UNIVERSITY OF GEORGIA
EXTENSION

What's Wrong with My Pepper? Common Defects of Bell Peppers Explained

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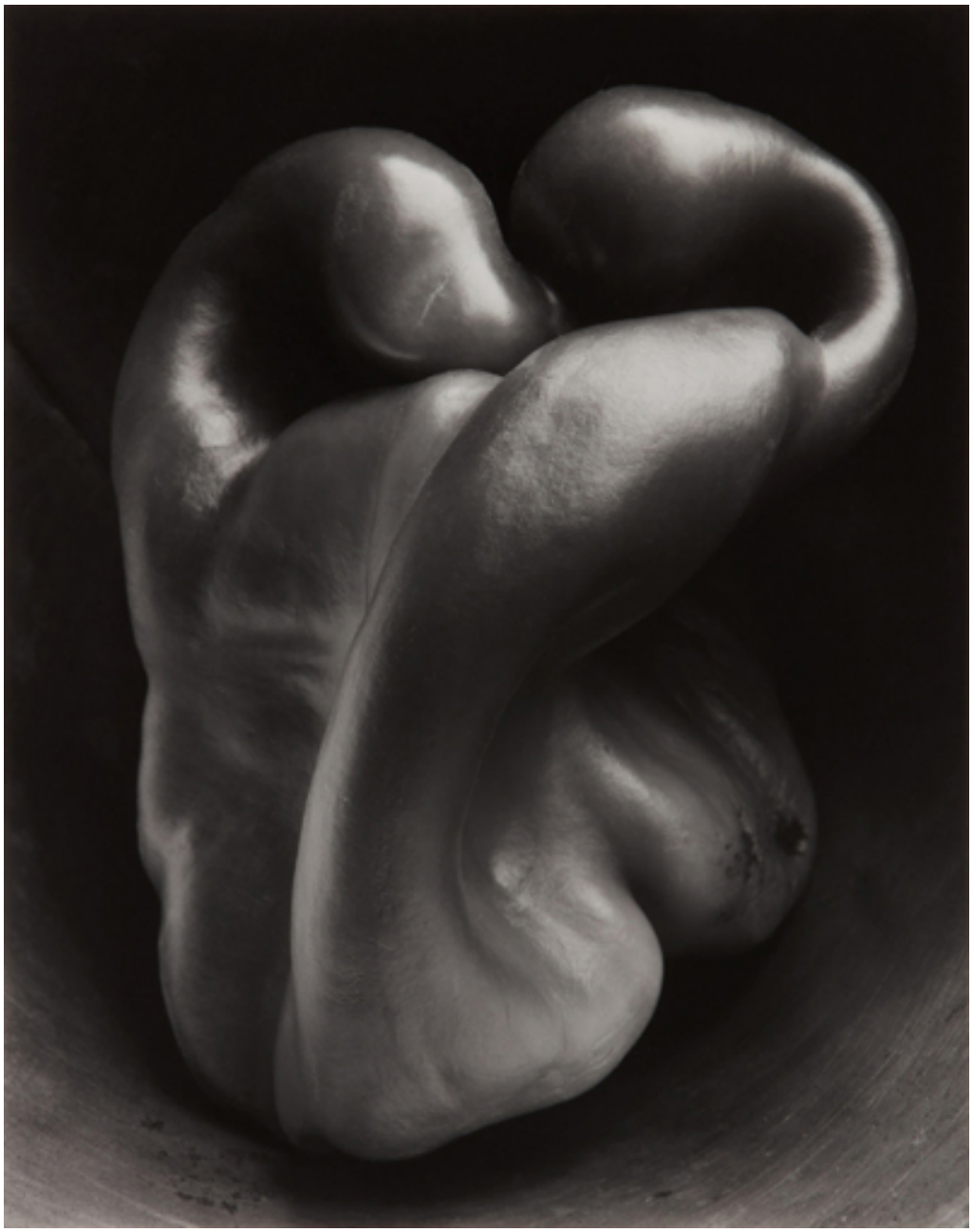

Fresh-market bell pepper growers are challenged to produce visually perfect fruit to match consumer preferences. Various physiological disorders can affect the appearance and desirability of bell peppers; these often arise from environmental stresses and nutritional imbalances. Understanding these physiological issues is essential for growers to manage and mitigate them effectively.

