



Corn gone wrong: When and why do abnormal ears develop?

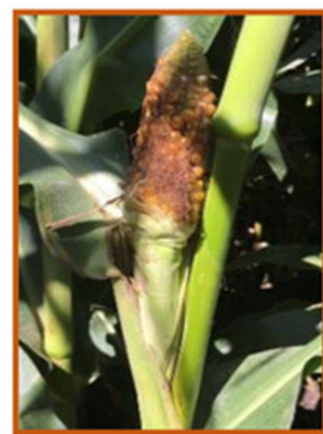
October 29, 2026



Multi-ears



Barbell ears



Short husks

Corn ear abnormalities don't just look ugly, they have lower yields. Abnormal corn ear types of recent concern include multiple ears on the same ear shank, short husks, and barbell ears. Image courtesy of Orteza et al. (2022a).

Why do some corn ears turn out short, misshapen, or barren? Researchers are uncovering how extreme weather, limited sunlight, plant hormones, and management practices can disrupt ear development and reduce yields.

This article is part of our [Down to Earth series](#), which breaks down and explains food, farming, and environmental sciences for readers of all backgrounds, including those without formal scientific training.

Corn ear abnormalities have been reported for more than 100 years. Reports of multi-ears, short husks, barbell-shaped ears, and other abnormal symptoms have been popping up again in recent growing seasons across the Corn Belt, Texas Panhandle, and Eastern Colorado. These abnormal ears are ugly looking, and most importantly, they have lower yields (and likely lower grain quality too), impacting the corn industry.

A study published in the journal [Crop, Forage and Turfgrass Management](#), explores three of the biggest factors behind abnormal corn ears and other possible causes that we do not know enough about. It explores the environmental and physical causes and their impact on yields.

The three main proposed factors

Strange corn ears are most often linked to susceptible genetics, conducive environmental conditions, and unfavorable management practices. Normal corn ears

can produce 800 to 900 kernels arranged in 16 to 18 rows around each ear (potential). The number of harvested kernels is usually lower due to pollination issues or other factors. Abnormal ear types of recent concern (2016 and later years) include:

- Multiple ears on the same ear shank (same node in the plant), often too small or short and less productive.
- Short husks, shortened husk leaves with ears protruding beyond the husks.
- Barbell ears, missing kernels and diameter decrease in the cob



Clockwise: Multiple ears on the same ear shank, short husks, and barbell ears. Images courtesy of Ortez et al. (2022b). Photos by Robert Nielsen.

In a 2016 survey of 15 Nebraska corn fields, affected fields averaged 26% abnormal ears. Plants with abnormal ears produced 35 to 91% lower yields than plants with normal ears. Research suggests that abnormal ear development can result from interactions among genetics, environmental stresses, and management factors. Extreme weather, low solar radiation, and plant growth regulator use have all been associated with these abnormalities. Primary (uppermost) corn ear abortion is commonly associated with corn ear abnormalities.

While more research is needed to fully understand all of the factors involved, these problems can result in reduced yields, making it harder for farmers to grow the food, feed, fiber, and fuel that we all depend on.

How corn grows

Most corn plants have been bred to only grow a single ear so that they can use all their energy to produce the biggest ears and most kernels possible. When a corn plant grows multiple ears, it divides its energy between each one, and so the ears end up being smaller and less productive.

An adequate or optimum plant density per unit of area is the first step. The three main components of corn grain yield are the number of viable ears per unit of area, the number of kernels per ear, and the kernel weight. Each of these components is determined at different points throughout the growing season. For instance, the number of kernels that can be harvested depends on how well the corn is pollinated and how well the kernels are fertilized, filled, and retained.

How extreme weather, sunlight affect corn

Droughts, hail, flooding, freezing, hot temperatures, and high-speed winds are some of the factors that can drastically limit corn yields. For example, droughts caused a 23% drop in production across the U.S. in 2012—leading to issues in crop establishment, pollination, and water usage in the plant overall. The 2012 damage extended through 2013 because of reduced soil moisture available for the subsequent crop. A few years later, a correlation was found between large numbers of abnormal ears and high-speed winds in July of 2016 across Nebraska, especially as those winds followed a cold spell that led into warm weather right after.



Droughts caused a 23% drop in production across the U.S. in 2012. Caption: USDA photo by Christina Reed.

Light availability is critical for achieving high corn yields; the potential effect of a cloudy day might be small, but an accumulation of several cloudy days during important periods of the crop can lower grain yields. The modeled effect of seven continuous cloudy days (about a 45% less solar radiation) in central Nebraska resulted in an estimated yield decrease of 5% in the 2019 crop season.

