Agronomic Spotlight

Seminis grow forward

Bacterial Spot and Speck in Fresh Market Tomatoes

- Bacterial spot and bacterial speck of tomato can cause significant problems for fresh market production.
- Infections of leaves, stems, and fruit result in lower yields and reduced fruit quality.
- Management efforts should focus on integrated strategies to prevent infection.

Bacterial Spot

Symptoms of bacterial spot, caused by *Xanthomonas spp.*, (Figure 1) include small (0.10 inch), circular, brown spots on leaves and stems. Leaves with multiple spots often turn yellow, and severely infected leaves may die. Spots first appear on older leaves in the lower canopy and spread upward with splashing water. Lesions on flower pedicels can result in flower abortion.[1,2,3]

Figure 1. Foliar and fruit spot symptoms of bacterial spot. Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org.

Fruit are only infected when green. Once they start to turn red, no new spots will develop on the fruit. Fruit spots start as small (0.16- to 0.24-inch), dark brown, raised blisters that become scab-like as they enlarge. These spots have a water-soaked appearance and feel slightly rough to the touch. The spots may initially be surrounded by a white halo, but this disappears with age.

Bacterial spot is caused by four species of ***Xanthomonas.*** There are several races, some of which infect only tomato, some infect only pepper, and some infect both crops. The bacteria are seedborne, surviving on the outside of seeds. The bacteria can also survive on infested crop debris for 1 to 2 years in temperate regions, as well as on volunteer tomato and pepper plants in the field. The disease is favored by warm (75 to 86 °F) and wet conditions.

Infection is often initiated in the greenhouse during transplant production with inoculum coming from infected seed. Warm, wet greenhouse conditions facilitate the spread of the pathogen to seedlings where it infects through wounds and natural openings. The bacteria can superficially colonize the plant, with no symptom development, but infect the seedlings after transplanting.

Bacterial Speck

Symptoms of bacterial speck (caused by *Pseudomonas syringae* pv. *tomato*) (Figure 2) also include lesions on leaves. The small, dark brown lesions are most numerous on the undersides of leaves, and they can coalesce, resulting in large areas of leaf necrosis leading to stunting of plants. Spots can also form on stems, petioles, and peduncles (fruit stems). The fruit spot symptoms of bacterial speck, as the name suggests, are smaller than those seen with bacterial spot. Fruit lesions are less than 1 mm (0.04 inches) in diameter. The lesions are slightly raised or sunken and feel smooth to the touch. Lesions may be surrounded by dark green to yellow halos. As with bacterial spot, fruit are only infected when green. [1,2]

There are two known races of the bacterial speck pathogen (races 0 and 1), and many strains are resistant to copper-based bactericides. Development of this disease is favored by cool (65 to 75 °F) conditions. The pathogen is seedborne, but it is not clear how important this is in establishing epidemics. The bacterium does overwinter on infested crop residues in temperate regions and on volunteer tomato plants. In tropical and subtropical regions, the pathogen may not oversummer on crop debris. High planting densities and overhead irrigation favor infection and spread of bacterial speck. The disease can spread in the field with splashing water and on contaminated tools, machinery, and clothing.

Figure 2. Foliar and fruit spot symptoms of bacterial speck. Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org.

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Management of Spot and Speck

Management of these two bacterial diseases is similar in that a multifaceted approach is required to prevent infection and to limit spread in the field. The most critical strategy is the use of disease-free seed and transplants. All seed should be disinfested with either hot water, chlorine, or acid treatments, and treated seed lots should be tested for the presence of the pathogens. Hot water treatments are the least effective for spot and speck, but they are easiest to apply on-farm. Acid and chlorine treatments are more effective for spot and speck, but more difficult to apply correctly. Because the role of seed infection is not clear with bacterial spot, seed treatment may be less important for this disease. If purchasing treated seed from a supplier, growers should ask what treatments were used, what procedures were used to ensure that all seed were adequately treated, if the disinfesting solutions were monitored and if so how often, and if treated seed lots were tested for the presence of any pathogens.[2]

