Microbial Treatment of Soil, Seed, and Plant: Can It Stop Chile Wilt?



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Biology of Verticillium Wilt (Verticillium dahliae)

Soilborne fungal pathogen

 May survive over 16 years as sclerotia (survival structures) in soil Has a broad host range including crops and weeds Causes stunting, defoliation, vascular discoloration, wilting, and plant death



Verticillium wilt





Verticillium wilt



Verticillium wilt



Verticillium wilt/Survival of pathogen in weeds



Verticillium wilt/Survival of pathogen in weeds

Tall morningglory

Ability of *Verticillium dahliae* from weed species to infect chile pepper

	Spurred anoda	Ground- cherry	Devil's- claw	Tall Morning-
Symptoms				glory
Wilt	Yes	Yes	Yes	Yes
Vascular discoloration	Yes	Yes	Yes	Yes

Pathway to Crop Losses – Verticillium wilt



Biology of Phytophthora Blight (Phytophthora capsici)

 Soilborne fungal-like (oomycete) pathogen Survives for many years as oospores (survival structures) in soil/debris Has a broad host range including crops and weeds Causes root rot, crown, foliar blight, fruit rot, wilting, and plant death





Spread of Phytophthora capsici





Zoospores

Pathway to Crop Losses – Phytophthora blight



Differential Features					
Sumptome	Phytophthora Blight	Verticillium Wilt			
Wilt	Yes	Yes			
Stunting	No	Yes			
Root Rot	Yes	No			
Defoliation	Νο	Yes			
Vascular necrosis	No	Yes			

Microbial Treatment



Microorganisms (Bacteria and fungi)



Microbial and Plant Interactions

Microbial interactions that reduce activities of pathogens

Microbial interactions that boost crop's response to pathogens Microbial interactions that reduce activities of pathogens (antagonism)

Antibiosis

Competition

Parasitism

Antibiosis



Antibiosis



Serenade

No Serenade

Competition



Competition



Parasitism

Trichoderma stromaticum

 Commercially used in Brazil (marketed as TRICOVAB) for control of cacao witchesbroom

















Т









Parasitism



Microbial and Plant Interactions

Microbial interactions that reduce activities of pathogens

Microbial interactions that boost crop's response to pathogens Microbial interactions that boost crop's response to pathogens

Mycorrhizae

Induced systemic Resistance (ISR)

VESICULAR-ARBUSCULAR MYCORRHIZA

ECTOMYCORRHIZA



fungal mantle



Handout-B1 Glomeromycota

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Source: The 5th Kingdom

Source: The 5th Kingdom

Efficacy of Microbial Products/ Laboratory Evaluation



Efficacy of Microbial Products Growth chamber/Greenhouse Evaluation





Efficacy of Microbial Treatment

 Seed with Streptomyces-based (Micro108) and Bacillus-based (Kodiak) biofungicides

 Transplant treatment with a Streptomycesbased biofungicide (Mycostop Mix @ 0.1% and 0.3%)

•No Seed treatment (Control) and Seed Treatment with Apron XL LS (chemical fungicide)



Effect of Seed Treatment and Transplant Treatment on Phytophthora blight

- 1 No seed treatment (Control)
- 2 Seed treatment with Streptomyces-based biofungicides (Micro108 at 8g/kg of seed)
- 3 Seed treatment with a Bacillus-based biofungicide (Kodiak at 85 mg/kg of seed)
- 4 Seed treatment with chemical fungicide (Apron XL LS at 0.42 ml/kg of seed)
- 5 No seed treatment + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.1% suspension)
- 6 Seed treatment with Apron XL LS + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.1% suspension)
- 7 Seed treatment with Micro 108 + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.1% suspension)
- 8 Seed treatment with Kodiak + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.1% suspension)
- 9 No seed treatment + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.3% suspension)
- 10 Seed treatment with Apron XL LS + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.3% suspension)
- 11 Seed treatment with Micro 108 + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.3% suspension)
- 12 Seed treatment with Kodiak + transplant treatment with Mycostop Mix (drenching with 100 ml of 0.3% suspension)

Seed /Transplant Treatment -Phytophthora blight



Soil and Transplant Treatment - Phytophthora



Efficacy of Microbial Products Field Evaluation









Treatment and rate/A (application time)	Marketable	AUDPC
Muscodor 3.5 oz/ft ³ soil (8 days pre transplant)	3.3	59.0
Muscodor 1.9 oz/ft ³ soil (8 days pre-transplant)	2.1	33.3
Actinovate SP 6 oz/100 gallons seedling drench		
pre-transplant + 12 oz foliar (1-9)	3.4	54.6
Serenade ASO 2.0% drench at transplant		
Serenade Max 2 lb + Kocide 2000 2 lb (1-9)	1.8	106.8
Ridomil Gold EC 1 pt drench at transplant		
Ridomil Gold Copper 2.5 lb (1,3,5,7)	3.0	70.1
Ridomil Gold EC 1 pt drench at transplant		
Ridomil Gold Copper 2.5 lb (3,7)		
alt Serenade Max 2 lb + Kocide 2000 DF 2 lb (1,5,9)	1.5	34.0
Ridomil Gold EC 1 pt drench at transplant		
Ridomil Gold Copper 2.5 lb (3,7) alt Actinovate SP 12 oz(1,5,9)	1.9	30.4
Ridomil Gold EC 1 pt drench at transplant		
Maestro 80DF 6 lb (3,7)		
alt Serenade Max 2 lb + Kocide 2000 2 lb (1,5,9)	3.4	36.3
Ridomil Gold EC 1 pt drench at transplant		
Maestro 80DF 6 lb (3,7) alt Actinovate SP 12 oz/A (1,5,9)	2.3	38.5
Untreated control	1.8	32.4
Miller et al. (2006)	(ton/A)	

Research Needs

Combination of strategiesFrequency of application