NEW APPROACHES TO CONTROL DISEASES IN ONIONS AND POTATOES

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OUTLINE

- Disease control in onions with drip application of Fontelis
- Control of the potato early die complex with biological pesticides

BACKGROUND

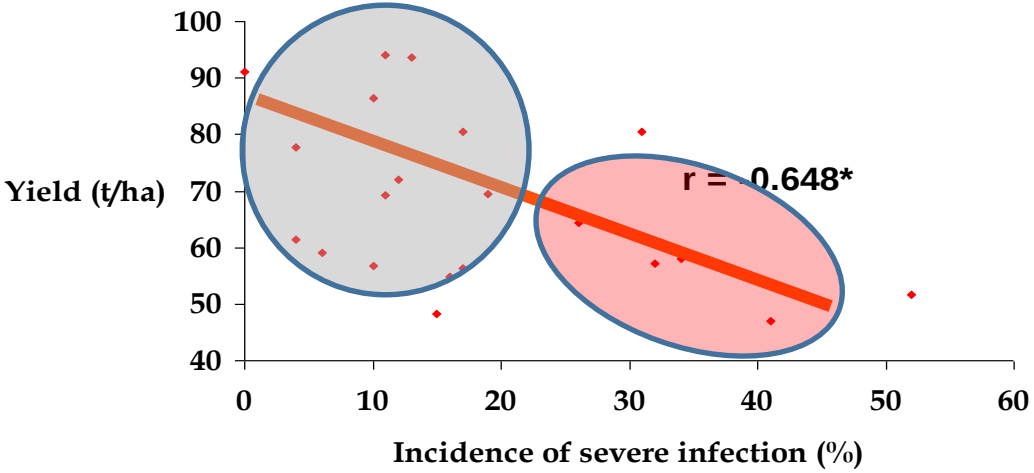
- Pink root is caused by the soil born fungus *Phoma terrestris.*

- Inoculum survives for long periods in soil, and pathogen has a wide host range = rotation is moderately effective.

- Soil temperatures above 70F are optimum for infection.

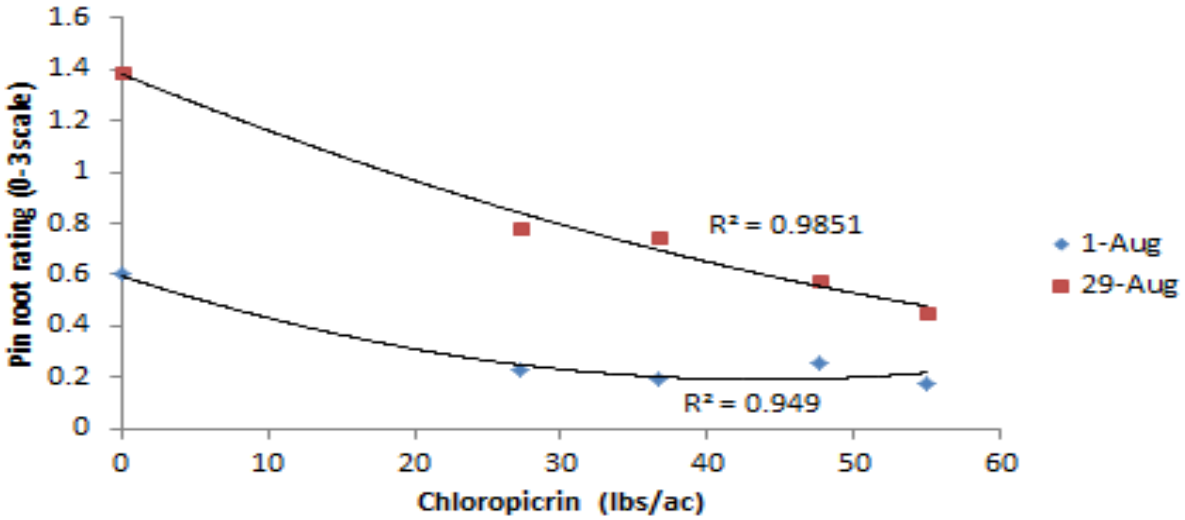
- **Host resistance and fumigation are primary means of control.**

