

Blossom-End Rot

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Blossom-end rot is a common, nonparasitic, physiological disorder that occurs on tomatoes, peppers, eggplant, and some melons. Blossom-end rot is a symptom of calcium deficiency in the fruit. It may be caused by low soil calcium, low levels of calcium in the maturing fruit, or other cultural factors -- particularly fluctuating soil moisture. This disorder is usually most severe following extremes in soil moisture (either too dry or too wet). These conditions result in a deficiency of calcium available to the maturing fruit, at the spot where damage becomes apparent.

Blossom-end rot is most prevalent on tomatoes; however, it can occur on other crops and the fruit symptoms are the same.

Symptoms

In tomatoes, as well as in eggplants and melons, decay is visible on the blossom end of the fruits. The first visible symptoms of the disorder is a small darkened or water-soaked area around the blossom end of the fruit, appearing about time the fruit begins to ripen. The spot darkens, enlarges, and becomes sunken as the fruits mature. Large lesions may show concentric rings. The affected tissue is leathery and firm unless invaded by secondary decay organisms. Blossom-end rot usually causes the fruit to ripen prematurely and to be inedible. Quite commonly, the affected fruit areas become infected with secondary pathogens, which appear as black, felt-like growth on the fruit. The affected area may be a mere speck or it may involve more than half of the fruit. In peppers the rot appears tan in color and should not be confused with sun scald, which is white and usually occurs higher up on the fruit.

The calcium deficiency producing blossom-end rot is most often a result of climatic or cultural problems. It is related to several factors, including calcium, nitrogen and soil moisture levels. The severity of this condition can be compounded when two or more of these factors interact with each other as in a low soil calcium level, in combination with an inadequate or interrupted supply of soil moisture to the plant. It can occur even when there is abundant calcium in the soil and tissue tests show high levels of calcium in the plant.

The physiology of the plant may contribute to the disorder. Dissolved in water, calcium is taken up and moves through the plant in the vascular system from the roots to the leaves. Under high moisture stress, the water containing calcium and other minerals moves rapidly to the leaves. Most water is lost (transpired) through the leaves, and, as a result, most of the calcium is found in the leaves after transpiration has occurred. Fruit does not transpire as much as leaves; thus, less calcium is deposited there, resulting in a localized calcium deficiency in the fruit. Ninety percent of the calcium that the mature fruit will contain is in the fruit by the time the waxy suberin layer (the waxy layer on the final skin of the fruit) has formed, when the fruit is about thumbnail size. When this calcium deficiency occurs in the end of the fruit, an area of rapid growth, it causes cells to collapse producing the sunken lesion symptom of blossom-end rot.

Blossom-end rot usually appears initially on the first fruit cluster of a plant due to the combination of rapid plant growth with a large leaf area for water transpiration, water stress, and fruit enlargement. Also, lack of calcium may be due to the plant's inadequate root uptake of certain nutrients. Even a temporary water stress during early fruit enlargement can cause blossom-end rot because the fruits are the last to receive adequate calcium.

Another cause of blossom-end rot is over-fertilization, especially with nitrogen, which stimulates vegetative growth. Excessive vegetative growth increases the transpiration surface and further prevents calcium accumulation in the fruit.

Prevention

Applying lime several months pre-plant to low-calcium soils can help prevent blossom-end rot (see cultural recommendations). Foliar sprays of calcium won't correct blossom-end rot once it has occurred on the fruit. Fruits do not have openings in the epidermis (skin) where moisture can be lost or where calcium can enter the fruit from surface application. Thus, direct application of calcium to fruit is ineffective, although when applied to the foliage, it can help prevent the condition from occurring on developing fruit.

Cultivars that grow quickly and produce large amounts of foliage tend to be more susceptible to blossom end rot. Therefore, reducing nitrogen levels will help reduce blossom end rot. Avoid ammoniacal forms of nitrogen that compete with calcium during uptake from the soil. Incidence of blossom end rot may also increase where there is a low ratio of calcium to certain other nutrients such as potassium and nitrogen. The use of 5-10-10 fertilizer in place of 10-10-10 or 13-13-13 on tomatoes will help reduce the nitrogen problems associated with blossom-end rot.

The plants should not be subjected to severe "hardening-off" before transplanting. Seedlings grown in the field at a steady rate are less susceptible to blossom end rot. Also, windy conditions in the spring coupled with low relative humidity can cause the high transpiration rates, that can induce blossom-end rot. Fluctuations in soil moisture during periods of rapid plant growth create moisture stress and limit calcium distribution to the fruit.

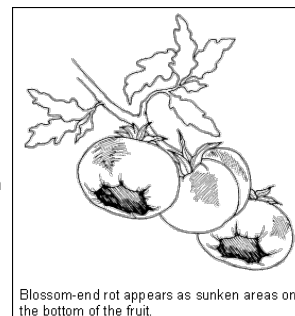
In addition, tomatoes, peppers and watermelon planted unusually early while the soil is still cold are likely to have their first fruits affected by blossom-end rot. Planting a bit later in the season helps reduce the problem.

