



# Agronomic Spotlight

## Causes of Corn Root Lodging

- Root lodging may occur when root growth is insufficient to fully anchor the corn plant against the force of the wind.
- Corn product selection, soil and environmental conditions, insect damage, and herbicide injury are factors that can contribute to root lodging.
- The growth stage of the corn plant at the time of damage influences the level of recovery from root damage.

## Factors Contributing to Root Lodging

Shallow corn roots can be partially pulled out of the soil by strong winds. Additionally, the stalks can buckle due to the disrupted "anchoring" system, causing the plant to lodge. Strong winds from one direction may pull the roots on one side of the plant and push roots further into the soil on the other. A rotation of the downwind root systems by as few as 10 degrees is enough to cause buckling of the corn stalk. Storms may also provide powerful downdrafts causing lodging in every direction (Figure 1).

Sidewall compaction of the root zone due to wet conditions at planting, poor seed placement, and general soil compaction can restrict proper root development.



Figure 1. Corn root lodging from windstorm.

Brace root development can be hindered during drought conditions by reducing the overall size of the root mass. Without moisture, brace roots fail to grow as cells do not elongate. Also, cloddy soil conditions and shallow plantings can result in underdeveloped root systems, known as "rootless corn syndrome". In addition, dry conditions can make brace roots grow horizontally over the dry, hard soil surface. However, heavy rainfall following drought can help soften the soil and roots will start to penetrate the soil surface, which can alleviate some of the root lodging problem.

Severe corn rootworm (CRW) pressure can dramatically contribute to root lodging. Larvae feeding can reduce root systems making plants more vulnerable to wind storms (Figure 2).



Figure 2. Pruned roots (left) and lodged plants due to CRW larvae feeding.

Wet soil conditions early in the season may inhibit root development or cause shallow roots, preventing the plant from properly anchoring in the soil. Shallow root systems, especially in late planted corn fields, can be prone to potential drought stress and nutrient deficiencies that may result in root and/or stalk lodging. Brace root formation may not occur quickly enough under moist conditions to support the top growth of corn. In addition, excessive moisture conditions can cause incomplete brace root development that can lead to plant lodging. Also, water-soaked soil compared to dry soil at the time of a wind storm can make it easier for the roots to be pulled by the force of the wind.

Field areas where nitrogen was lost due to wet conditions or low soil pH levels may reduce root growth and development.

Vulnerability to root lodging varies among corn products. Plants are most susceptible during the period of rapid growth just before tasseling.

Excess application of certain growth regulator herbicides can cause upcurling or fusing of the brace roots and twisting of other roots.

## Corn Plants May Recover

It is important to be patient and allow the crop time to recover before estimating potential yield loss. Depending on the severity of the root lodging, corn plants can typically recover by "goosenecking" back upright; however, negative impacts can still occur throughout the remainder of the growing season.

The corn growth stage when the root lodging occurs influences the extent of goosenecking damage and impact on yield potential. If root lodging occurs:

- Before pollination, the plant is usually able to recover on its own and return to an upright growth pattern within a few days, without severely affecting crop yield potential. However, the lower part of the stalk will likely have a gooseneck bend to it that may require slower harvesting to help prevent ear loss.
- During pollination or grain fill, crop yield potential may be decreased.
- At or near pollen shed, the pollination process may not be completely successful, potentially resulting in barren tips or scattered grain on the ears.

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## Management

Special management practices should be considered for plants that are damaged but survive and for future plantings.

Lodged corn plants that are laying on each other may have a higher potential for disease development. Fungicides cannot recover yield potential lost due to lodging, but may help protect against further yield reductions from some diseases.

Irrigation management, where possible, can be adapted for corn plants with shallow roots. Irrigation will likely need to be applied more frequently with less water each time to minimize pushing available nitrogen past the root zone.

Goosenecked stalks can be difficult to harvest, resulting in mechanical harvest losses. The use of after-market corn head reels may be of benefit to help direct stalks into the header. Local equipment dealers, neighbors, and the internet are likely sources for special equipment.

If lodging was due to CRW larvae feeding, best management practices (BMPs) should be implemented on these fields. If severe feeding and lodging is observed, follow these BMPs:

- Rotate to a non-host crop such as soybeans to break the CRW life cycle. Periodic rotation provides a number of benefits in addition to effective CRW control.
- Plant SmartStax® RIB Complete® Corn Blend products that provide dual mode-of-action (pyramided) B.t. traits and provide CRW protection.
- If rotation or SmartStax® RIB Complete® Corn Blend products are not acceptable options, consider using soil-applied insecticides in combination with seed products that do not provide B.t. protection from CRW larvae.
- Due to resistance concerns, planting single mode-of-action technologies such as Genuity® VT Triple PRO® products or Genuity® VT Triple PRO® RIB Complete® Corn Blend products is not recommended when less than satisfactory control of CRW larvae has been previously observed.

## Summary

Understanding the causes of root lodging can provide valuable information and direction for harvesting the damaged field and also for future management decisions. Root lodging can occur as early as the late vegetative stages and as late as harvest maturity. Recovery depends on the condition of the plant at the time of damage. Plants that are knee-high or shorter may recover without noticeable goosenecking, while taller plants may not straighten up but may gooseneck because the upper stalk internodes continue to elongate.

## Sources

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<sup>2</sup> Corn stalk rots. 1995. Report on plant diseases number 200. University of Illinois Extension. <https://ipm.illinois.edu/>.

<sup>3</sup> Elmore, R. 2005. Root-lodged corn at or before silking. *Integrated crop management*. Iowa State University Extension. <http://www.ipm.iastate.edu/ipm/icm/2005/8-1/rootlodge.html>.

<sup>4</sup> Hanna, M. 2006. Harvesting lodged corn. *Integrated crop management*. Iowa State University Extension. <http://www.ipm.iastate.edu/ipm/icm/2006/9-18/lodged.html>.

<sup>5</sup> Nielson, R.L. 2002. Root lodging concerns in corn. *Purdue University*. <https://www.agry.purdue.edu/ext/corn/news/articles.02/RootLodge-0711.html>.

<sup>6</sup> Thomison, P. 2010. Effects of pre-tassel root lodging on corn performance. *C.O.R.N. Newsletter*. 2010-19. The Ohio State University Extension. <http://agcrops.osu.edu/newsletters/2010/19#7>.

<sup>7</sup> Lauer, J. 2011. Yield response of flattened (lodged) corn. *Integrated pest and crop management*. University of Wisconsin. <http://ipcm.wisc.edu/blog/2011/07/yield-response-of-flattened-lodged-corn/>.

<sup>8</sup> Ransom, J. 2011. Root lodging in corn. *Crop and pest report*. North Dakota State University. <https://www.ag.ndsu.edu/cpr/plant-science/root-lodging-in-corn-7-28-11>. Web sources verified 06/28/16. 130405060652.

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