RELATIONSHIP OF PINK ROOT SEVERITY TO YIELD IN ONIONS



Source: Thornton and Mohan, 1996

RELATIONSHIP BETWEEN FUMIGATION RATE AND PINK ROOT

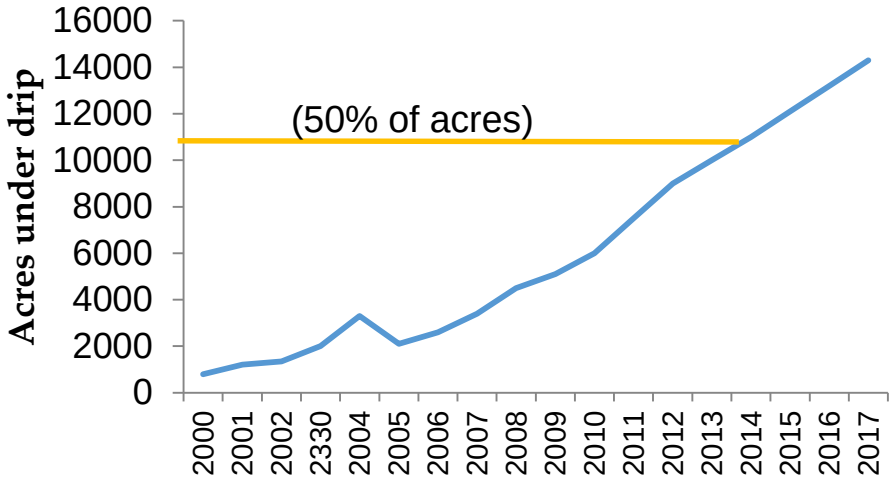


TWO-YEAR FIELD TRIAL

Compare pink root control of Chloropicrin to Fontelis

- Penthiopyrad (Group 7 fungicide)
- 2ee label for pre and post-plant applications for suppression of pink root
- Trials have evaluated in-furrow applications, few drip injection trials

