Managing Blossom-end Rot in Tomatoes and Peppers

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Blossom-end rot can cause significant crop losses in tomatoes and peppers, especially early in the season. Eggplants may also be affected and occasionally watermelons.

Symptoms

Blossom-end rot (BER) is a physiological disorder which causes a dark, sunken area on the lower (blossom) end of tomato, pepper, and eggplant fruits. On peppers, it may also occur on the sides of the fruit, near the blossom-end. The discoloration is usually tan, brown, or black and should not be confused with sunscald, which causes a whitish or translucent discoloration.

Secondary pathogens may infect the BER-affected area, causing overall fruit rot. In dry foothill summers, the area becomes dry and leathery and is rarely infected by pathogens, leaving the rest of the fruit intact. However, blossom-end rot is unsightly and reduces the marketability of the fruit.

BER in Tomatoes

Susceptibility to blossom-end rot varies among tomato varieties. Fast growing cultivars with extensive foliage and determinate cultivars, which set all their fruit in a short period, are frequently affected. Pear or Roma tomato cultivars seem to be among the most susceptible, followed by some beefsteak and salad types. Cherry tomatoes are rarely affected.

Peppers are generally not as susceptible to BER as tomatoes, but larger, thick walled varieties may be affected. The disorder is not very common in eggplant.

Causes of BER

Blossom end rot starts when the demand for calcium in the expanding fruit exceeds the supply. However, it is not a case of a simple calcium deficiency, but is much more complex. Adding calcium to the soil rarely alleviates the problem. BER involves a low level of calcium *in the fruit*, but often the supply may be more than adequate in the plant or soil.

In terms of management, blossom-end rot is primarily a water issue. It is most severe following drought stress or wide fluctuations in soil moisture.

BER is usually an early season problem, and the first fruits are most severely affected. As a result, it can have significant economic impacts, as early fruits often garner higher prices.

A number of events factor into early season blossom-end rot. These include rapid plant growth, development of a large leaf area with a high transpiration rate, rapid fruit enlargement, and temporary water stresses as the weather fluctuates.

Fruits in the rapid expansion phase (⅓ to ½ of full size) are very susceptible to water stress. Even a temporary water stress in this period can induce blossom-end rot because water preferentially goes to the leaves,

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reducing calcium delivery to the developing fruit. High levels of calcium are needed for cell growth and strong cell walls, so when a rapidly expanding fruit is deficient, tissues break down, leaving the dry, sunken lesions characteristic of blossom-end rot.

Calcium and Transpiration

Calcium is a critical player in blossom-end rot, but is only one of several factors (Taylor et al. 2004). Calcium is dissolved in the soil solution, taken up by plant roots, and then moves through the xylem from the roots to the leaves. Calcium only moves with water in the xylem, it does not move in the phloem.

Under conditions of high evaporative demand, i.e. low relative humidity and high temperature, water moves rapidly to the leaves, where most transpiration occurs. The calcium is carried along with the water, so most calcium absorbed by the plant ends up in the leaves. Fruit do not transpire as much as leaves; therefore less calcium reaches the fruit, which can cause a localized calcium deficiency.

The transpiration rate of the fruit is further reduced after the waxy cuticle develops, when the fruit is about ½-¾” in diameter. With decreased transpiration, the amount of calcium moving into the developing fruit also declines, contributing to the onset of BER.

Calcium-related plant disorders can also result from restricted transpiration. Restricted transpiration can occur when soil moisture is inadequate so the plant shuts its stomata and ceases to move water. Since calcium moves with the transpiration stream, its movement also stops. Transpiration can also be restricted in cool or cloudy weather because the atmospheric demand for moisture is low. Thus, early plantings of tomatoes, especially those planted into cold soil, are often subject to blossom-end rot.

The Role of Other Nutrients

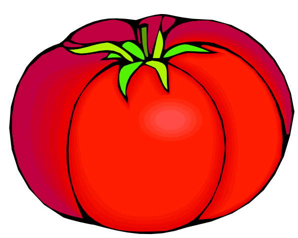
A calcium deficiency in the fruit may also result from other factors. Excess nitrogen stimulates vegetative growth, increasing the leaf area and thus the amount of transpiration from leaves. Potassium (K), magnesium (Mg) and ammonium -nitrogen (NH_4-N) all compete with calcium for uptake into the plant, so high concentrations of those nutrients may reduce the amount of calcium available in the fruit.

Because of the perception that BER is an overall calcium deficiency, many growers add calcium to the soil or apply foliar calcium. This rarely has an impact on the disorder, but does add to the cost of production.

Often, BER incidence will decline as the season progresses, which may lead growers to believe that applications of calcium have been effective. However, a reduction in BER is more likely due to slowing of vegetative growth, changes in weather, or better irrigation scheduling.

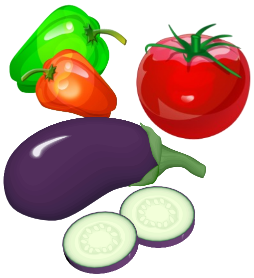
Soil applications of calcium are generally not very effective because BER is seldom induced by soil calcium deficiency. UC researchers have shown that most California soils contain adequate plant-available calcium and that commonly used soil tests systematically underestimate calcium in the soil solution. The most common test for soil calcium, an ammonium acetate extraction, actually provides almost no information about calcium availability to the plant. A saturated paste extraction is a better test, but it still underestimates calcium in the soil solution by a factor of 5 (Hartz et al. 2007.).

Foliar applications of calcium are also unlikely to affect blossom-end rot incidence. In the plant, calcium only moves with water in the xylem. It has no ability to move through the phloem from leaves to fruit, thus it cannot move from the application site to the fruit where it is needed.



Managing Blossom-end Rot

Blossom-end rot can be prevented with good soil management and careful monitoring of soil moisture so as to limit stress.



Strategies to Reduce Blossom-end Rot

1. Cover crop or incorporate compost to increase soil organic matter and diminish soil moisture fluctuations, especially in decomposed granite soils.

2. Use tensiometers or matrix blocks to monitor soil moisture. Do not allow soil to completely dry out when tomato fruit are expanding rapidly. Schedule irrigations to maintain moist, but not wet, soil conditions. For determinate cultivars, once the fruit are more than half of full size, some water stress can be tolerated and will improve flavor.

3. Reduce plant stress by irrigating **before** periods of high heat.

4. Use organic mulch along plant rows to reduce soil temperatures and evaporation, thus moderating soil moisture fluctuations.

5. Avoid cultivating close to plants so as to prevent feeder root damage that may restrict water flow during hot periods.

6. Calibrate nitrogen applications to actual plant use. Avoid over-fertilizing as rapid plant growth induced by high N can contribute to BER. Tomatoes use a maximum of about 200 pounds of nitrogen per acre. Depending on soil, and environmental conditions, less may be appropriate.

7. Use nitrate forms of nitrogen rather than ammonium. Excess ammonium in soils reduces calcium uptake and may exacerbate blossom-end rot.

8. Unless soil tests clearly indicate calcium deficiency in your soil, soil applications of calcium will probably not reduce the problem. If you have a high magnesium soil (and a pH below 6.5), liming may be useful to increase the ratio of calcium ions to other competitive ions in the soil.

9. Foliar applications of calcium are of little value as calcium is poorly absorbed by leaves and does not move easily in the plant.

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