CORTEVA™ agriscience

CROP BULLETIN

Why Do Corn Plants Develop Multiple Ears on the Same Shank?

Mark Jeschke, Ph.D., Agronomy Manager

KEY POINTS

- Modern corn hybrids generally produce one ear per plant but may produce a second ear on the node below the primary ear if sunlight and resources are abundant.
- In rare cases, plants will produce multiple ears at the same stalk node.
- The phenomenon of multiple ears on the same shank is associated with a disruption in the hormonal apical dominance of the primary ear, and often occurs when the primary ear fails to develop properly.
- In many cases, the primary ear remains dominant and develops normally, with smaller secondary ears that will often fail to pollinate.
- "Bouquet ears" refers to a form of multiple ear development in which a plant forms a cluster of several ears, none of which develop normally.

MORE EARS, MORE PROBLEMS

Modern corn hybrids grown at plant populations that optimize yield generally produce one main ear per stalk. However, in areas of the field where plants experience less competition with their neighbors for sunlight and resources, such as along field edges or adjacent to gaps, it's not unusual to find two ears per plant. The second ear typically grows from the node below the primary ear and is almost always smaller.

A much less common phenomenon is the development of multiple ears on the same node. In many cases, this amounts to little more than an agronomic curiosity if there is still a dominant primary ear that is able to develop normally. Secondary side ears will often be much smaller and cease development after they fail to pollinate. However, in cases where multiple ears develop on a node where there is no dominant ear, all of the ears can exhibit stunted, abnormal growth. If a lot of plants in a field are affected, this can have a negative impact on yield.

Figure 1. Corn ear with a primary ear and multiple secondary ears growing from the same ear shank.

CORN EAR GROWTH AND DEVELOPMENT

Corn ear development is a highly organized function in the corn plant. Ear shoot initiation begins early in the life of the plant – around the V6-V7 growth stage – long before any ear is visible on the plant. Ear shoots initiate at all ear nodes from the first to approximately the 14th leaf node; however hormonal apical dominance in the plant ensures that it is the uppermost ear shoot that fully develops (Figure 2). A second ear can develop on the node below the primary ear if resources are abundant and may produce harvestable grain.

Much as apical dominance in the plant suppresses development of ears at additional stalk nodes, hormonal apical dominance expressed by the primary ear suppresses the initiation of any other ears along the ear

shank. This normally prevents the development of multiple ears at the same stalk node.

Figure 2. Dissected corn plant at the V12 growth stage. A total of 8 ear shoots are visible with the lowest at node 7 and the primary ear shoot at node 14. *Image courtesy of Iowa State University Extension.*

The ear shank is essentially a miniature version of the main stalk, with multiple nodes and internodes. Leaves emerge from the nodes and an inflorescence is produced at the terminal node. In this case of the ear shank though, the inflorescence at the terminal node is the ear rather than the tassel and the leaves on the shank enclose the ear, forming the husk (Figure 3).

In some cases, additional ears do initiate on the same ear shank, which suggests the normal apical dominance has been disrupted somehow. This phenomenon has been noted in scientific literature dating back to at least the 1960s and was dubbed MESS (Multiple Ears on Same Shank) syndrome by Purdue University Extension agronomist Dr. Bob Nielsen in 1998 (Nielsen, 1999).

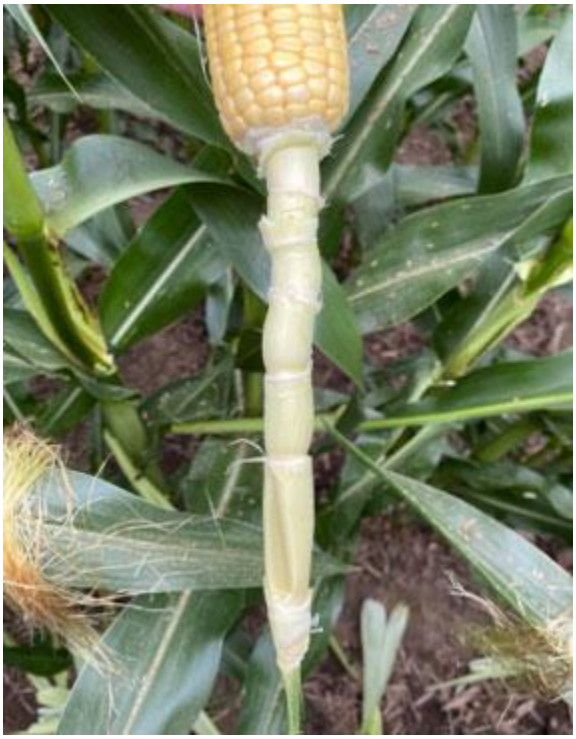

Figure 3. Removing the husk leaves reveals the nodes and internodes of the ear shank

EXPRESSION OF MULTIPLE CORN EARS

Expression of multiple ears on the same shank can vary, both in terms of the number of ears and the extent to which one ear is dominant. Both of these factors will determine the potential impact on yield. In general, a greater number of ears and the lack of a dominant ear are both likely to be detrimental to yield. Manifestations of multiple ears on the same shank can be broken out into a few general categories.

