New Mexico Chile Association ♦ Report 30

New Mexico Chile Association

# Bacterial Leaf Spot of Chile Pepper: A Short Guide for Growers

NM State University
College of Agriculture and Home Economics
Cooperative Extension Service • Agricultural Experiment Station

In January 2006, the New Mexico Chile Association (NMCA) accepted the role of what was formerly the New Mexico State University (NMSU) Chile Task Force. The NMCA is a non-profit organization composed of processors and farmers whose mission is "To create an environment in the New Mexico region that reinstates us as the world leader in chile production, processing and innovation." The NMCA continues to work closely with NMSU. Indeed, this partnership is key to their success.

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# Bacterial Leaf Spot of Chile Pepper: A Short Guide for Growers[1]

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## What are the symptoms of bacterial leaf spot?

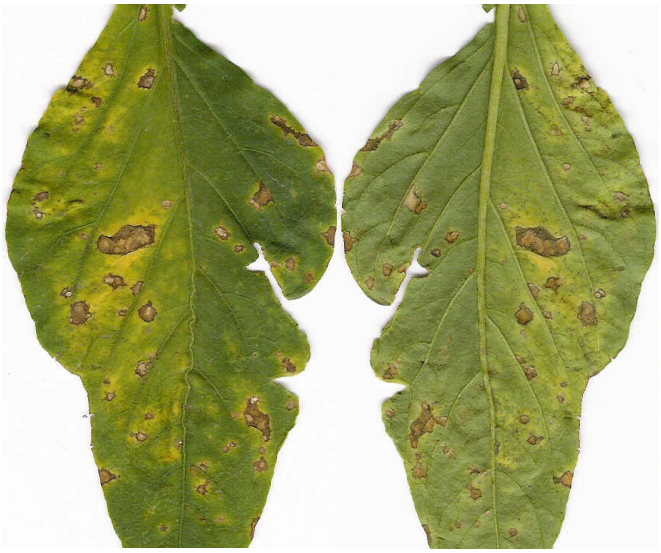

Figure 1. Symptoms of bacterial leaf spot on the upper surface (left) and the lower surface (right) of a chile pepper leaf.

- Leaf spot of pepper is caused by bacteria belonging to several species in the genus *Xanthomonas*. Symptoms appear as water-soaked spots that change from green to dark-brown as infection progresses. The spots or lesions are often surrounded by yellow zones called halos (Figure 1).
- The size of lesions is fairly variable. On some cultivars, leaves may display several small lesions (0.25 to 0.5 cm) covering over 80% of leaf area, whereas on others fewer large lesions (larger than 0.5 cm) may be visible. In some cases a combination of small and large lesions may be found on the leaves.
- Fruit can also be infected by bacteria and show symptoms similar to those exhibited by leaves.

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- Appearance of symptoms on leaves and fruit is influenced by several factors, including the strain of the causal bacterium, cultivars, and weather conditions. Defoliation can occur as a result of serious bacterial leaf infection on peppers.

## Where is bacterial leaf spot found?

- Bacterial leaf spot of pepper occurs worldwide. In New Mexico, bacterial leaf spot occurs in all major chile pepper growing areas. In 2006 and 2007, the disease was particularly noticeable due to higher moisture conditions recorded during the growing season in those two years.
- In surveys in Luna, Doña Ana, Sierra, Chaves, and Roosevelt counties, disease was present in all fields surveyed, with up to 100% disease incidence at the field level (all plants in the field showed symptoms of leaf spot) and plant level (all leaves on each plant had symptoms of leaf spot), and with over 50% disease severity at the leaf level (more than 50% of leaf area was covered with spots).

## How do leaf spot bacteria survive?

- Bacteria causing leaf spot of pepper survive from season to season in seeds, in infested plant debris in soil, and in the roots of non-host plants, including weeds.
- Bacteria can survive on dried seeds for at least 10 years. Infested dried seeds that have been stored for 10 years can produce plants with bacterial spot symptoms. Therefore seeds constitute a good avenue for survival and spread of the pathogen.
- In soil alone, bacteria can survive from about two weeks to at least 18 months depending on soil type and location.
- On dried pepper leaves, bacteria can persist for at least four months, and disease can originate from infested leaves left on soil surface or buried in soil.

## How do leaf spot bacteria hide in fields?

- Leaf spot bacteria can be present inside leaves, buds, and roots without any expression of disease symptoms. This is referred to as symptomless or asymptomatic infection.