Used on ~65% of onion acreage in the Treasure Valley

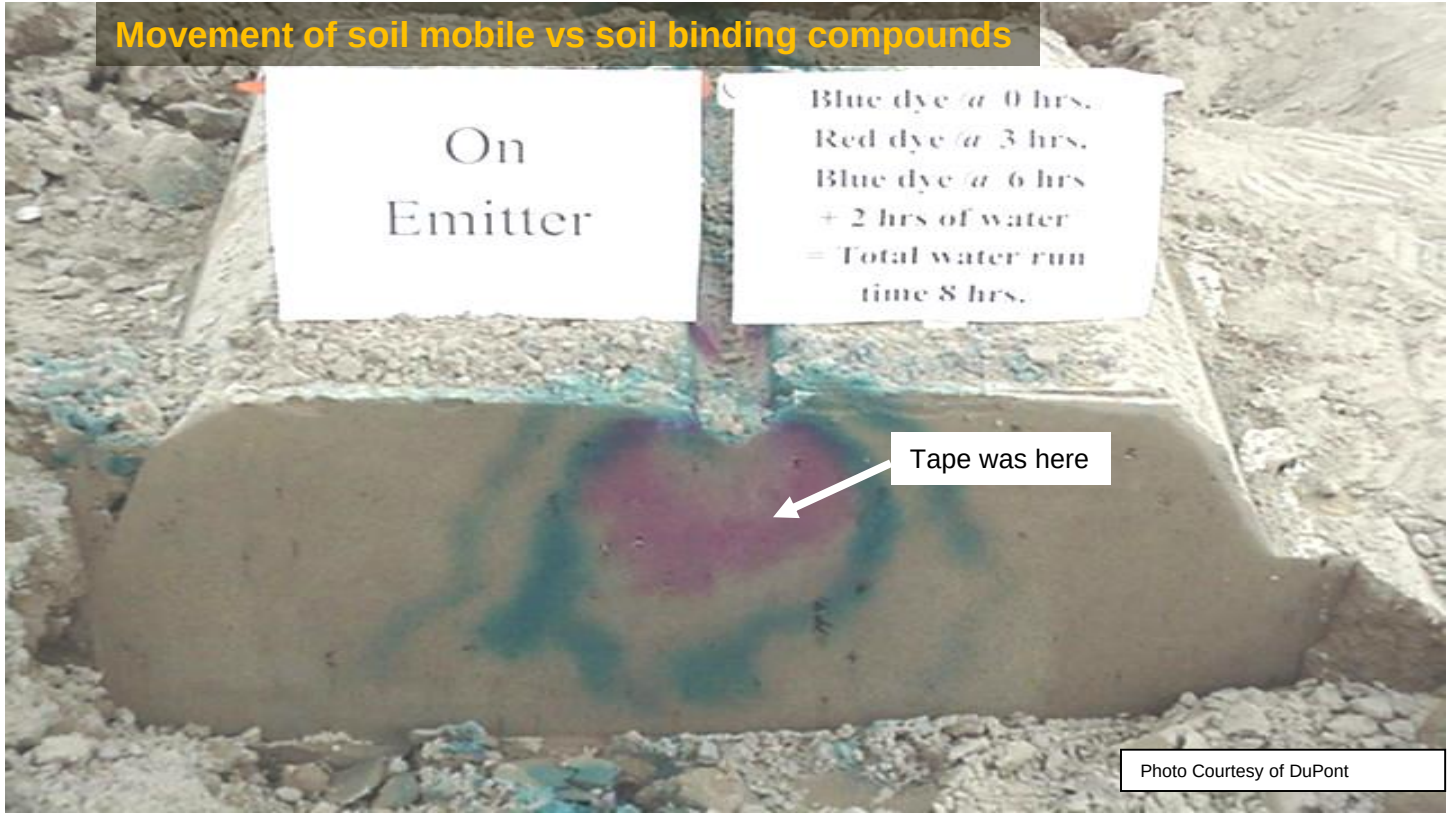


Treatments

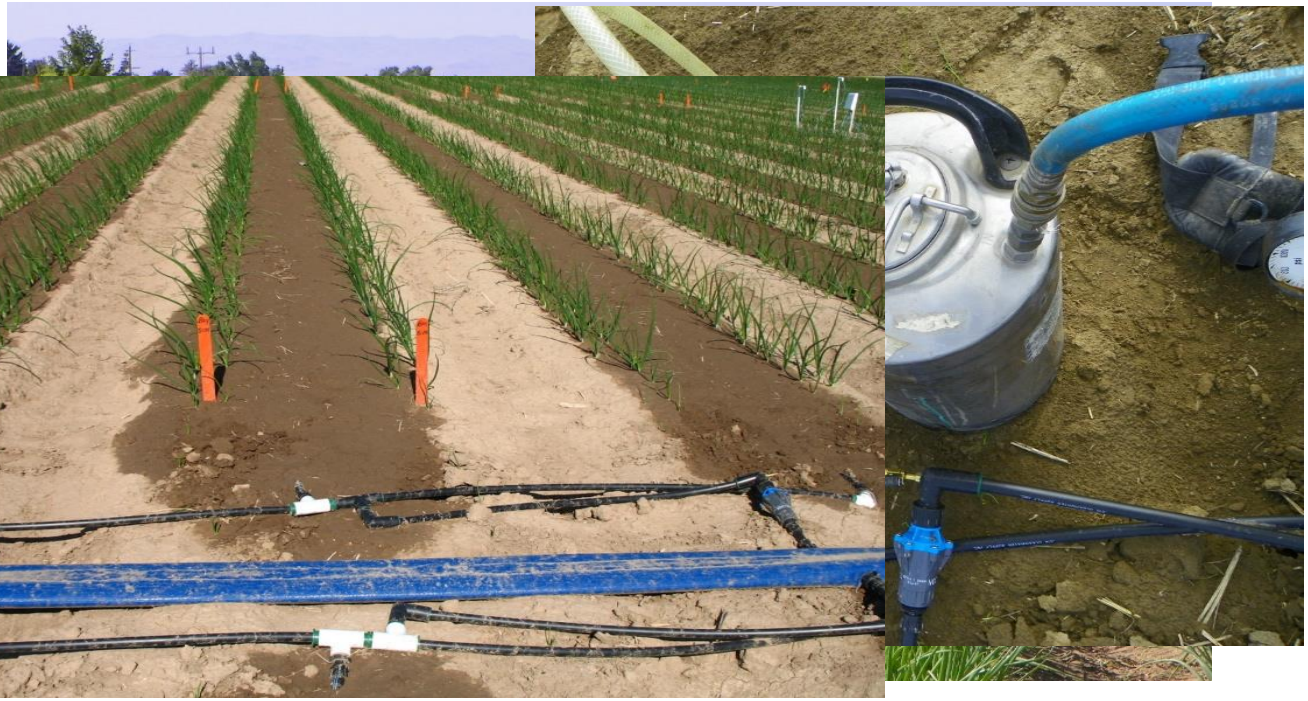
Treatment	Rate applied	Timing
Strike CP^	4 gal	Fall
Fontelis (early)*	24 oz	2 leaf
Fontelis (early + late)	24 oz 24 oz	2 leaf July 1
Control	--	--

