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## Did the recent cold weather affect corn germination and seedling growth?

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# Did the recent cold weather affect corn germination and seedling growth?

## **Abstract**

Frost and soil temperature swings after planting are two factors that can place corn under significant stress. The amount of stress experienced will vary based on whether the corn seed has imbibed (absorbed) water, started growth but not yet emerged, or if the seedling has emerged above the soil surface. Variable soil temperatures have little effect on the first phase of corn germination, water imbibition. Seed will absorb about 30 percent of its weight in water. The time required for radical emergence is directly related to temperature; it increases linearly if soil temperatures are between 46 and 90 °F.

## **Keywords**

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# INTEGRATED CROP MANAGEMENT

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## Crop Production

### Did the recent cold weather affect corn germination and seedling growth?

by Roger Elmore, Mike Owen, and Lori Abendroth, Department of Agronomy

**F**rost and soil temperature swings after planting are two factors that can place corn under significant stress. The amount of stress experienced will vary based on whether the corn seed has imbibed (absorbed) water, started growth but not yet emerged, or if the seedling has emerged above the soil surface.

Variable soil temperatures have little effect on the first phase of corn germination, water imbibition. Seed will absorb about 30 percent of its weight in water. The time required for radical emergence is directly related to temperature; it increases linearly if soil temperatures are between 46 and 90 °F. Little, if any, mesocotyl or coleoptile growth occurs in soils cooler than 60 °F (Figure 1). A constant soil temperature of 86 °F optimizes seed germination and seedling emergence.

Wide swings in soil temperatures (soil high temperature–soil low temperature = 27 °F) will particularly affect mesocotyl growth based on research reported in the *Rhodesian J. of Agric. Research*, (Buckle and Grant, 1974, 12:149–161). We suspect that in some Iowa locations corn experienced this range if it was planted in early April. Seedlings adversely affected by wide swings in soil temperatures will have stunted and distorted leaves and may or may not emerge from the soil (Figure 2).

On the other hand, emerged corn seedlings are relatively resistant to cold weather. Air temperatures near 30 °F may kill or damage exposed above-ground

parts, but the growing point of the seedlings remains below the soil surface until approximately the V6 stage of development (six collared leaves visible). Recovery from a moderate freeze is usually rapid and nearly complete when the growing point

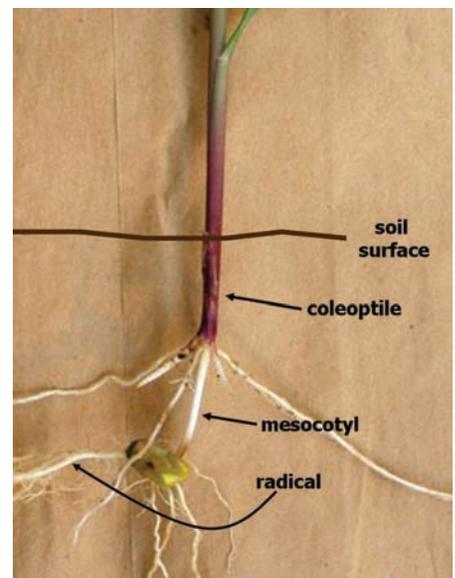


Figure 1. Corn seedling, 2006. (Lori Abendroth)

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is below ground. Frost injury on very young corn plants surprisingly has very little effect on yield if the plants survive the frost (Figure 3).

When poor growing weather follows an early season frost, corn seedlings may occasionally die. Check for rot by splitting the seedling and looking for dark, water-soaked tissue. In the event that young corn plants are damaged by early season frost, a hasty decision to replant would be ill advised. Wait a few days to see if growth resumes. If the growing point is not damaged, a new leaf should emerge in 3 to 4 days. If this does not occur, refer to the Iowa State University Extension publication, *Corn Planting Guide*, PM 1885, for replant decisions.

You should be able to identify seedling stress caused by environmental versus herbicide influences. There are instances, though, when the two are interrelated. We know that corn seedlings weakened from cold weather will have a heightened sensitivity to herbicide injury. Postemergence herbicide applications should be evaluated carefully until corn begins to demonstrate “normal” growth and development. If weeds are small and growing slowly, there is likely sufficient time to allow delayed application timing. However, if weed pressure is high, and if weeds are large relative to the optimum size for control, growers should consider the risks of crop injury and the benefits of weed control before making a herbicide application. Often, the benefits of early weed control, thus protecting potential corn yields, outweigh the risks of herbicide injury to a previously stressed crop.

Growth regulator herbicides such as 2,4-D and dicamba are of particular concern. If these herbicides are applied in combination with other translocated herbicides, such as sulfonylureas that require surfactants or crop oils, the potential for injury increases significantly. Contact herbicides such as bromoxynil also may have a higher risk of significant corn injury if applied to stressed seedling plants.

If weeds are small, rotary hoeing or careful cultivation may be a better management option than a postemergence herbicide application. Each field must be evaluated to determine the best weed control strategy.

We do not expect to see large areas of damaged corn from the recent cool temperatures. Be aware, though, that the frost and variability in soil temperatures may have caused some seedling damage and variability in emergence. It is possible that you will not notice anything abnormal unless you go into your fields and dig several plants.



**Figure 2. Seedlings affected by fluctuating soil temperatures, 1989. (Garren Benson)**



**Figure 3. Seedlings affected by frost showing tied-up and off-color leaves, April 2006. (John Kenniker)**

This updated version is based on “Cold weather stresses corn; herbicide injury possible” (5/26/1997), *ICM Newsletter*, Iowa State University Extension.

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