- Symptomless infection can lead to a severe outbreak of leaf spot when environmental conditions become favorable to disease development. Populations of bacteria on asymptomatic leaves can be significantly reduced by copper sprays; however, bacterial populations in buds may be less affected by such sprays. Thus, buds provide bacteria ideal refuge from sprays as well as UV light, and provide moisture for growth and reproduction of bacteria.
- Fruit can also support high populations of bacteria without showing any symptoms, and fruit can shed off as a result.

## How do leaf spot bacteria spread in fields?

- Infected plants displaying symptoms act as a rapid means of dispersal of the leaf spot bacteria. The spread of the pathogen is favored by rainfall splash and by farm operations in fields when foliage is wet. Upon impacting on lesions, rain droplets disperse bacterial cells through many micro-droplets from infected plants to neighboring healthy plants or over distances as far as a few meters, especially under windy conditions.
- When foliage is wet, farm operations allow bacterial cells from infected plants to be carried on tools and clothing and transported to healthy plants in other field areas. Bacteria can become airborne as aerosols and be carried afar.

## How do bacteria invade plants and what conditions favor plant infection?

- Bacteria typically enter plant tissue through wounds and natural openings such as stomata on leaves. In warm weather and under moisture conditions such as those provided by prolonged light rainfall, high relative humidity (higher than 85%), or overhead irrigation, populations of bacteria can reach high levels and cause severe infection. As a result, severe plant defoliation can occur with high yield loss.

## How to manage bacterial leaf spot?

- Any disease management (DM) strategy should be focused on breaking up the disease cycle. This can be achieved by using the following formula: $DM=S^2IR$ (Sanogo, unpublished). This formula states that Disease Management is achieved by stopping or reducing Survival of pathogens, Spread of pathogens, Infection of plants, and Reproduction of pathogens.
- For bacterial leaf spot, three methods can be used to reduce survival, spread, and reproduction of bacteria and to minimize infection of plants: seed treatment, foliage treatment, and an integrated strategy.

## What seed treatments are used for bacterial spot?

1. **Bleach treatment**
   - Seed treatment with sodium hypochlorite (for example, Clorox) is effective in reducing bacterial populations on seed surfaces. However, bacteria inside the seeds are little affected by this treatment. Growers in New Jersey and Ohio have been using Clorox seed treatment for years on peppers, with excellent results.
2. **Hot water treatment**
   - Seed treatment with hot water is effective in reducing bacterial populations on the surface and inside the seeds. However, seed germination may be jeopardized by heat treatment more than by properly applied sodium hypochlorite treatment.

## What foliage treatments are available for bacterial leaf spot?

1. **Transplant treatment with streptomycin**
   - Control of bacterial spot on greenhouse transplants is an essential step for preventing spread of the leaf spot bacteria in the field. Transplants should be inspected regularly to identify symptomatic seedlings. Transplants with symptoms may be removed and destroyed or treated with streptomycin. It should be noted that strains of leaf spot bacteria resistant to streptomycin may arise with multiple applications of streptomycin.

2. **Copper sprays and other topical treatments**
   - Copper sprays can be used for control of leaf spot bacteria, but they may not be effective when used alone continuously. Indeed, continuous copper sprays may lead to the development of resistant strains of leaf spot bacteria and thus decrease the effectiveness of copper sprays.
   - Other topical products such as Oxidate may be used.
3. **Plant activator sprays**
   - Some pathogens invade plant tissue and cause tissue death. This infection triggers resistance in other plant parts that have not been exposed to the pathogen. This resistance has been termed systemic acquired resistance (SAR).
   - Certain commercial chemicals are known to induce SAR in plants and are called plant activators. Plants treated with such activators produce compounds that interfere with the activities of plant pathogens.
4. **Biological or microbial products**
   - Products containing microorganisms can be used to enhance plant growth and reduce the negative effects of diseases. These products may contain plant-growth-promoting rhizobacteria (PGPR) or biological agents.
   - PGPR are bacteria that live on plant roots or in soil around plant roots without causing any harm to plants. Instead, these bacteria enhance plant growth and also may induce resistance to plant pathogens. The resistance triggered in plants by PGPR bacteria is known as induced systemic resistance (ISR).
   - Biological agents are microorganisms (fungi, bacteria, or viruses) that are able to compete with or antagonize plant pathogens. As such, biological agents can reduce the negative effects of diseases on crops.
   - Several products containing microorganisms are sold for biological control of diseases. Examples are Serenade and Sonata, both of which contain beneficial bacteria. Another example is Agriphage, which contains bacteriophages—viruses that infect bacteria.