^55 lbs/ac active ingredient
*0.3 lbs/ac active ingredient

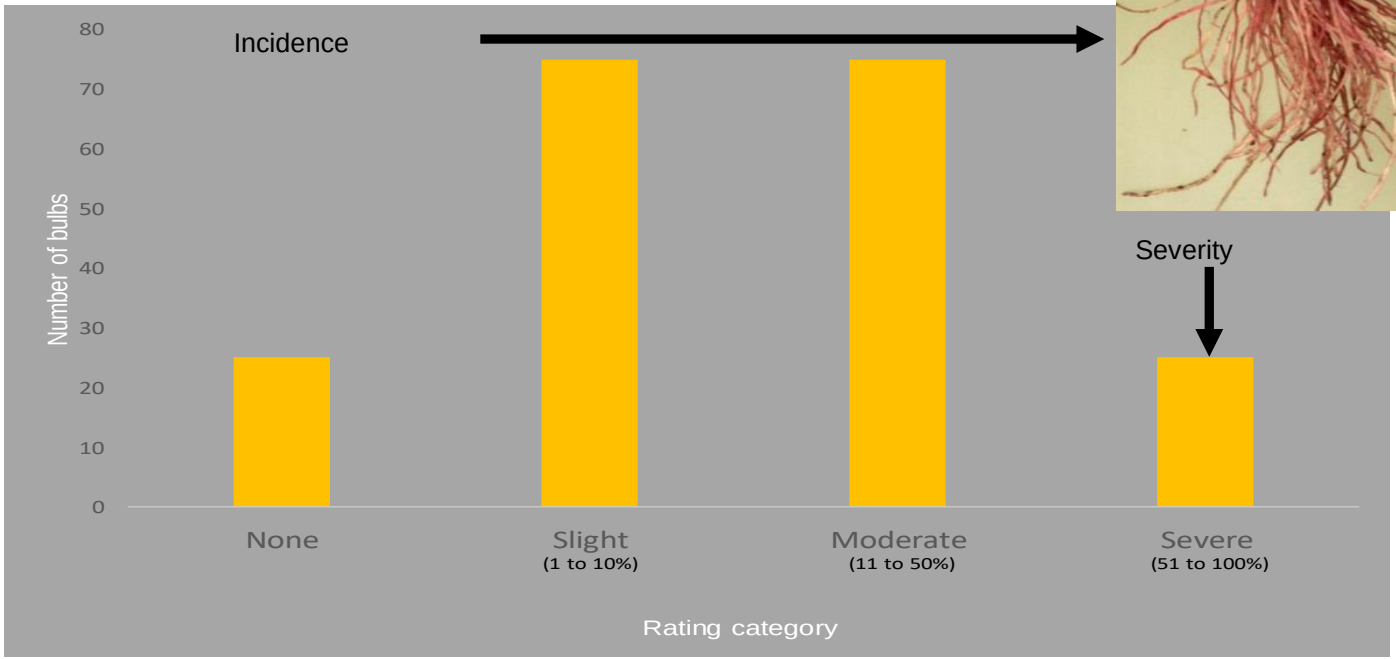
Movement of soil mobile vs soil binding compounds



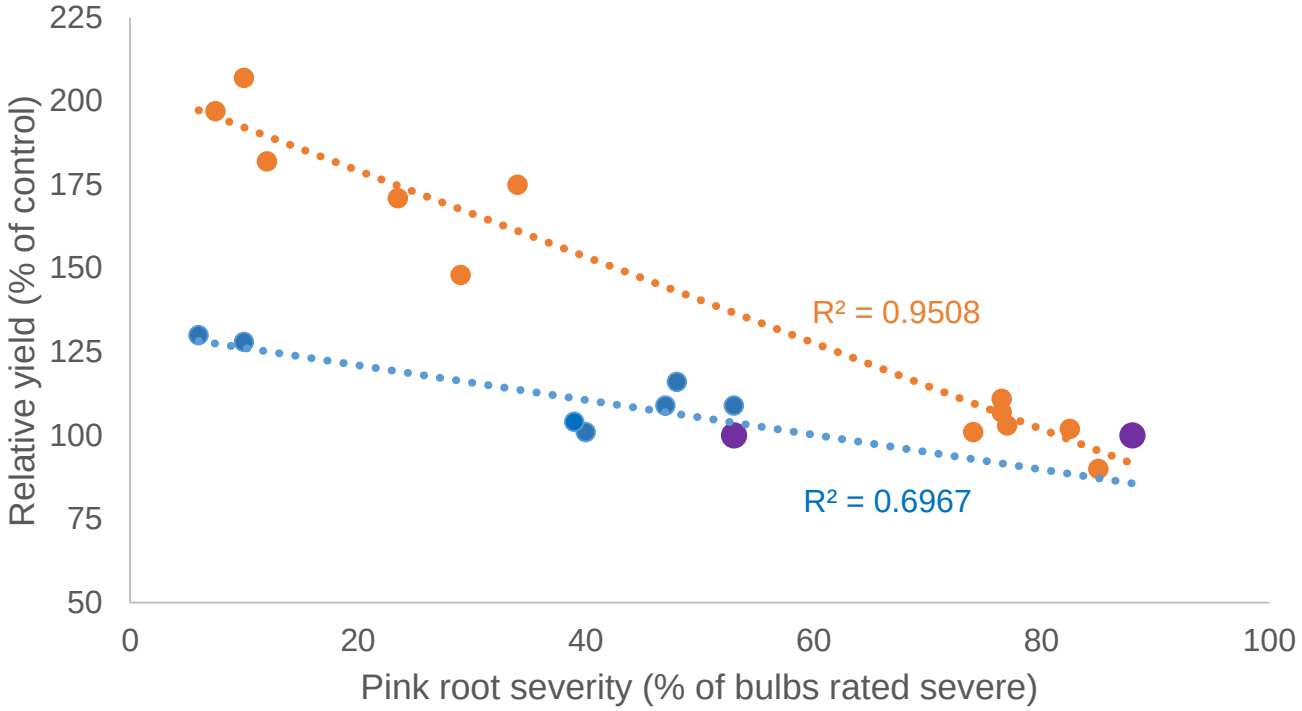
Both dyes highly soluble, red dye binds to the soil



