



# Agronomic Spotlight

## Late Season Frost Damage to Soybean

- Aboveground soybean plant tissue can be damaged if exposed to frost temperatures (30 °F to 32 °F); however, the whole plant can be killed when temperatures drop below 30 °F for an extended period of time.
- The effect of a late-season frost on soybean grain quality is related to crop maturity and the amount of leaf tissue killed.
- Yield losses due to frost are uncommon after soybean plants have reached full maturity.

### Frost Temperatures

Soybean is more susceptible to frost temperatures than corn. The impact of a late-season frost on a soybean crop depends upon the growth stage of soybean plants when frost occurs, temperatures and time length of exposure, and cultural practices. University of Wisconsin research has shown that yield was usually reduced when frost occurred at or before full seed (R6) growth stage.<sup>1</sup> Frost temperatures that range from 30 °F to 32 °F can damage the top leaves of soybean plants; however, if air temperatures drop below 30 °F, the entire plant may be killed. Generally, soybean plants in a narrow row spacing (15 inches or less) may tolerate a light frost better than plants in wider rows (30 inches and greater). A thicker soybean canopy can hold soil heat better and protect the developing lower pods, which can continue to fill soybeans and develop normally after a frost.<sup>1</sup>

### Damaged Soybean Plants

If only the upper soybean leaves are damaged, the plants were probably not exposed to cold temperatures for an extended period of time. However, if leaves are damaged throughout the plant and close to the stem, potential yield loss may be expected.

The growth stage of soybean plants when frost occurred should be determined to evaluate the loss in yield potential. Table 1 can be used to help assess the average yield loss at different growth stages. As soybean plants approach maturity, the risk for potential yield loss decreases.<sup>2</sup> A frost can cause severe damage (65% yield loss) to a soybean crop at the beginning seed stage (R5) while a frost after soybean plants have reached full maturity (R8) should not affect yield potential.

### Management

Severe problems may arise when soybean plants are killed before reaching maturity, such as some or all of the grain being green, lower quality seeds, lower yield potential, and variable moisture content. Frost damaged soybean seed are generally considered salvageable as long as the plants reached the R6 growth stage at the time of the frost-killing event.

An early frost prior to maturity may slow field dry down. If soybean plants need to be harvested with moisture levels higher than desirable, placing the harvested seeds in an on-farm bin with steady aeration for two to four weeks should be considered. This process can help reduce moisture levels and may begin to turn some of the green seeds to a normal mature color. Soybean seeds in on-farm storage should be checked regularly for

spoilage. Soybean seeds can be dried in a grain dryer at 130 °F or lower temperatures.

**Table 1. Soybean growth stages and predicted yield loss after a frost.<sup>2</sup>**

Growth Stage <sup>3</sup>	Yield Loss
<b>Beginning Seed (R5).</b> Seed is 1/8 inch long in the pod at one of the four uppermost nodes on the main stem.	65%
<b>Full Seed (R6).</b> Pod containing a green seed that fills the pod cavity at one of the four uppermost nodes on the main stem.	37%
<b>Beginning Maturity (R7).</b> One normal pod on the main stem that has reached its mature pod color.	11%
<b>Full Maturity (R8).</b> 95% of the pods have reached their mature pod color.	0%

### Sources

<sup>1</sup> Berglund, D.R. Assessing frost damage in soybeans. North Dakota State University Extension. <https://www.ag.ndsu.edu/>. <sup>2</sup> Staggenborg, S., Dhuyvetter, K., Fjell, D., and Vanderlip, R. 1996. Fall freeze damage in summer grain crops. MF-2234. Kansas State University Extension. <https://www.bookstore.ksre.ksu.edu/>. <sup>3</sup> Pedersen, P. 2004. Soybean growth and development. PM 1945. Iowa State University. <sup>4</sup> Hurburgh, C.R. and Benson, G.O. 2012. Frost damage to corn and soybeans. PM 1635. Iowa State University Extension. <http://extension.agron.iastate.edu/>. <sup>5</sup> Staton, M. 2013. How to manage frost-damaged soybeans. Michigan State University Extension. <http://msue.anr.msu.edu/>. Web sources verified 09/15/16. 130903023036

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