Dominant Primary Ear

The most common form of multiple ears on the same shank is a dominant primary ear at the terminal node of the ear shank with one or two side ears emerging from lower nodes on the shank. Sometimes the side ears will be wrapped in the husk with the primary ear and only become noticeable when silks begin emerging from the side of the husk. In other cases, secondary ears are visibly separate from the primary ear.

Figure 4. Multiple ears on the same shank with the secondary ear(s) separate from the main husk (left) and contained in the main husk (right).

In this scenario, yield is unlikely to be affected as long as the dominant ear is able to develop normally. Side ears often silk late and fail to pollinate, so they don't compete with the primary ear for resources during grain fill. This form of multiple ears on the same shank often shows up most in areas where plants have received more abundant sunlight and resources – near gaps, in end rows, and in more productive areas of the field.

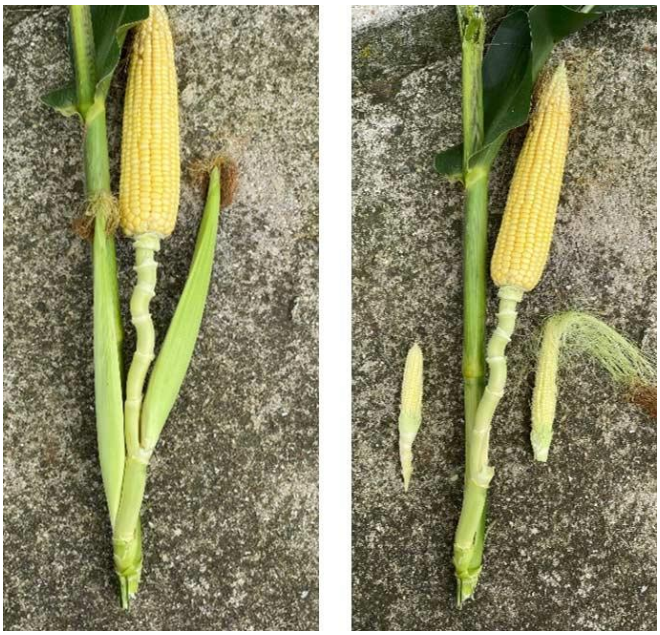

Figure 5. Corn plant with a well-developed primary ear and two secondary ears growing from lower nodes on the ear shank. Neither of the secondary ears have pollinated.

Often, they occur alongside plants with a normal second ear below the primary ear node. This suggests that resource availability plays a role, in addition to disruption in normal apical dominance of primary ear in some plants. Plants set extra ears because they have the resources to do so but instead of setting a second ear on the lower node, some plants will set more ears on the primary node.

Failed Primary Ear

In some cases, multiple ears on the same shank occur following the failure of development of the primary ear (Figure 6). Secondary ears may form on the same node as the failed primary ear, or they may form on the node below it. In this scenario, normal apical dominance has clearly been disrupted by the loss of the primary ear. Yield impact will depend on the extent to which one or two ears are able to develop normally.

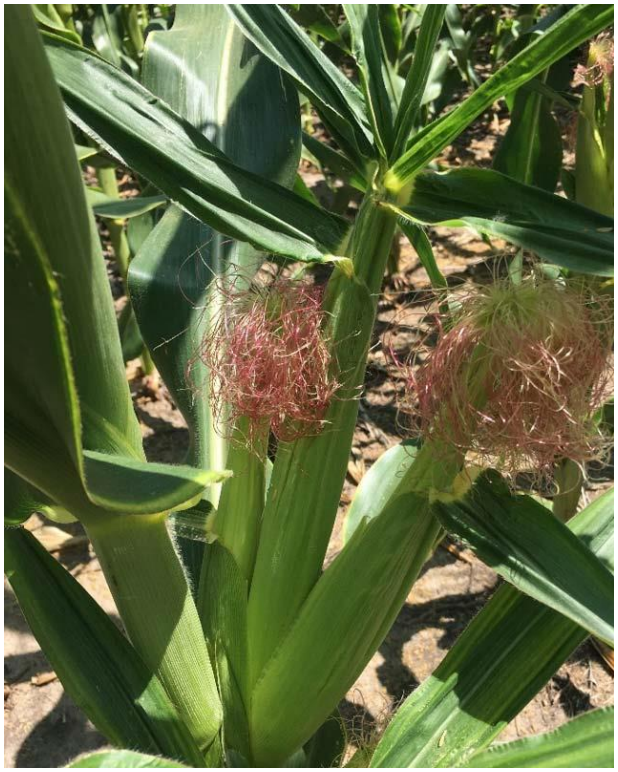

Figure 6. Corn plant with a primary ear that has failed to produce silks. The plant has compensated for the failed primary ear by producing two more ears at the same node. *Image courtesy of Rachel Veenstra, Ph.D. student, Department of Agronomy, Kansas State University.*

Bouquet Ears

The term "bouquet ears" is commonly used to refer to the most extreme form of multiple ears on a shank, in which a cluster of multiple ears emerges close together on a shank (Figure 7). This commonly includes 3 to 5 ears on the same shank but clusters of up to 8 ears have been observed (Elmore and Abendroth, 2006). The crowding of the ears causes them to splay out in multiple directions forming a "bouquet."