This publication covers common physiological disorders in bell peppers—including their likely

causes, visual characteristics, and potential management practices—to help growers improve fruit quality, reduce losses, and enhance the market appeal of their bell pepper crops.

Pancaking

Pancaking is the term used to describe an atypically flat fruit shape (Figure 1). This is thought to be caused by improper pollination and is more prevalent when temperatures are extremely hot (as during early fall and late spring) or cold (late fall, winter, and early spring). Incomplete pollination will produce fewer seeds, resulting in improper fruit development. Certain varieties are more or less susceptible to pancaking. In general, peppers with an elongated blocky shape will resist pancaking better than peppers with a shorter blocky shape.

Figure 1a. A Pancaked Pepper (left) Compared to a Normal Pepper Shape (right).

Figure 1b. Pancaked Peppers Look Flattened Compared to Normal-Shaped Peppers.

Pointy or Tapered Fruit

Pointy or tapered fruits taper from the shoulder to the blossom end of the fruit (Figure 2). These fruits usually have three lobes, although a three-lobed pepper may still have a blocky (square) shape. Certain varieties are more susceptible to tapering. In general, a four-lobed blocky pepper is the most preferred fruit shape. However, there will be a normal distribution of three-, four-, and five-lobed fruit within all bell pepper varieties. Typically, varieties that have a distribution of more four- and five-lobed fruits will tend to have fewer pointy fruits. In addition, a five-lobed pepper fruit is usually less desirable than a four-lobed fruit since it may have more of a pumpkin shape instead of a blockier appearance.

Figure 2a. The Blossom-End of Pointy Fruits is Narrow Compared to a Normal-Shaped Fruit.

Figure 2b. Pointy Peppers Appear Elongated Compared to Normal Peppers.

Blossom-End Rot

Blossom-end rot (BER) is a disorder resulting in ***necrosis*** (dead tissue) at the blossom end of pepper fruits (Figure 3). Blossom-end rot is thought to be a symptom of a localized calcium deficiency that occurs early in fruit development (Bangerth, 1979; Marcelis & Ho, 1999). This calcium deficiency can cause cell death, resulting in the characteristic “rot” appearance.

Interestingly, this disorder is usually not caused by a lack of calcium in the soil—though that can certainly occur. Rather, blossom-end rot is usually caused by poor calcium uptake in the fruit. Calcium uptake in the plant occurs primarily by mass flow via the xylem tissue. Anything that inhibits water movement and/or transpiration into the fruit can cause blossom-end rot. Because calcium is relatively immobile in the plant, even temporary disruptions in calcium uptake can

cause localized deficiencies in rapidly dividing plant cells.

Figure 3. Blossom-End Rot is Thought to be Caused by a Calcium Deficiency in the Rapidly Dividing Cells of a Growing Pepper Fruit.

Genetics, growth rate, irrigation, relative humidity, and calcium fertilization may affect the incidence of blossom-end rot in peppers and tomatoes (Diaz-Perez & Hook, 2017; Taylor & Locascio, 2004; Taylor et al., 2004). The plant's leaves tend to accumulate more calcium compared to fruit, so the incidence of blossom-end rot may increase in plants with excessive foliar canopy growth (Taylor & Locascio, 2004).

Fertilizers that contain high levels of ammonium also have been shown to cause blossom-end rot—the ammonium can compete with calcium for uptake. Because of calcium's lack of mobility within plants, foliar sprays of calcium rarely correct blossom-end rot because the calcium doesn't travel from leaves to fruit.

Sunburn or Sunscald

Figure 4a. Sunscald Can Appear on Any Part of the Pepper Fruit.
The scalded tissue is more prone to infection.

Sunburn or sunscald is when a pepper's skin burns from exposure to direct sunlight (Figure 4). Growing a bigger shade canopy to protect peppers from the sun will reduce sunburn. Staking and stringing pepper plants to prevent them from lodging and exposing the fruit to sun also will reduce sunburn. Sometimes, if peppers are planted on an east-west orientation, the south-facing rows of peppers may experience sunscald as they are exposed to a higher incidence of sunlight.

