

effects of cold temperatures following soybean planting

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Imbibitional chilling injury can occur when cold water is imbibed by the seed within 24 hours of planting.



Emerged soybeans are more susceptible to damage from freezing temperatures than corn because their growing points are above the soil surface.



The use of a fungicide seed treatment is important in early planted soybean when development can be delayed by poor conditions.



Benefits and Risks of Early Planting

- Trends toward larger farms and planting equipment size along with the availability of effective seed treatments and proven yield benefits have prompted a shift toward earlier planting of soybeans.
- Several Pioneer agronomy research studies have shown the benefits of early planting with a full-season soybean variety for maximizing soybean yield.
- Early planted soybeans generally reach canopy closure sooner, intercept more sunlight, and spend a longer duration in reproductive growth.
- However, it is possible to plant too early every year, and several management factors as well as risks associated with early planting must be considered.
- Cold and wet conditions at and after planting can injure developing seedlings; delay germination and emergence; and reduce stand establishment.



Soil Temperature

- Like corn, soybeans are typically planted into soils well below their optimum temperature for germination, making early growth conditions inherently stressful. The optimum temperature for soybean germination is around 70 °F (21 °C).
- A minimum soil temperature of 50 °F (10 °C) during the 24 hours following planting is recommended. At soil temperatures below 50 °F (10 °C), the risk of slow germination, infection of seedling diseases, and reduced stand establishment increases.
- Soybeans typically require between 90 and 130 GDUs to emerge, depending upon soil type.
- The GDU requirement of soybean is similar to corn with a base temperature of 50 °F (10 °C). Thus, planting ahead of a cold spell often does not result in accumulation of additional GDUs or gain any early growth.



Figure 1. Pioneer® brand soybean varieties are rated for field emergence, which is based on speed and strength of emergence in suboptimal temperatures.

Imbibitional Chilling Injury

- The initial uptake of water into the seed following planting is referred to as the imbibitional phase. A soybean seed imbibes approximately 50% of its weight in water during germination.
- The imbibitional phase occurs very rapidly after planting, typically not lasting more than 24 hours.
- Imbibitional chilling injury and stand loss can occur when very cold soil water (<40 °F, 4 °C) is imbibed by the seed during this time. A damaged seed coat can increase the likelihood of imbibitional chilling injury. Care should be taken when handling/treating seed.
- Once the imbibitional phase is completed, the risk of chilling injury associated with cold soil temperature or rain declines.

Risk of Freezing Injury

- Emerged soybeans are more susceptible to damage from freezing temperatures than corn because their growing points are above the soil surface as soon as the plants emerge.
- Temperatures below 32 °F (0 °C) can cause frost damage to emerged soybean plants, while temperatures below 28 °F (-2 °C) for an extended period of time (>4 hrs) can be lethal, especially on lighter-textured soils.



Figure 2. Just-emerged soybean plants damaged by frost. The cotyledons are still green and look healthy, but the region of the hypocotyl just below the cotyledonary node is turning brown and is becoming soft and shrunken.

- Heavier-textured soil can better store and release previously accumulated heat near the soil surface when air temperatures drop, helping to protect recently emerged soybean plants.
- High levels of residue on the soil surface can increase the risk of freezing injury by reducing the transfer of heat from the soil to the plants.

- A soybean plant at the cotyledon stage has three growing points – the main shoot and two axillary buds at the base of the cotyledons. Recovery from freezing injury is possible as long as at least one of these buds survives.
- Soybean seedlings that have just cracked the soil surface will be more tolerant to freezing temperatures than plants at the cotyledon or unifoliate stages.
- The cotyledons are full of solutes, which makes them good buffers to protect the three potential growing points between them, and causes them to be more resistant to injury.
- Freezing damage that extends below the cotyledons will result in the death of the plant.

Disease Risk

- Cold, wet soils following planting increase the risk of seed rots and seedling blights in soybeans.
- The use of a fungicide seed treatment is important in early planted soybean when development can be delayed by poor conditions.
- Pythium is favored by cold and wet soils. In fields where the disease is present, infection is likely when soils are cold and heavy rains occur soon after planting.
- Cold, wet conditions early in the growing season can also result in higher incidence of sudden death syndrome (SDS).
- SDS is caused by a virulent strain of the common soil-inhabiting fungus *Fusarium virguliforme*, which infects soybean plants very early in the growing season, often as early as germination to just after crop emergence.
- The use of resistant soybean varieties and ILeVO® fungicide seed treatment (active ingredient: fluopyram) provides protection of seedlings against *Fusarium virguliforme* infection and can reduce the incidence of SDS in early planted soybean.

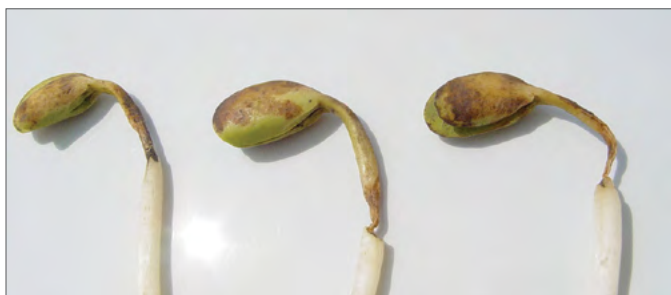


Figure 3. Soybean seedlings with damping-off symptoms due to Pythium seedling blight, a soil-borne fungal pathogen that is favored by wet soil conditions and cool temperatures just after planting. Damping-off occurs when germinating seedlings are infected prior to or just after emergence. Diseased seedlings collapse when the infection girdles the hypocotyl.

Management Considerations

- Early soybean planting is a consistently proven management practice for high-yield soybean production.
- Imbibitional chilling injury can occur when very cold soil water is imbibed by the seed within 24 hrs after planting. However, if the soil is fit, soil temperatures are near 50 °F (10 °C), and the weather forecast for the next 24 to 48 hours is favorable, soybean planting should begin.
- Predicting a frost event 10 or more days after planting when soybeans are beginning to emerge is a difficult task. Many factors affect the potential for freezing injury to emerged soybean plants – growth stage; air temperature and duration; soil temperature; soil texture; residue; and field topography.
- If temperatures drop below freezing after soybeans have emerged, allow approximately five days before assessing any potential stand loss and replant considerations.
- Planting soybean seed treated with a fungicide seed treatment can help protect against elevated disease risks associated with early planting, particularly when development is delayed by poor conditions.