FIELD FACTS

PIONEER
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Corn Planting Depth

How Deep Should Corn be Planted? Everyone knows the answer to this—corn should be planted at the depth equivalent to the second knuckle on your index finger! But since everyone's fingers are not the same size, it's worth spending some time discussing this critical step in getting the corn crop established. Most university extension publications recommend a corn seeding depth of about 1.5 to 2.0 inches. There are 2 important reasons for this recommendation. The first is to achieve good seed-soil contact. Remember, a corn seed needs to imbibe (absorb) about 30% of its weight in water to germinate, so the seed needs to be pressed down into the soil where the moisture levels are more consistent in order to quickly germinate. The second reason is to establish a strong nodal root system. Corn nodal root development normally starts about ¾" below the soil line (Figure 1).

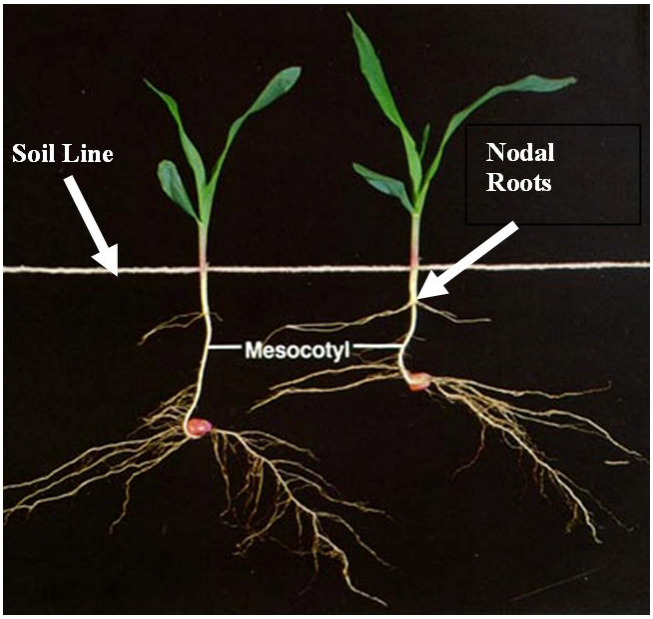

Figure 1: Corn early growth and development.

The nodal root system is responsible for the uptake of the vast majority of the water and nutrients that a corn plant will need through its lifetime. Establishing a good nodal root system is key in reducing the risk of early season root lodging and a well established nodal root system also helps the plant fare better under drought stress. Planting at 1.5-2.0" ensures that this nodal root system starts growing well below the soil line, while shallow planting can cause nodal roots to begin development at or even above the soil line.

That said one of the theories in favor of shallow planting is that the shallow planted corn will emerge more quickly. Figure 2 shows a planting depth study conducted this year in NW Ohio to evaluate this idea. In this study, 35F44 was planted at ~2.0" and ~3/4". The picture below shows those 2 treatments side by side. So which treatment is which? The pictures in Figure 3 should help. The deeper planted corn was out of the ground first! The 2.0" planted corn is at stage V1 while the ¾" planted corn is at VE.

Figure 2: Pioneer Hi-Bred planting depth study.

Figure 3: Planting depth measurements of Pioneer® brand 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 region of NW Ohio once known as the "Great Black Swamp" where the soils tend to have high clay content and are poorly drained—representing a perennial challenge to corn emergence. In 2009, there was a slight crust on this soil (Figure 4), and the Pioneer 35F44 planted at 2.0" still came up faster than the ¾" planted corn.

Figure 4. Soil crusting.

So why was there such a difference in speed of emergence? First, soil-seed contact was better at 2.0" and soil moisture was more stable at this depth. But what soil temperature, shouldn't the ground be warmer closer to the surface?

Let's consider some detailed soil temperature data to address this point. The charts in Figure 5 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 we would plant corn—so shouldn't it be even warmer? Note that in early April when soils are cold, the soil temperatures are almost the same at both the 0.4" and the 2.0" depth. In fact, from April 15-18 in this year, the 2.0" depth was slightly warmer than the 0.4" depth.

It is not until temperatures became very warm during the first week in May (highs during this week were unseasonably warm in this year—upper 70s to mid 80s) that the soil temperatures began to deviate.

Why was there so little difference in temperature between the 0.4" and 2.0" depths early in the season? The two main factors are that sunlight intensity is typically lower during this time of year than later in the season, and that there is an "insulating" factor at the 2.0" depth. So while 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.

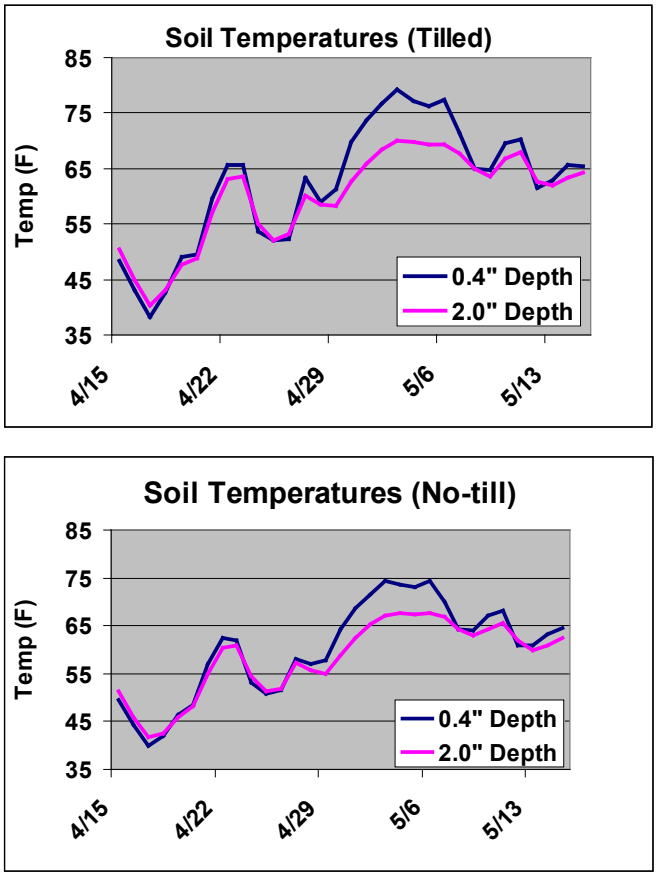

Figure 5. Soil temperature in tilled and no-till environments.