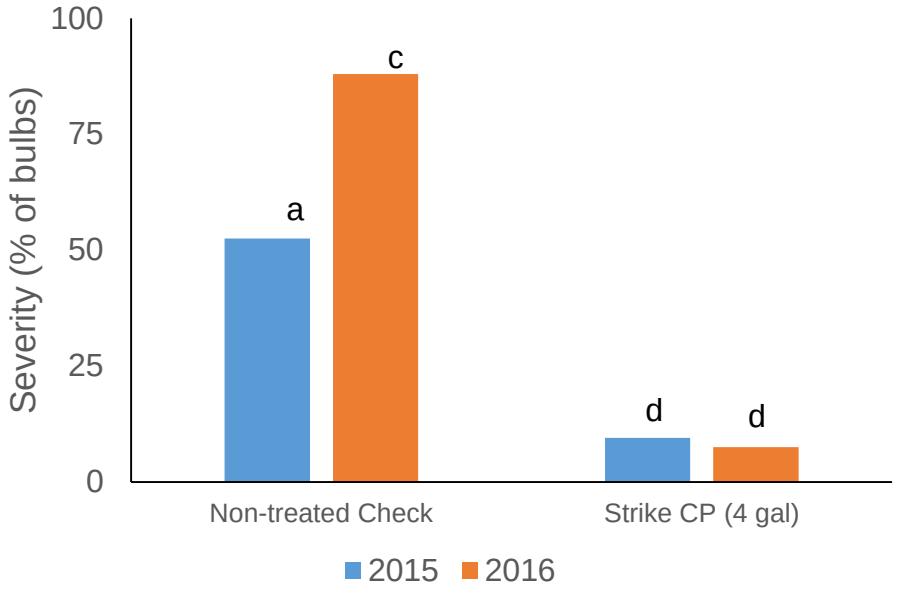
PINK ROOT RATING

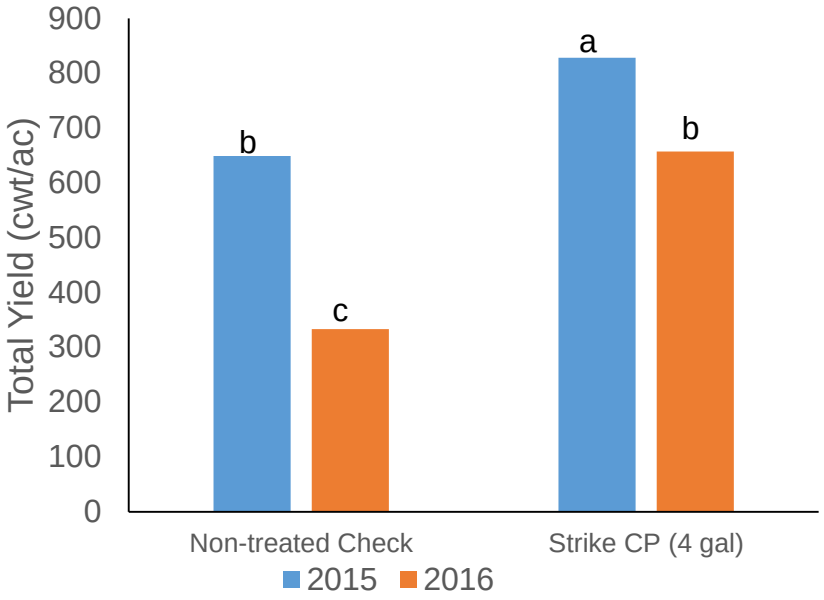


RELATIONSHIP BETWEEN PINK ROOT AND YIELD



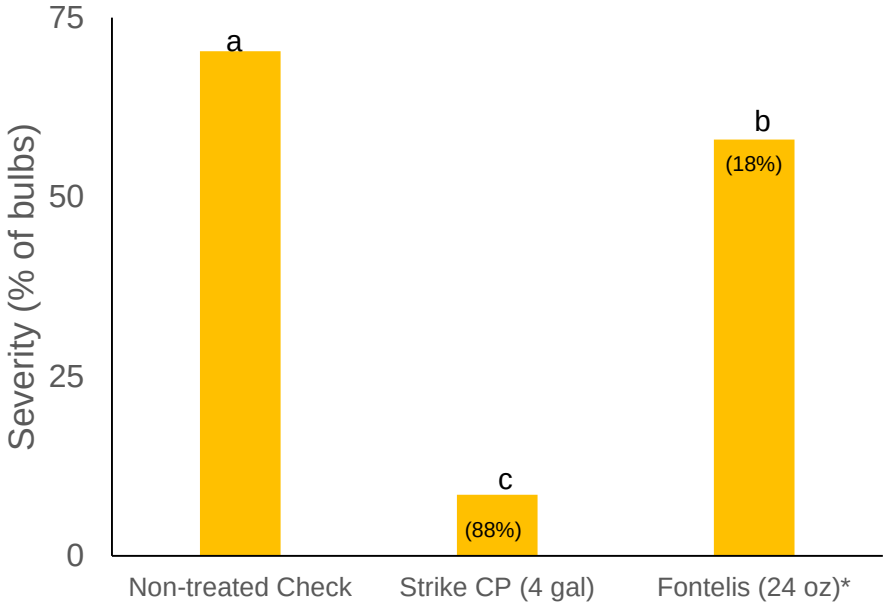
