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Cold Temperatures & Injury to Newly Planted Corn

R.L. (Bob) Nielsen
Agronomy Dept., Purdue Univ.
West Lafayette, IN 47907-2054
Email address: rnielsen at purdue.edu

Corn planting progress throughout Indiana in 2014 has been slow to date. As of April 27, USDA-NASS estimated that 8% of Indiana's corn crop had been planted, compared to an average of 26% for the past five years. The primary reasons for the slow start have been wet soil conditions and cool soil temperatures. Where soil moisture was acceptable for planting, some growers accepted (or ignored) the risks associated with cold soils and corn germination or initial seedling development and planted corn. Should they be concerned about the health of their newly planted and, in a few cases, newly emerged crops? Well, we'll know for certain come harvest time. But in the mean time, we can talk about possibilities.

Newly Planted Corn

One of the risks that newly planted corn faces is that of **imbibitional chilling injury** due to cold soil temperatures during the initial 24 to 36 hours after seeding when the kernels imbibe water and begin the germination process. In response to the imbibition of water, kernels naturally swell or expand. If the cell tissues of the kernel are too cold, they become less elastic and may rupture during the swelling process. Some sources indicate that the injury is not so much due to literal cell membrane rupture, but rather to the failure of embryonic cell membranes to reorganize their structure from a dry and somewhat "leaky" state to a rehydrated and less permeable state during the initial period following imbibition. Regardless of the cause, the symptoms of imbibitional chilling injury include swollen kernels that swell but fail to exhibit further signs of germination or arrested growth of the radicle root and/or coleoptile following the initiation of the germination process.

> It is not clear how low soil temperatures need to be for imbibitional chilling or subsequent chilling injury to occur. Some sources simply implicate temperatures less than 50F (10C). Others suggest the threshold soil temperature is 41F (5C). Daily minimum soil temperatures at the 4-inch depth (typical depth for National Weather Service measurements) have been in the mid- to high 40's F around the state in the past week or so, especially in the northern third of the state. Elsewhere, daily minimum soil temperatures have ranged from the low 50's to the low 60's; probably warm enough NOT to cause imbibitional chilling injury to corn.

Instances of **non-imbibitional chilling injury** following germination during the emergence process

can also occur, often causing stunting or death of the seminal root system, deformed elongation of the mesocotyl (the so-called "corkscrew" symptom) and either delayed emergence or complete failure of emergence (i.e., leafing out underground). This type of chilling injury is more closely related to physical damage to the outer cell tissues that literally cause death of the plant part or inhibit further elongation of the affected area. Thus, chilling injury to only part of the circumference of the mesocotyl results in the "corkscrew" symptom as the undamaged sections of the mesocotyl continue to elongate.

Newly Emerged Corn

Damage from exposure of above-ground plant tissue to frost can range from minor leaf injury to complete death of all exposed leaf tissue. That's the bad news. The good news is that the all-important growing point region of a young corn plant remains below the soil surface, safe from exposure to frost, until the V4 to V6 stages of development. That means that the above-ground plant tissue you see in fields younger than about V4 is composed primarily of leaves and rolled up leaf tissue in the whorl, but does not include stalk tissue or the growing point. As long as temperatures are not lethally cold, "simple" frost injury usually does not literally kill such young corn plants. Damaged plants will begin to show recovery from the whorl within 5 to 7 days, depending on temperatures following the frost event.

> Disclaimer: Repeated frost events that re-inflict damage to recovering corn plants can cause permanent stunting or death.

When folks worry about the effects of cold weather on corn, they often fail to distinguish between simple frost events and lethal cold temperatures. Frost can occur at temperatures easily up to the high 30's F, but lethal cold temperatures for corn are generally thought to be 28F (-2C) or colder. With little to none of the 2014 corn crop emerged to date plus the near absence of such low temperatures in the past week or so, I doubt that any above-ground injury to "early" planted corn has yet occurred.

Bottom Line

Only time will tell whether corn planted during the past couple of weeks has suffered from the cool soils during germination. Obviously, those "early" planted fields should be scouted over the next few weeks for emergence problems. Come October, we will know for certain whether this year's early planting risk takers will have "won the game" or not.

Related Reading

Kruger, Greg, Jim Specht, Roger Elmore, Jenny Rees, and Tom Hoegemeyer. 2014. Factors Influencing Cold Stress in Corn and Soybean. CropWatch, Univ of Nebraska Extension. http://goo.gl/Ya0owU [URL accessed Apr 2014].

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