When more solar radiation is available and when more is intercepted by the lower parts of corn plants because they're spaced farther apart in the field, they produced more harvestable ears. Researchers concluded that the flowering (silking) stage is a critical period for corn growth and development and that plants with more ears generally had better access to sunlight and less competition from neighboring plants.

If corn plants are lost at the flowering stage of development, the remaining plants are able to compensate for the grain yield losses, at least to some degree, by increasing the weight of ears in the remaining plants; however fewer ears in unfavorable environments cannot fully recover the loss.



Studies have also reported barren ears when sunlight was reduced by 80 and 90% or more. Photo courtesy of Shutterstock/kristof lauwers.

When corn does not get enough sunlight, not only is grain yield affected, but also plant size and total protein and oil. Studies have also reported barren ears when sunlight was reduced by 80 and 90% or more. On the other hand, more mild reductions of light, 30%, were enough to suppress the development of secondary ears in the same plants. Researchers believe that the plant's responses are affected by both the amount

of time solar radiation is reduced and when those conditions occur during the plant's development.

Other studies have found similar results, linking shading that reduced sunlight by 60 to 90% with barbell-shaped ears, arrested ears, and banana-shaped ears. Moreover, when sunlight was reduced by 90% for extended periods, ear abortion could occur. These findings show that corn needs the right amount of sunlight to grow and produce good ears and yields. Understanding the amount of solar radiation available is important to preventing corn from going wrong.

Plant growth regulators

Plant hormones, also known as growth regulators, play a critical role in how plants grow, respond to stress, and develop reproductive structures like ears and grains. In corn, specific hormones such as cytokinins and ethylene have shown to influence ear formation and grain development. For example, applying cytokinins before the floral transition can reduce ear abortion and promote the growth of additional ears. On the other hand, stress-related hormones like ethylene can negatively impact grain development, especially under conditions like shading or temperature extremes, leading to kernel abortion and reduced grain weight.

Recent studies have highlighted ethylene's role in regulating corn productivity.

Manipulating ethylene levels has shown promise in improving ear length and kernel number, resulting in higher yields. However, ethylene is also linked to adverse effects when plants are stressed, such as heat or excessive moisture, and has led to fruit abortion in crops like cotton and wheat.

Additionally, depending on the application rates and the application timings, certain

foliar sprays containing non-ionic surfactants may unintentionally increase ethylene levels, causing abnormal ear development (i.e., arrested ears) and yield loss. These findings suggest that while plant hormones are powerful tools for crop management, their timing, concentration, and interaction with environmental factors must be carefully reviewed to avoid unintended consequences.



Researchers have found that some foliar applications to corn can influence plant hormone activity, affecting ear development and yield. Photo courtesy of Shutterstock/Fotokostic.

What this means for corn and consumers

Despite recent scientific contributions in the field of abnormal corn ears, there are still questions that need answers. The occurrence of abnormal corn ears is often random and scattered, but reports of affected farmer fields are received almost every year in the U.S. Improving our understanding of corn ear development can lead to more stable yields and better-quality grain, benefiting both producers and the corn industry at large.

This report has important implications for farmers, the corn industry, and consumers:

- For farmers, understanding the environmental and physiological factors that lead to abnormal ear development—such as extreme weather, limited sunlight, and the use of certain plant growth regulators—can help them make better management decisions. For example, they could avoid specific chemical applications during sensitive periods of the crop’s development or select hybrids less prone to ear abortion/abnormalities to reduce yield losses.
- For the corn industry and consumers, this work underscores the importance of crop resilience and quality. Abnormal ears not only reduce overall yield, but can also affect grain quality, impacting ag supply chains and market value. As weather variability increases, the industry may need to invest more in breeding programs that develop stress-tolerant genetics and precision agriculture technologies that monitor crop health in a more cost-effective way.

Dig deeper

For more information on this topic, check out this published research:

Ortez, O. A., McMechan, A. J., Hoegemeyer, T., Ciampitti, I. A., Nielsen, R. L., Thomison, P., Abendroth, L. J., & Elmore, R. W. (2022a). Conditions potentially affecting corn ear formation, yield, and abnormal ears: A review. *Crop, Forage & Turfgrass Management*, 8, e20173. <https://doi.org/10.1002/cft2.20173>

Ortez, O. A., McMechan, A. J., Hoegemeyer, T., Ciampitti, I. A., Nielsen, R., Thomison, P. R., & Elmore, R. W. (2022b). Abnormal ear development in corn: A review. *Agronomy Journal*, 114, 1168–1183. <https://doi.org/10.1002/agj2.20986>

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