SIGNIFICANT TREATMENT BY YEAR INTERACTIONS

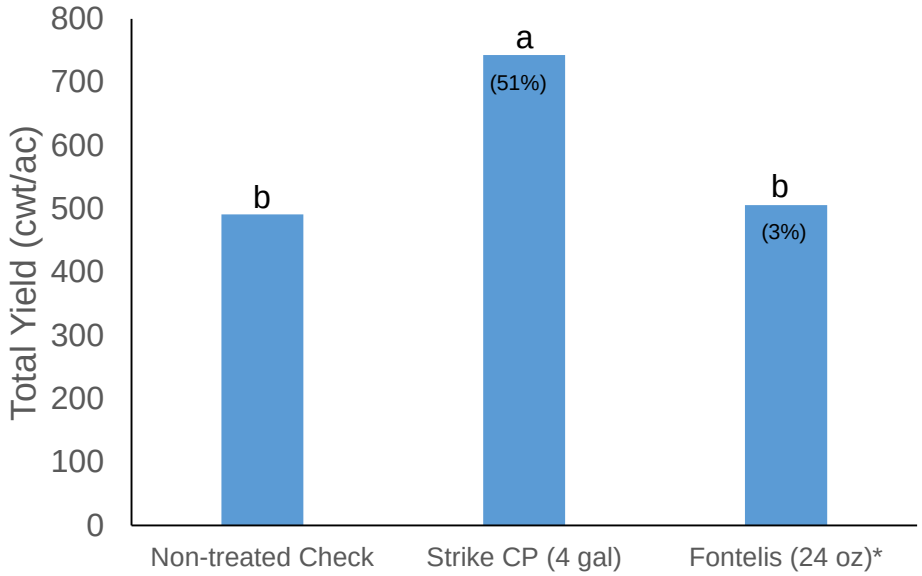




COMPARISON OF FUMIGATION TO FONTELIS

(MEANS OF 4 REPLICATIONS OVER 2 YEARS)