Sanitation is important during transplant production. All plant materials should be removed from the greenhouse prior to starting a new crop of seedlings. Weeds and volunteers in and around the greenhouse should be eliminated. Potting mixes should be sterilized, and flats, pots, racks, and stakes should be disinfested if reused. Tools and greenhouse surfaces should also be cleaned and treated with a disinfectant. Avoid contact between seedlings from different seed lots and minimize the handling of seedlings and human traffic in greenhouses. Choose irrigation methods and schedules to minimize the hours of leaf wetness. Do not handle wet plants and allow plants to dry before transporting them to the field. Remove and destroyS symptomatic seedlings and seedling trays immediately adjacent to the trays containing infected plants. [1,2,3]

In the field, eliminate solanaceous weeds and volunteer tomato plants. Plow under crop debris shortly after the last harvest. Rotate fields to non-solanaceous crops. For spot, a minimum rotation of one year is recommended. For speck, a minimum rotation of 2 years is recommended. Promote good water drainage, and, if possible, plant seedlings from different seed lots in different locations. Whenever possible, keep workers out of the fields when foliage is wet, and avoid pruning plants when leaves are wet. Avoid the use of overhead irrigation if possible; if not, use low-pressure systems that minimize the spread of bacteria through splashing. Carefully rogue-out and destroy symptomatic plants. Clean equipment and tools between plantings. [1,2,4]

The application of copper-based bactericides (Table 1) can reduce the spread of spot and speck. The efficacy of copper products is increased if they are tank-mixed with the fungicide mancozeb. These are protectant products, so treatments need to start before symptoms appear, and products should be applied weekly during rainy periods to slow disease spread and development. [1,2,3] Strains of both the spot and speck bacteria have developed resistance to copper-based bactericides. Mixing coppers with mancozeb or using non-copper products is important in areas where these strains are present. Actigard® is a SAR (systemic acquired resistance) product that can be used to stimulate the plant's disease defense responses. It has been shown to slow the development and spread of spot and speck in the field when applied on a 7- to 14-day schedule, beginning 1 week after transplanting.[4] Serenade® is a biological control product that also can be used to manage both spot and speck, and it can be used in organic production systems.[5,6]

Table 1. Products recommended for controlling bacterial diseases of tomato as of 2017.[4,5,6]

Active Ingredient	Example Product Name	Bacterial Speck	Bacterial Spot
Acibenzolar-S-methyl	Actigard® 50WG	✓	✓
Bacillus subtilis	Serenade® Max	✓	✓
Copper compounds*	Champ®, Kocide®	✓	✓
Famoxadone + cymoxanil	Tanos®	S	S
Quinoxyfen	Quintec®		✓
Streptomycin sulfate	Agri-mycin® 17		✓**

* Copper compounds are most effective when tank-mixed with mancozeb.
** Streptomycin can only be applied to seedlings in the greenhouse. Not for field use.
S – Suppression only

Sources:
[1] Jones, J., Zitter, T., Momol, T., and Miller, S. 2014. Compendium of tomato diseases and pests, second edition. American Phytopathological Society, St. Paul, MN.
[2] LeBoeuf, J., Cuppels, D., Dick, J., Loewen, S., and Celetti, M. 2005. Bacterial diseases of tomato: bacterial spot, bacterial speck, bacterial canker. OMAFRA FactSheet, ISSN 1198-712X.
[3] Keinath, A. 2012. Controlling bacterial spot on tomato and pepper. Clemson Cooperative Extension. IL 91.
[4] Saha, S., Pfeufer, E., Bessin, R., Wright, S., and Strang, J. 2016. Vegetable production guide for commercial growers, 2016-17. University of Kentucky, Cooperative Extension Service. ID-36.
[5] Reiners, S. and Seaman, A. 2017. Cornell integrated crop and pest management guidelines for commercial vegetable production.
[6] Egel, D., Foster, R., Maynard, E., Weller, S., Babadoost, M., Nair, A., Rivard, C., Kennelly, M., Hausbedk, M., Hutchinson, B., Eaton, T., Welty, C., and Miller, S. 2017. Midwest vegetable production guide for commercial growers 2017.

For additional agronomic information, please contact your local seed representative.

Performance may vary from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields. The recommendations in this article are based upon information obtained from the cited sources and should be used as a quick reference for information about tomato production. The content of this article should not be substituted for the professional opinion of a producer, grower, agronomist, pathologist and similar professional dealing with this specific crop.

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