Removing affected fruits when symptoms are first observed may promote subsequent sound development of other fruit on the plant. By the time a second set of fruit begins developing, the plant has an expanded and developed root system capable of gathering and delivering calcium to the fruiting structures (if sufficient calcium is available in the soil profile).

Cultural Recommendations

In order to control blossom-end rot, the following steps should be taken:

- Select sites that have deep, well-drained soils. A large well-formed root system is better able to take up calcium and other minerals.
- Tomatoes and other susceptible crops grown on land that has not been limed for two years or more are prime candidates for blossom-end rot. Soil test to determine soil pH and soil nutrient levels annually and adjust the pH to 6.5 as needed. Maintain soil pH between 6.0 and 6.5 and soil calcium levels at or above 200 lb Ca/acre in the coastal plains and 400 lbs Ca/acre in the rest of the state. If soil calcium is low and the pH is correct, gypsum (CaSO_4) can be incorporated into the soil at a rate of 500 to 1000 lb/acre (1 to 2 lb/100 sq. ft.) to supply additional calcium. The lime and gypsum should be worked into the soil 8-12 inches deep. Lime and/or gypsum should be applied 3 months before planting. If no lime has been applied in the last three years and no soil test is available, broadcast 5 lbs of dolomitic lime per 100 square feet (area 10 feet by 10 feet).
- Following soil test recommendations is the best way to insure proper fertilization. Work all fertilizer into the top 8-12 inches of soil. Adjust the nitrogen rate to the cultivar of tomato being grown to avoid excessive vegetation. The uptake of calcium is inhibited by ammonia. Use nitrogen in the form of potassium or calcium nitrate and avoid ammonium nitrate if possible. Apply potassium, phosphorus, and magnesium as recommended because balancing these nutrients with calcium is also important in preventing blossom-end rot. Applying too much fertilizer, especially ammoniacal nitrogen, at one time can result in blossom-end rot -- use several smaller side-dress applications. For untested soils you may use the following: Mix 1/2 cup of dolomitic lime, 1/2 cup of superphosphate or bonemeal and 2/3 cup of 6-12-12 or 5-10-15 into the soil in a 2 x 2 foot area (dug 1 foot deep) for each plant. Mix in well and plant. Don't over fertilize tomatoes when planting them.
- Mulch plants to conserve moisture and to provide a more uniform water supply. Straw, pine straw, ground leaves, or newspapers are all good mulches. Mulches conserve and maintain a uniform moisture supply, thereby helping to reduce blossom-end rot. Under drought conditions, plastic mulch may overheat the soil and increase blossom-end rot if plants are not watered properly. Adequate soil moisture throughout the season through mulching and water management is essential for avoiding the disorder. Avoid cultivation and hoeing. If cultivation is necessary, it should be shallow to avoid root pruning.
- Avoid severe pruning. Severely pruned tomato plants are more prone to develop blossom-end rot than unpruned plants.
- Keep water supply uniform and regular. Irrigate plants thoroughly and often enough to maintain a constant water supply without water-logging the plants. Tomato plants require 1.0 to 1.5 inches of water per week during growth and fruiting depending on soil type and weather conditions. Extreme fluctuations in soil moisture can cause an increase of blossom-end rot. Preventing moisture stress is important to control blossom-end rot, especially during fruit set and fruit enlargement.
- Foliar sprays can be used to help prevent the problem on young developing fruit before signs of blossom end rot occurs. Calcium chloride is suggested only for tomatoes. Calcium chloride sprays (see below), beginning prior to the first cluster of fruit appearing, can be used to supply calcium to the plant. Calcium nitrate can also be used as a spray treatment. Calcium chloride may burn the plant if sprayed during the hotter part of the day. Do not spray plants under stress conditions. Soil-applied treatments and prevention by cultural practices are generally preferred over sprays.



Spray with calcium chloride at the rate of 4 level tablespoons of calcium chloride per gallon of water (or 4 pounds per 100 gallons of water). Apply sprays every 7 to 10 days until 3 or 4 applications have been made. Application should be done while temperatures are cool in the morning. If blossom-end rot appears on the first cluster, begin spraying immediately. Spray to the point of run-off. Chelated calcium solutions also provide an excellent source of calcium. When using these chelates, follow label directions. Several foliar spray materials containing calcium are available, and all work well for tomatoes.

Remember, controlling blossom-end rot is based on proper calcium nutrition of the crop and optimum irrigation scheduling.

Source	Rate to Apply
95% (USP Grade) Calcium Chloride	4 tablespoons per gallon of water or 4 lbs per 100 gallons of water
78% (USP Grade) Calcium Chloride	5 tablespoons per gallon of water or 5 lbs per 100 gallons of water
Calcium nitrate	5 tablespoons per gallon of water or 5 lbs per 100 gallons of water

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