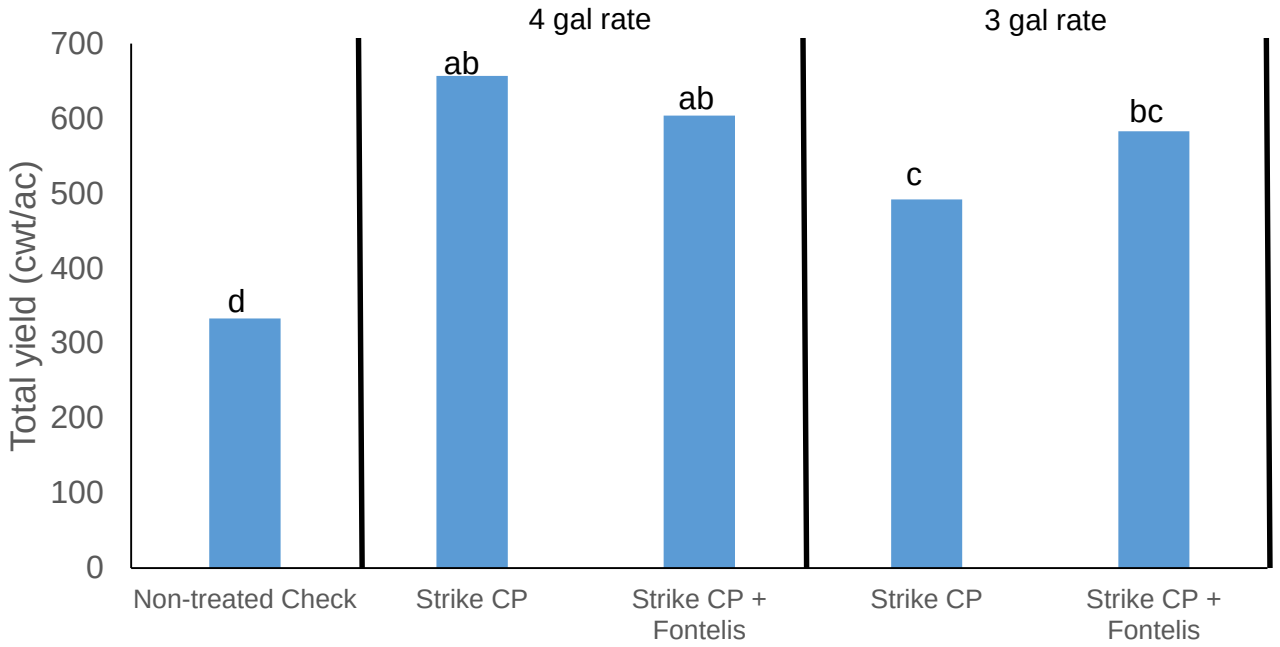




* Applied via drip at 2 leaf stage

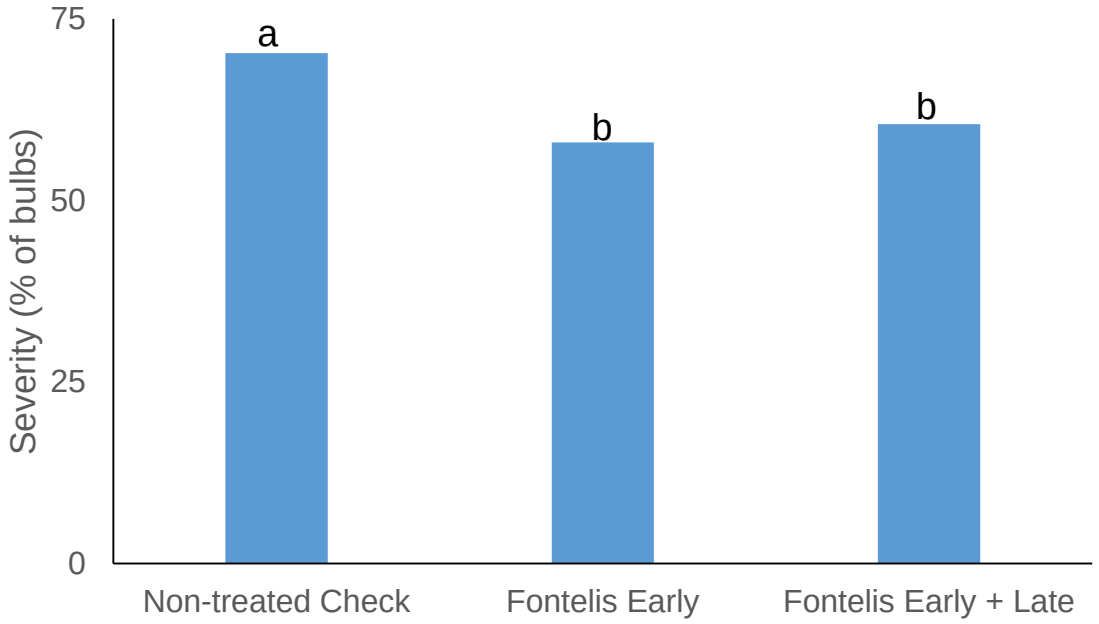
CAN FUMIGATION AND FONTELIS BE COMBINED?

