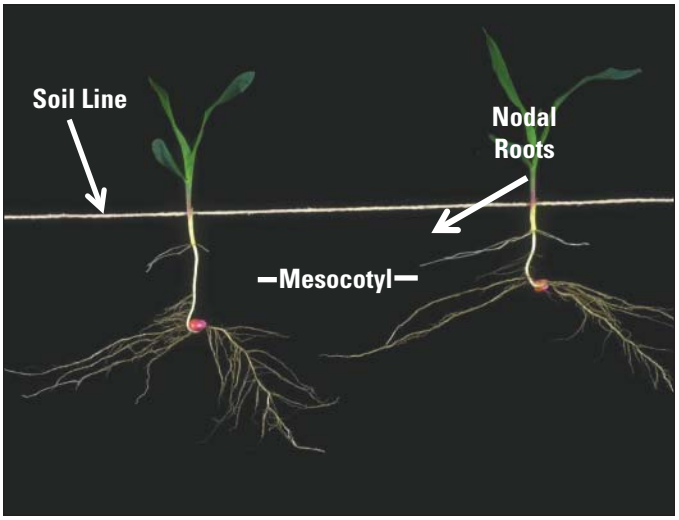


Figure 1. Corn early growth and development.

The nodal root system not only helps support the corn plant structurally, but is also responsible for uptake of the vast majority of the water and nutrients the plant will need through its lifetime. Establishing a good nodal root system is key in reducing the risk of early season root lodging and helping the plant fare better under drought stress.

Figure 2. Early emergence in 2009 Pioneer planting depth study.

Planting at a depth of 1.5 to 2 inches deep ensures that this nodal root system starts growing well below the soil line. Shallow planting, on the other hand, can cause nodal roots to begin development at or even above the soil line.

One theory in favor of shallow planting is that the shallow planted corn will emerge sooner. In 2009, Pioneer researchers conducted a planting depth study in NW Ohio to evaluate this idea. Pioneer® brand 35F44* was planted at approximately 2 inches and 3/4 inches deep in this study. Figure 2 shows those two treatments side by side. Contrary to the theory presented above, it was actually the deeper-planted corn that emerged first, as Figure 3 confirms. In fact, the corn planted 2 inches deep is at stage V1 and the corn planted ¾ inches deep is at VE.

Figure 3. Planting depth measurements of Pioneer 35F44.

A complementary argument to speed of emergence is that the shallow planting is necessary to allow the crop to penetrate the crust that can occur with heavy clay soils. This study was conducted in a once-swampy region of NW Ohio where most soils have high clay content and are poorly drained—representing a perennial challenge to corn emergence. In 2009, in spite of a slight crust on this soil (Figure 4), the Pioneer 35F44 planted 2 inches deep still came up faster than the corn planted 3/4 inches deep.

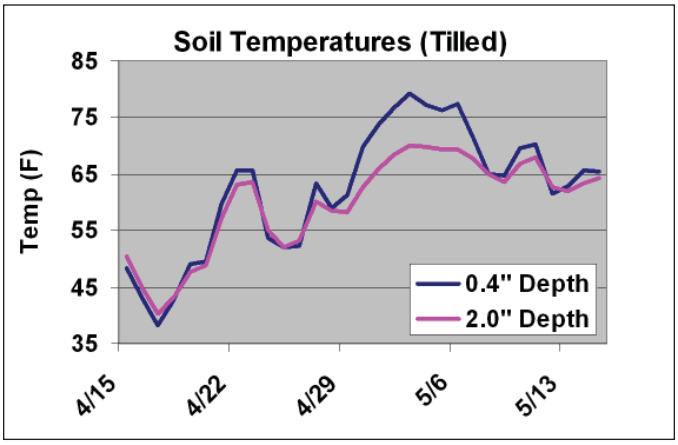
Figure 4. Soil crusting.

So why was there such a difference in speed of emergence? First, soil-seed contact was better at the 2-inch depth, and soil moisture was more stable at this depth. But another consideration is soil temperature – shouldn't the ground be warmer closer to the surface?

Figure 5 shows some detailed soil temperature data to address this point. The charts show average daily soil temperature data collected from a 2001 study designed to evaluate temperature effects on emergence. This study was actually designed to study weed emergence in both tilled and no-till environments, so the shallow depth in this study is even shallower than corn would be planted. Note that in early April when soils are cold, the soil temperatures are almost the same at both the 0.4-inch and the 2-inch depth. In fact, from April 15 to 18, the 2-inch depth was slightly warmer than the 0.4-inch depth. It is not until temperatures became very warm during the first week in May (highs during this week were unseasonably warm - in the upper 70s to mid 80s) that the soil temperatures began to deviate.

Why was there so little difference in temperature between the 0.4-inch and 2-inch depths early in the season? The two main factors are sunlight intensity, which is typically lower during this time of year than later in the season, and the "insulating" factor of soil at the 2-inch depth. So although it is can be true that the soil is warmer at shallower depths, this differential doesn't typically become important until after the corn crop has emerged.

**35F44 contains HXX, LL and RR2 traits.*



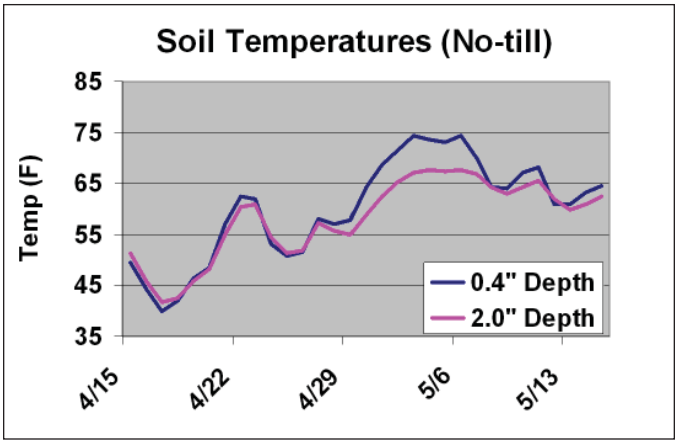


Figure 5. Soil temperature in tilled and no-till environments.