Bouquet ears also appear to be associated with failure of the primary ear. Often, none of the ears will develop properly, and the total yield of the plant ends up being less than what would have been achieved by a single normal ear. The potential to negatively impact yield makes

bouquet ears particularly concerning compared to other, less extreme forms of multiple ears on the same shank. In some cases, bouquet ears have been observed throughout a field, affecting the majority of plants. The potential for significant reductions in yield makes it important to try to determine the factor or factors causing bouquet ears, in the instances when they occur.

Figure 5. Corn plant showing a cluster of ears at a single leaf node, a condition referred to as "bouquet ears." *Image courtesy of the University of Illinois*

POSSIBLE CAUSES OF MULTIPLE CORN EARS

Iowa State Observations

In 2006, bouquet ears appeared at a higher-than-normal frequency in corn fields from Iowa to Indiana. Iowa State researchers recorded the following observations that year (Elmore and Abendroth, 2006):

- Incidence reports from fields expressing bouquet ears ranged from 20% to 100% of plants.
- In extreme cases, clusters contained up to eight small ears.
- Different hybrids from different seed companies were affected.
- Several different herbicides (pre and post) were used.
- Some locations were affected by early-season drought.
- Some had mid-season fungicide applications, others did not.
- In the end, no single cause could be identified.

University of Illinois Observations

When bouquet ears occurred in Illinois in 2007, the following observations were made (Nafziger, 2007):

- Some hybrids were more likely than others to produce "side" ears. In some fields, up to 5 or 6 ears developed.
- The side ears were well developed, though many likely failed to form kernels due to late silking and lack of pollen.
- In general, the larger and more numerous the side ears, the more likely that the main ear was damaged in some way or had low kernel number.

Nafziger concluded that secondary ears were likely able to grow faster when the primary ear either showed less dominance or just used less plant sugar, leaving more for the other ears. He also surmised that the causes of damage to the main ear might have been different in different fields.

Corteva Agriscience Observations

Corteva Agrisicence corn breeders place an ear shoot bag over the small ear shoot of a corn plant prior to silk emergence to protect silks from pollen contamination prior to making a controlled pollination. These researchers have long noted that when such plants are not pollinated, multiple ears often develop at the same stalk node as the non-pollinated ear. This suggests that the failure of the primary ear is the stimulus for the development of the secondary ears. Other observations by Corteva Agriscience researchers and agronomists confirm this conclusion. When extreme silk feeding by corn rootworm beetles or Japanese beetles prevents or limits pollination of some ears, the formation of multiple ears often results.

Multiple ears on the same shank may also result from stress to the plant earlier in its development. Stress during primary ear formation around the V6 stage can cause disruption of ear development and the loss of apical dominance. Corteva agronomists have observed multiple ears on the same shank associated with stress caused by high winds, extreme temperatures, and wide swings in temperature during ear development.

Corteva agronomists have observed bouquet ears resulting from a specific disease commonly referred to as crazy top. This disease is caused by a fungal pathogen (*Sclerophthora macrospora*) spread by flooding. Crazy top may result not only in a proliferation of leaves in the tassel of the plant (from which it draws its name), but also a proliferation of ears at a single node (Figure 8). Other diseases have been implicated in expression of bouquet ears, but a direct cause and effect relationship has not been conclusively established. Likewise, no conclusive relationship has been established between herbicide, fungicide, or insecticide application and bouquet ears.

Figure 8. Bouquet ears resulting from crazy top of corn.

It has often been difficult to definitively pinpoint a single cause or interaction of causes that results in multiple ears on the same shank, but a common thread in many cases seems to be some sort of disruption in development of the main ear that weakens its apical dominance and allows other ears to develop on the same node.

MANAGEMENT CONSIDERATIONS

Multiple ears that occur due to poor pollination of the primary ear can be avoided by addressing insect feeding on the silks. Corn rootworm beetles, and in some areas, Japanese beetles are the primary silk-feeders that can prevent or limit normal pollination.

If hybrid differences are observed, growers should note them for future reference when selecting hybrids. However, if maturities also differ, silk timing may have been more important than hybrid performance per se. In previous cases where multiple ears on the same shank have been observed over a wide area, it generally has not been limited to a single hybrid or brand.

REFERENCES

- Elmore, R., and L. Abendroth. 2006. Multiple ears per node: Iowa 2006 situation & hypothesis. Integrated Crop Management. Iowa State Univ. Extension.
- Nafziger, E. 2007. Unexpected problems of corn ear development. The Bulletin, No. 20 Article 9, August 10, 2007. University of Illinois Extension, Urbana-Champaign.
- Nielsen, R.L. 1999. What A MESS! (aka Multiple Ears on a Single Ear Shank). Purdue Pest Management & Crop Production Newsletter. Purdue University Extension.
- Nielsen, R.L. 2006. A Problem With "Bouquets." Corny News Network Articles. Purdue University Extension.
- Nielsen, R.L. 2014. Multiple Ears of Corn on the Same Shank. Corny News Network Articles. Purdue University Extension.