



PREVENTATIVE CONTROL GUIDE: BACTERIAL LEAF SPOT

Bacterial Leaf Spot (BLS) diseases impact a wide range of crops, including flowering ornamentals (geranium, begonia, chrysanthemum, impatiens, poinsettia, and many more); foliage plants; nursery crops (lilac, rhododendron, etc.); and key vegetable and fruit crops such as tomato, pepper, cucurbits, lettuce, strawberry, stone and pome fruits, and others. BLS may infect leaves, stems, flowers and fruit.

BLS diseases are caused by various *Xanthomonas*, *Pseudomonas*, and *Erwinia* species. Some of these species have a wide host range, while others are host specific. Identification of the disease organism(s) by a reputable diagnostic lab will aid in developing a successful Integrated Plant Health Management strategy.

SYMPTOMS

Small brown to black spots, circular or irregular, are described as water soaked or greasy. They begin on the underside of leaves, where bacteria primarily reside. Areas around the spots may turn yellow. Infections expand to form Y-shaped or angular lesions, bounded by the veins in the leaf. Wilting may occur as disease progresses.



SOURCES AND SPREAD

Seeds, cuttings and plugs frequently serve as new sources of pathogens. But bacterial pathogens may also come in via contaminated water, can persist in plant debris for years, and reside on benches, pots, trays or equipment. The bacteria are spread by splashing water: overhead irrigation, rain, or dripping water. Conditions favorable for foliar bacterial disease development are warm temperatures, free water on foliage, high humidity, dense crop canopy and tight plant spacing.



PREVENTION IS THE BEST STRATEGY

Bacteria build to high levels before symptoms become visible. And bacterial pathogens can multiply much more quickly than fungal pathogens. Once an infection is established, it is difficult or impossible to eradicate.

+ Start with clean plant material

Bacterial diseases may be transmitted on seeds, cuttings, plugs and liners. Purchase clean plant material from reputable suppliers who maintain good disease management practices.

+ Master good sanitation practices

Maintain clean and disinfested growing environments to greatly reduce accumulation and transfer of bacterial (and fungal) plant pathogens. Once plant material and other debris are physically removed, disinfect equipment, benches, pots, trays and tools with PERpose Plus.

+ Use cultural controls to avoid creating conditions that are favorable for disease

Wet leaves are ideal candidates for disease. The bacteria reproduce in water and swim into leaves through stomata and wounds. The longer leaves remain wet, the greater the chances for bacterial infection, growth and manifestation as a foliar disease. Ideally, overhead irrigate only when leaves can dry in an hour or less. Minimize handling when the plants are wet to reduce spread and infection.

+ Rogue-out diseased plants ASAP; remove plant debris from growing area

These practices remove bacterial inoculum during and after crop production. *Xanthomonas* can survive in dried leaf tissue in greenhouses for 3+ years!



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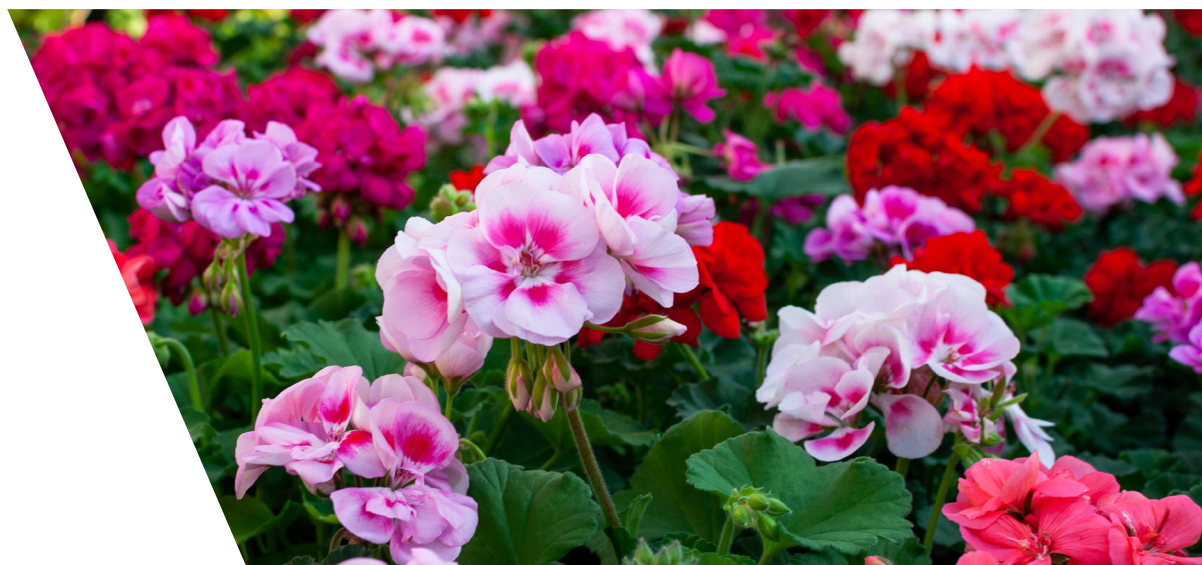
SOLUTIONS

Successful management strategies require products that will not develop disease resistance, effective application timing and product rotation, and preventative action to avoid devastating outbreaks.