Secondary pathogens can invade sunburned tissues. Foliar applications of kaolin clay or calcium-based products can act as a sunscreen and reduce sunburn. The cultivar can also influence the

incidence of sunburn. Plants with larger canopies, thicker fruit cell walls, and darker skin color appear to be less susceptible to sunburn damage.

Figure 4b. Sunscald Causes Visible Discoloration and Physical Changes in the Peppers' Skin.

Suntan

Suntan is similar to sunburn—but suntan is discoloration (tan), rather than burning, of the pepper skin because of sun exposure (Figure 5). Suntan is less severe than sunburn. The same management practices apply.

Figure 5. Suntan Looks Like a Tan Discoloration on Green Pepper Fruit, Distinct From the Look of a Pepper Turning Red.

Silvering or Epidermal Separation

Silvering looks like silver stripes on the fruit, hence the name. It is the visual symptom of epidermal or skin separation. This occurs when rapid expansion causes an air layer to form in the outer skin of the fruit (Figure 6). Silvering typically becomes a problem when it is hot and wet, especially during the early fall and, to a lesser degree, in the late spring. Some varieties are particularly prone to silvering.

In past studies, epidermal separation has been associated with *Phytophthora*-resistant cultivars and genotypes rather than a specific production system (Wyenandt et al., 2017).

Figure 6a. A Close-Up of a Bell Pepper with Silvering or Epidermal Separation.

Figure 6b. Peppers With Varying Amounts of Epidermal Separation.

Blue Nose or Purpling

Figure 7a. A Jalapeño Pepper With Blue Nose.

Blue nose or purpling is the prevalence of purple color on pepper fruits (Figure 7). Typically, the tip of the pepper (nose) shows purpling, but in severe cases, the sides of the pepper also will be purple. This purple color is caused by *anthocyanin*, a purple-pigmented secondary metabolite in plants that they express during times of stress, such as in cold or hot temperatures.

Figure 7b. A Pepper Plant Expressing Anthocyanin in Multiple Fruits.

Varieties that lack anthocyanins will not purple. Anthocyanin-less varieties do not express anthocyanin and will have green stems, green fruit, and yellow anthers (Figure 8a; Kovács et al., 2017).

Varieties that express anthocyanin will have purple anthers (Figure 8b), purple seedling stems, purple joints, and—if conditions are favorable—purple pigment expressed on the fruit. There are

completely purple bell pepper varieties that heavily express anthocyanin.

Figure 8. Anthocyanin Expression in Pepper Plants. A pepper plant that lacks anthocyanin (left) has green stems, green fruit, and yellow anthers. Varieties that express anthocyanin have purple anthers and purple joints (right).

Bicolor or Light-Colored Fruit

Consumers prefer uniform medium- to dark-green fruit. Light-green or yellow-colored fruit can be caused by genetics and excessive canopy. Bicolor fruit is yellow on one side and green on the other (Figure 9). When this occurs, the light-green side is on the inside of the canopy, and the dark side is facing the outside of the canopy. The side deprived of sunlight remains yellow.

Figure 9. Bicolor Fruit Shows a Range of Shades From Yellow to Dark Green, Rather Than a Uniform Green Color.

Surface Cracking or Corking

Surface cracking and concentric radial cracking are small imperfections (cracks) that appear on the surface of the fruit (Figure 10). A probable cause is the fluctuation of day and nighttime temperatures and water (from dew or irrigation) sitting on the shoulders of fruits. Cracking usually occurs on the shoulders of the fruit but can appear anywhere. Different varieties exhibit differences in susceptibility to cracking. Many older jalapeño varieties were susceptible to surface cracking.