## Integrated management strategy is the key to minimizing bacterial spot

- Several steps can be used to minimize bacterial leaf spot on chile pepper. These steps include selecting resistant or tolerant varieties, field scouting to time treatments well, roguing infected plants to reduce the spread of leaf spot bacteria, and timing mechanical and labor operations to occur at times when the risk of spreading leaf spot bacteria is lower.
- The grower's first line of defense is at planting. Growers should plant only bleach-treated seeds of leaf-spot-tolerant varieties. Plant only fields in which peppers and pepper residues have been absent for at least two growing seasons. In the greenhouse, treat transplants with streptomycin if there is any possibility of increased bacterial leaf spot. Growers are advised against multiple applications of streptomycin because spontaneous resistance to streptomycin can occur in leaf spot bacteria.
- If a problem with bacterial leaf spot is anticipated, it is advisable to scout fields regularly to identify plants with early symptoms. During the growing season, regular inspections of a cross-section of each field should be made. Often, the first signs of infection are individual plants with very few leaf spots. These plants most likely originate from infected seed and can be the source for rapid spread of bacteria when favorable weather occurs. Any such plants should be removed and destroyed before they serve as a center from which bacteria may spread to other field areas. Alternatively, plants should be treated, and treatment should begin even if only a few plants are identified. (Hoping that the weather will cooperate is not a good strategy.)
- Regardless of the treatment strategy you adopt (copper sprays, SAR, ISR, biological), total plant coverage is essential. Total coverage requires multiple nozzles and high water volumes and is much easier to accomplish on smaller plants at first opportunity.

## Note

*This short guide is intended to provide chile growers with an understanding of bacterial leaf spot. Products mentioned herein are for illustration purposes, and no endorsement is implied by the authors or the New Mexico Chile Association. Before using any products, check with your crop consultant or advisor.*

## Selected Information Sources


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Notes

# NM Chile Task Force/NM Chile Association Publication List

**Report 1:** An Industry-University Response to Global Competition

**Report 2:** Chile Seed Germination as Affected by Temperature and Salinity

**Report 3:** Yield and Quality of Machine-Harvested Red Chile Peppers

**Report 4:** Chile Seed Quality

**Report 5:** Guidelines for Chile Seed Crop Production

**Report 6:** Improving Chile Harvesting and Cleaning Technologies

**Report 7:** Farm Labor Employers' Handbook

**Report 8:** New Mexico's Chile Pepper Industry: Chile Types and Product Sourcing

**Report 9:** Economic Impact of Southern New Mexico Vegetable Production and Processing

**Report 10**: Chile Pepper Growers' Notes: 2003

**Report 11**: Developing New Marketing Strategies for the Southwestern Chile Industry

**Report 12**: Incidence of the Beet Leafhopper, *Circulifer teneilus* (*Homoptera: Cicadellidae*), in New Mexico Chile

**Report 13**: Plant Spacing/Plant Populations for Machine Harvest

**Report 14**: Economic Return to Adoption of Mechanical Thinning

**Report 15**: U.S. Imports and Exports of Chile Peppers and Pepper Products: Frequently Asked Questions

**Report 16**: International Trade in Chile Peppers: Data from the Global Trade Atlas

**Report 17**: Basic Research on the Use of Polarization to Sort Chile Peppers

**Report 18**: An Analysis of Farm Labor Contracting in New Mexico

**Report 19**: Use of Kaolin to Suppress Beet Curly Top Virus in Chile Peppers

**Report 20**: Using a Color Sorter to Remove Sticks from Mechanically Harvested Red Chile

**Report 21:** Regional Branding in a Global Marketplace

**Report 22:** Refinement and Testing of Mechanical Cleaners for Red Chile

**Report 23:** NMSU Crop Thinner Project: A Model for Commercialization of University Intellectual Property

**Report 24:** Chile Machine Harvesting Observations: 2004

**Report 25:** Design and Development of a Prototype Mechanical Gap Sorter for Mechanically Harvested Red Chile

**Report 26:** Good Agricultural Practices: What Growers Should Know

**Report 27:** Red Chile Pod Reclaimer Evaluations

**Report 28:** Chile Machine Harvesting Trals

**Report 29:** 2006 Southwest Agribusiness Conference: Proceedings

**Report 30:** Bacterial Leaf Spot of Chile Pepper: A Short Guide for Growers

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