BOTRYSTOP® WP

- + Biofungicide with a unique a.i.: *Ulocladium oudemansii* strain U3, that aggressively out-competes pathogens on plant surfaces and in dead and senescing plant tissue
- + Excellent rotational partner and tool for resistance management; it is highly unlikely that resistance will develop



PERPOSE PLUS®

- + A versatile hydrogen peroxide-based product which controls bacterial and fungal diseases and algae without harming plants
- + Clear and odorless, leaves no residue, OMRI Listed, 0 to 1-hour REI



CEASE®

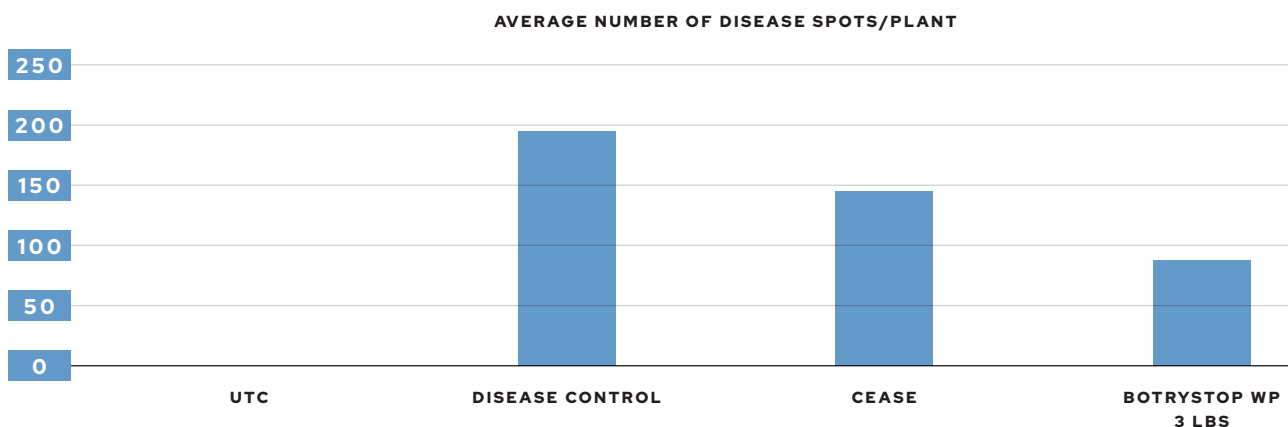
- + Biofungicide (*Bacillus subtilis* strain QST 713) for preventative control or suppression of a wide array of both fungal and bacterial pathogens, including *Xanthomonas*, *Pseudomonas* and *Erwinia*
- + Performs as well as copper-based products, without phytotoxicity, resistance or visible residues



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APPLICATION TIMING			
BACTERIAL LEAF SPOT	PROPAGATION	VEGETATIVE GROWTH	FLOWERING AND FRUITING
PERpose Plus	Apply in mist 1:1000-5000; Treat contaminated water sources 1:300	Weekly preventative foliar spray at 1:300; Curative rate 1:100 for 1-3 days	
CEASE		Weekly preventative spray, use in tank mix or rotation; can apply as often as every 3 days	
BotryStop WP		Apply every 7-10 days when conditions favor disease	Apply at early and late bloom

BOTRYSTOP WP VS XANTHOMONAS (BLS) ON GERANIUM



Key takeaways:

- + CEASE provided significant control of BLS on geranium (results taken 14 days after inoculation)
- + BotryStop WP provided superior control of BLS on geranium
- + BotryStop WP and CEASE are effective biopesticides for some bacterial leaf spot diseases

Research trial carried out by Dr. Dave Norman, University of Florida.

Please refer to product labels for complete application instructions. Always read and follow label directions.
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GOING ABOVE AND BEYOND

At BioWorks, we not only help eradicate harmful diseases and pests that threaten your crops, but we design and support integrated plant health management programs. And because we know how quickly some diseases can work, we respond to any questions you might have in just four hours. So you can get back to the business of successful growing.



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