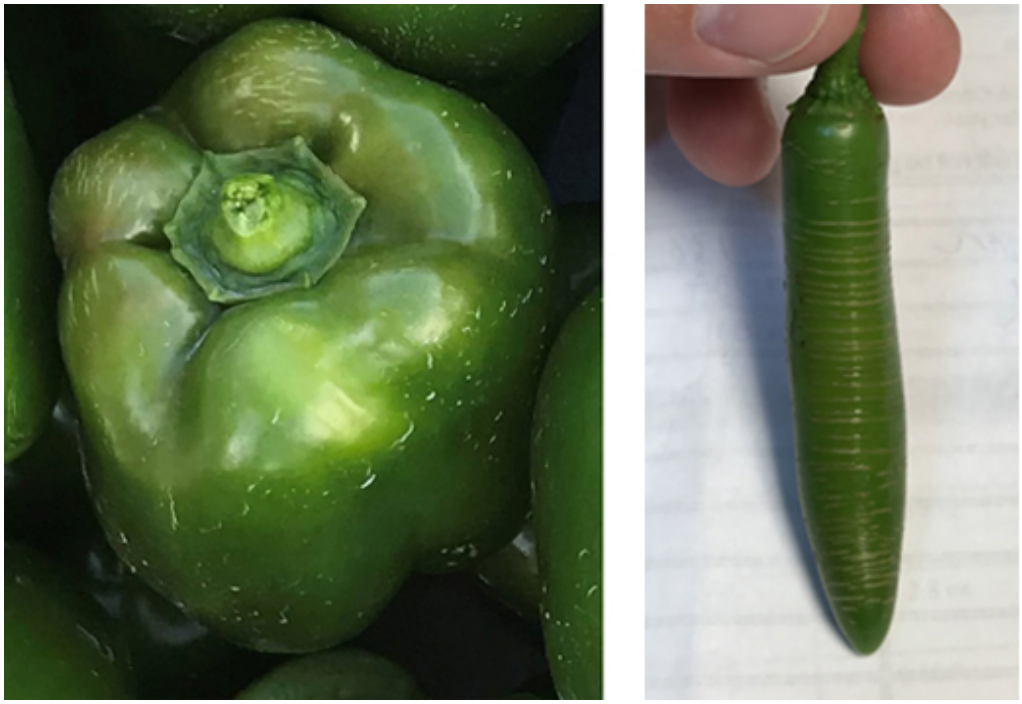

Figure 10. Surface Cracking in a Bell Pepper (left) and on a Jalapeno Pepper (right).

Blossom-End Cracking

Blossom-end cracking appears as cracking or fissures between the lobes on the blossom end of the fruit (Figure 11). The cracks in these fruits may go unnoticed by harvesters and become a problem in the packing house—especially because of water intrusion during washing. Different varieties have differences in susceptibility to blossom-end cracking.

Figure 11. Blossom-End Cracks Appear Between the Lobes of Mature Fruit.

Crowded or Misshapen Fruit

Misshapen fruit are simply poorly formed fruit (Figure 12). One of the most common causes of misshapen fruit is crowding. Crowding is when the crown fruit develops in the crotch of the first branching node and develops indentations where it grows into the stems.

Flat sides may occur when fruits grow against each other. On some occasions, when plants are very tightly trellised, crowding of branches can also result in misshapen fruit. Poor pollination is yet another cause. Growing a bigger plant or varieties with longer internodes/longer fruit stems can reduce crowded or misshapen fruit.

Figure 12. Poorly Formed Fruit Caused by Crowding or Fruits Growing Too Closely Together on the Plant.

Stip

Stip is the presence of black spots under the surface of the fruit (Figure 13). It is not a symptom of a disease or from insect feeding. It is thought to be related to calcium deficiencies, but the cause is often unknown. Some varieties and types of peppers are more susceptible. Stip is more common in current mini sweet peppers.

Figure 13. Stip Appears as Black Spots Under the Fruit Surface.

Breakers

Breakers are fruits that are starting to mature and turn color (Figure 14). They're sometimes referred to as chocolate since the fruits appear brownish before they start to turn red. This is different from suntanned fruit (Figure 5). In open-field production of mature green bell peppers, breakers are considered undesirable.

Growers can get more money for fully mature red, orange, or yellow peppers, but they need to be left longer in the field and are susceptible to more diseases, rots, and sun damage. Faster maturing yellow and orange varieties tend to turn color quicker than red varieties. Generally, green bell peppers that mature to red take longer to turn color—this is why green-to-red maturing varieties are almost exclusively grown for green bell pepper production. Harvesting on time will reduce the number of breakers.

Figure 14. A Bin of Peppers With Breakers in Addition to Green Fruits.

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