

EVALUATION OF BACTERICIDES FOR SUPPRESSING BACTERIAL SPOT OF BELL PEPPER IN THE GREENHOUSE

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Introduction

Bacterial spot (caused by the bacterium *Xanthomonas campestris* pv. *vesicatoria*) affects bell pepper grown in Georgia each year. This disease attacks all stages of the crop and the fruit as well. Complete defoliation and yield loss is often observed during hot, wet growing seasons. Some resistant varieties are available but there are many more races of the pathogen than there are resistance genes in commercially available pepper lines. Few materials are labeled to suppress bacterial spot of bell pepper. Generally, copper + maneb has been the mainstay for bacterial spot suppression but copper resistance has been reported in the pathogen and is common. Other materials such as antibiotics, disinfectants, bacteriophages, biological antagonists, and plant defense activators have been used but with limited success. Especially on pepper because Actigard (acibenzolar-s-methyl) is phytotoxic to pepper but not tomato. This study is part of ongoing research focused on evaluating potential materials that suppress the development of bacterial diseases on pepper.

Materials and Methods

Bell pepper (*Capsicum annuum* 'Early Cal Wonder') were seeded on August 15th into 200 cell, black, plastic seedling trays. Seed were placed in a germination chamber for 1 week prior to being placed in a commercial greenhouse in Ty Ty, GA. Trays were arranged in a randomized complete block design with six replications. There was approximately 1-ft between each tray on a rail for a total of 8 trays per rail. Bactericide treatments were applied with a single 8002 nozzle that was attached to a rail supported by a plexiglass box. The rail could be adjusted to raise or lower the nozzle based on the height of the crop. The plexiglass box was used to support the boom rail and to isolate bactericide treatments. The spray was calibrated to deliver the field rate of 80 GPA using 80 psi at 1.5 mph. Sprays were applied on September 23, 26, 28, and 30 October 3, 5, 7, 10, 12, and 14. The 4 center plants of each tray were inoculated with a race 1 strain of *X. c.* pv. *vesicatoria* by injecting a 1.0×10^8 cfu/ml suspension on the underside of the leaf with a needle-less syringe. The preventive mix of Agriphage® was used until October 5th and the following Agriphage® sprays was a mix specifically made using the strain of the pathogen used to inoculate. Plants were evaluated by assessing the amount of disease severity and spread from the inoculated area and the rating system used a 1-10 scale where 1=little to no spread and 10=100% spread on a foliage not inoculated.

Results and Discussions

Overall, bacterial spot severity was severe by the end of the test and was consistent with what growers observe in severe epidemics in commercial transplant situations. Treatments that performed well regardless of rotating with Kocide + Maneb were AgriPhage™ and Kasumin (kasugamycin antibiotic) (Table 1.). Serenade alone did provide significant suppression of bacterial spot compared to the non-treated check. All treatments were effective if they were rotated with Kocide + Maneb which underscores the importance of copper in bacterial spot management programs as well as copper use for resistance management.

Table 1. Effect of various bactericides on bacterial spot of bell pepper.

Treatments, rates, and (spray times) ^z	%BS Spread ^y
Agriphage @ 8.0 oz/9600 ft ² (1-10).....	4.4 bc ^x
Agriphage @ 8.0 oz/9600 ft ² (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre (2,4,6,8,10).....	4.5 bc
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(1-10)	4.1 c
Oxidate @ 1:100 ratio dilution (1-10)	7.8 a
Oxidate @ 1:100 ratio dilution (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(2,4,6,8,10).....	4.8 bc
Tanos @ 8.0 oz/acre(1-10).....	7.4 a
Tanos @ 8.0 oz/acre (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(2,4,6,8,10).....	4.9 bc
Terpene @ 4.0 ml/L (1-10).....	7.4 a
Terpene @ 4.0 ml/L (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(2,4,6,8,10).....	4.7 bc
BioPhos @ 3.6 fl oz/1000 ft ² (1-10).....	7.6 a
BioPhos @ 3.6 fl oz/1000 ft ² (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(2,4,6,8,10).....	5.0 b
Serenade @ 1.0 lb/acre + Biotune @ 0.3% v/v (1-10)	7.1 a
Serenade @ 1.0 lb/acre + Biotune @ 0.3% v/v (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(2,4,6,8,10).....	4.2 bc
Kasugamycin @ 500 ml/ha(1-10).....	4.5 bc
Kasugamycin @ 500 ml/ha (1,3,5,7,9)	
Kocide 2000 @ 1.0 lb/acre + Maneb @ 1.0 lb/acre(2,4,6,8,10).....	4.4 bc
Non-treated (water only).....	7.9 a

Spray times are: 1=Sept 23; 2= Sep 26; 3=Sept 28; 4=Sept 30; 5= Oct 3; 6=Oct 5; 7=Oct 7; 8=Oct 10; 9=Oct 12; and 10=Oct 14.

^yDisease severity value as described in materials and methods.

^x Means followed by the same letter(s) are not significantly different according to Fisher's protected LSD test at P≤0.05.