



## ABNORMAL CORN EAR DEVELOPMENT

### What You'll Learn...

- Environmental or chemical stress during the vegetative and early reproductive stages (V5 to R3) of corn can cause abnormal or malformed ears.
- Distinctly different symptoms develop depending on the timing, type, and severity of the stress corn undergoes.
- Pesticide applications can be a source of stress on corn if application occurs outside of product label conditions or other stresses increase corn susceptibility.

Abnormal corn development can begin at the V5 corn growth stage, or when the 5th fully expanded leaf and collar occurs and ear shoot tissue development is initiated.<sup>1</sup> Any stress during the V5 growth stage through early corn development can cause abnormal growth and development of reproductive plant tissues. Corn may experience one or more stresses, such as drought, extreme temperature, saturated soil, nutrient deficiencies, disease or insect injury, and misapplied pesticides. Many stresses result in specific malformations of the corn ear.<sup>2</sup> Symptom recognition will help diagnose the causal factors of malformed ears.

### Ear Pinching

Typically, a bottle-like ear shape, or ear pinching, can occur when the number of ear rows is reduced by up to 50% from the base to the tip of the ear (Figure 1).<sup>2</sup> The length of the ear is usually normal. Severe stress during the V7 to V10 growth stages can cause a reduction in kernel rows. Late post-emergence application of ALS inhibitor herbicides may result in ear pinching.



Figure 1. Ear Pinching.

### Blunt Ear Syndrome

Corn with blunt ear syndrome can have a nearly normal ear size and number of kernels per row at the basal end of the ear, but kernels are greatly reduced toward the middle of the ear and barren at the tip (Figure 2). Husk



Figure 2. Blunt Ear Syndrome.

length and the number of kernel rows are usually normal. The reduced number of kernels suggests stress occurred prior to the completion of ear size determination.<sup>3</sup> Research suggests that cold shock or late post-emergence applications of herbicides (ALS, PGR, glufosinate, glyphosate), fungicides (strobilurin), insecticides, foliar fertilizers, and spray adjuvants during the V8 to V12 (pre-tassel) growth stages may be possible causes of blunt ear syndrome problems.<sup>3</sup>

### Incomplete Kernel Set

Figure 3 shows corn ears with a limited number of kernels pollinated.<sup>2</sup> There can be several causes for poor kernel set: uneven crop development, an inadequate supply of pollen during pollen shed and silking, severe drought, high temperatures, herbicide injury, or insect feeding and silk clipping. In addition, phosphorous deficiency can interfere with pollination.<sup>2</sup>



Figure 3. Incomplete Kernel Set.

### Drought Damaged Ears

Drought damaged (nubbin) ears are small irregularly shaped ears with poor kernel set, which is pronounced at the ear tip (Figure 4). Kernel numbers are reduced due to fewer kernel rows and kernels/row.<sup>2</sup> The cause can be severe drought during mid-vegetative growth through the grain filling period. Nubbin ears may also be caused by nitrogen deficiency or high plant populations.



Figure 4. Drought Damaged Ears.

### Zipper Ears

Zipper ears typically have partial or missing kernel rows on the underside of the ear due to kernel abortion (Figure 5).<sup>2</sup> Differential kernel formation can result in a bending of the ear (banana ear). The specific cause of this effect is not known but is often associated with drought stress or defoliation after pollination.



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Misapplication of Roundup® brand glyphosate-only agricultural herbicides beyond the labeled 48-inch crop height can result in poor kernel set, due to a portion of the reproductive tissues (pollen, silks, ovules) being injured.

### Tip Dieback

Symptoms of tip dieback are the result of kernel abortion at the tip of the ear which is associated with poor fertilization (Figure 6). Unfertilized ovules and aborted kernels may appear dried up and shrunken but aborted kernels may have a yellow color.<sup>2</sup> The cause of tip dieback is stress during early kernel development as the result of drought, nitrogen deficiency, high temperatures, foliar diseases, or cloudy weather.



Figure 5. Zipper Ear.



Figure 6. Tip Dieback.

### Chaffy Ears

Chaffy ears are light in weight due to poorly filled, shrunken kernels with spaces in between them (Figure 7).<sup>2</sup> There are multiple causes of chaffy ears that include frost damage, pre-mature plant death, plant death caused by drought, high plant population, foliar diseases, severe potassium deficiency, and hail damage that reduces the photosynthetic capacity of the plant.



Figure 7. Chaffy Ears.

### Pesticide Management

Most crop stress can't be controlled by a grower but postemergence applications of pesticides, within the guidelines and recommendations of product labels, can be managed by growers and custom applicators.

Environmental conditions can play a large role in altering normal corn growth. In addition, environmental conditions can delay pesticide applications beyond prescribed crop

### Guidelines for post-emergence applications of Roundup WeatherMAX® Herbicide and Roundup PowerMAX® II Herbicide in corn products with Roundup Ready® 2 Technology.

- Maximum use rate of 32 oz/acre for a single application and a total of 64 oz/acre applied from corn emergence up to 48 inches in height.
- Broadcast applications, alone or in tank mixtures, may be applied over the top of corn from emergence to V8 stage of growth (8 leaves with collars) or until corn reaches a free standing height of 30 inches.
- Drop nozzles are recommended for optimum spray coverage and weed control when corn is 24 to 30 inches free standing height. When free standing heights of corn have reached 30 to 48 inches, only ground applications can be made with drop nozzles that are aligned to avoid spraying into the whorls of corn plants.

growth stages and crop tolerance. Stress conditions can alter plant cuticle thickness, tolerance to tank mixtures, and the effects of adjuvants, all of which may compromise crop tolerance to pesticides.

**Always read and follow pesticide label directions** and do not apply Roundup® brand glyphosate-only agricultural herbicides later or at higher rates than specified in the product label. Consult with your local agronomist about the proper application timing and rates of Roundup® brand glyphosate-only agricultural herbicides.

**Sources:** <sup>1</sup>Nielsen, R.L. 2003. Ear initiation & size determination in corn. Corny News Network. Purdue University. <sup>2</sup>Thomison, P and A. Geyer. 2007. Abnormal corn ears ACE-1. The Ohio State University. <sup>3</sup>Nielsen, R.L. 2007. Symptomology of arrested ear development in corn. Corny News Network. Purdue University.

Photos courtesy of Dr. Peter Thomison, Ohio State University, from the publication Abnormal Corn Ears - ACE-1.<sup>2</sup>

For additional information, contact your local seed representative. Developed in partnership with Technology, Development & Agronomy by Monsanto.

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**Always read and follow IRM, where applicable, grain marketing and all other stewardship practices and pesticide label directions.**

Roundup Ready® crops contain genes that confer tolerance to glyphosate, the active ingredient in Roundup® brand agricultural herbicides. Roundup® brand agricultural herbicides will kill crops that are not tolerant to glyphosate. **Tank mixtures:** The applicable labeling for each product must be in the possession of the user at the time of application. Follow applicable use instructions, including application rates, precautions and restrictions of each product used in the tank mixture. Monsanto has not tested all tank mix product formulations for compatibility or performance other than specifically listed by brand name. Always predetermine the compatibility of tank mixtures by mixing small proportional quantities in advance. Roundup PowerMAX®, Roundup Ready PLUS®, Roundup Ready®, Roundup Technology®, Roundup WeatherMAX® and Roundup® are registered trademarks of Monsanto Technology LLC. All other trademarks are the property of their respective owners. ©2015 Monsanto Company. 130718061031 060915JSC.