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Imbibitional Chilling and Frost Damage to Corn and Soybean Seedlings

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Abstract

Freezing and near-freezing temperatures have afflicted western and northern Iowa this week. There have been reports of frost damage to both corn and soybean seedlings, although most of Iowa's corn is at the second vegetative growth stage or less and most of the soybean has not emerged yet. Imbibitional chilling is still a concern for seeds that have not germinated.

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Imbibitional Chilling and Frost Damage to Corn and Soybean Seedlings

By Mark Licht, Department of Agronomy, and Clarke McGrath, ISU Extension and Outreach

Freezing and near-freezing temperatures have afflicted western and northern Iowa this week. There have been reports of frost damage to both corn and soybean seedlings, although most of Iowa's corn is at the second vegetative growth stage or less and most of the soybean has not emerged yet. Imbibitional chilling is still a concern for seeds that have not germinated.

Imbibition is the process by which seeds absorb water for the initiation of germination. A chilling effect occurs when water colder than 50 degrees F is imbibed. The imbibition of cold water disrupts the reorganization of cells during rehydration and can result in the loss of seed vigor or seed death. The most critical time for imbibition is within 24 hours of planting. Therefore, imbibitional chilling effects are more severe when seeds are planted into soils 50 degrees F or colder compared to planting into warmer soils followed by a drop in temperature.

Frost of corn and soybean can be classified as either 'damaging' or 'lethal.' Temperatures between 28 and 32 degrees F are damaging, but not necessarily lethal until temperatures fall below 28 degrees F. Severity of frost damage is influenced by the length of time below 32 degrees F. Symptoms of frost are water-soaked leaves, hypocotyls or cotyledons 24 to 36 hours after cold conditions. Affected plants will begin to blacken and wither. Bob Nielsen has a [photo gallery](#) that demonstrates frost injury. PPO herbicide injury will not be consistent across a field and have brown lesions where the soybean seedling contacts the herbicide. In some cases, the soybean hypocotyl will be girdled or the developing bud will be killed. Bob Hartzler features some [photographs of PPO herbicide injury](#). Generally, the two types of injury are not similar enough in appearance to be confused.

Frost damage to corn is often less severe than frost damage to soybean because the growing point of corn is 0.5 to 0.75 inches below the soil surface until V5 (i.e., the fifth leaf stage). However, temperatures below 28 degrees F can penetrate 1 to 2 inches below the soil surface and kill the growing point of corn. The soybean apical meristem and axillary buds are present above the soil surface upon emergence. Soybean regrowth can occur if the apical meristem or axillary buds are not frozen. Soybeans in the VE to VC stage can tolerate colder temperatures (29 - 30 degrees F), but trifoliate are susceptible to temperatures below 32 degrees F.

When temperatures below freezing occur after emergence, confirm frost symptoms of water soaked plant tissues. Wait 48 to 96 hours after the frost event to assess plant stand survival. Regrowth following frost events will be dictated by temperature. Warmer conditions will result in quicker regrowth. In corn, plants can be dug and stems split to examine the growing point. A healthy plant will have cream to yellow colored tissue above the growing point. Yield loss from frost is associated with loss of stand rather than leaf damage. If significant stand loss occurs from frost damage, replanting should

be considered. Replant consideration should take into account yield potential of the existing stand; yield potential from late planting; cost of seed, labor and fuel for planting and tillage; and additional weed control for the existing stand. If replanting is in your future, the [Corn Replant Checklist](#) and [Soybean Replant Decisions](#) may be helpful resources.

Mark Licht is an extension cropping systems agronomist with responsibilities in corn and soybean management and production. He can be reached at lichtma@iastate.edu or 515-294-0877. Clarke McGrath is an extension field agronomist in southwest Iowa. He can be reached at cmcgrath@iastate.edu or 712-215-2146.

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