(2016 only)

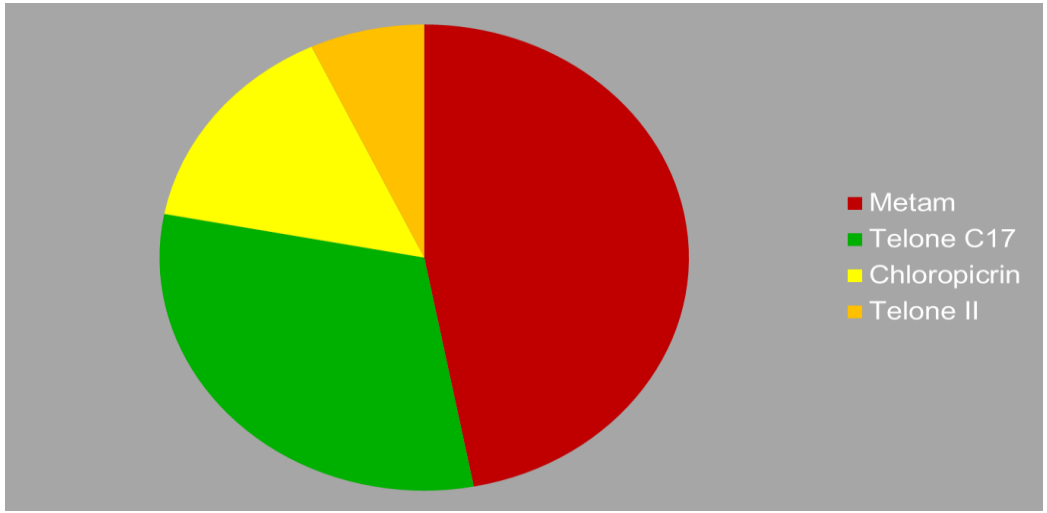


IS MORE THAN ONE APPLICATION NEEDED?

(means of 4 replications over 2 years)



2009 SURVEY OF ONION GROWERS
(> 90% FUMIGATED PRIOR TO ONIONS)

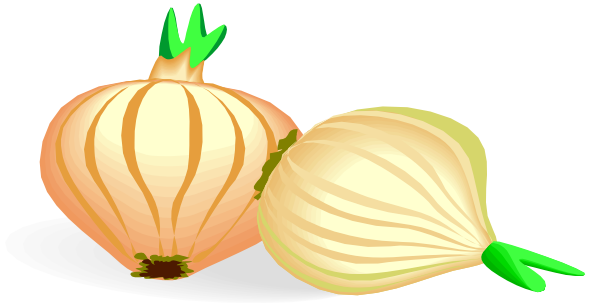


SHOULD WE RE-THINK HOW MUCH WE RELY ON FUMIGATION IN ONION PRODUCTION?

+ Breeding efforts are working
+ Drip irrigation reduces stress
+ Drip irrigation is lengthening rotations
+ Alternatives like Fontelis are available

ACKNOWLEDGEMENTS

- **Funding/ support provided by IEOOC, Dupont, Seminis and Allan Marks custom application**



EARLY DIE COMPLEX

- Two main pathogens: *Verticillium dahliae* and *Colletotrichum coccodes*
- Root lesion nematode interaction (*Pratylenchus* sp.)
- Cause plants to wilt prematurely leading to decreases in yield and quality
- Large host range >200
- Has cause yield losses as high as 50%

CONTROL MEASURES

- Crop rotation
- Sanitation
- Using certified seed
- Planting resistant varieties (Ranger Russet, Clearwater, Payette, etc)
- Fumigation (Metam sodium)
- Biological pesticides

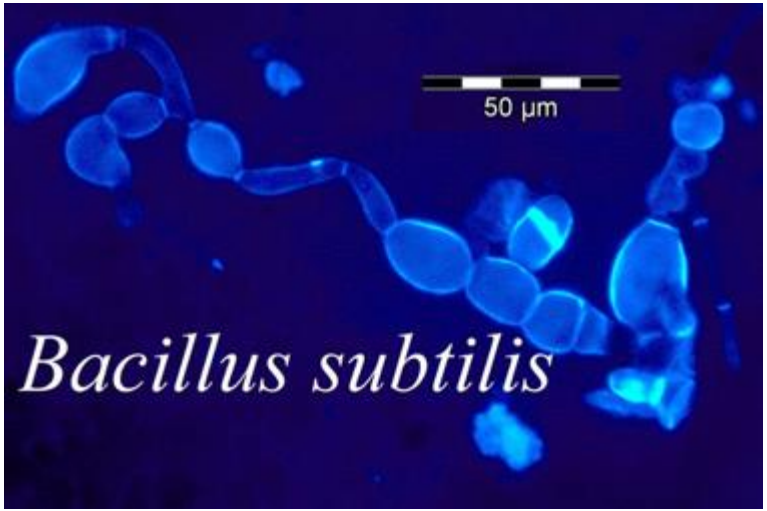
Source: http://spudsmart.com/soil-fumigation-potatoes/

BIOLOGICAL PESTICIDES

- Definition: Types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.
- Three types of biopesticides
  - Microbial
  - Plant-incorporated protectants (PIPs)
  - Biochemical

MICROBIAL BIOPESTICIDES

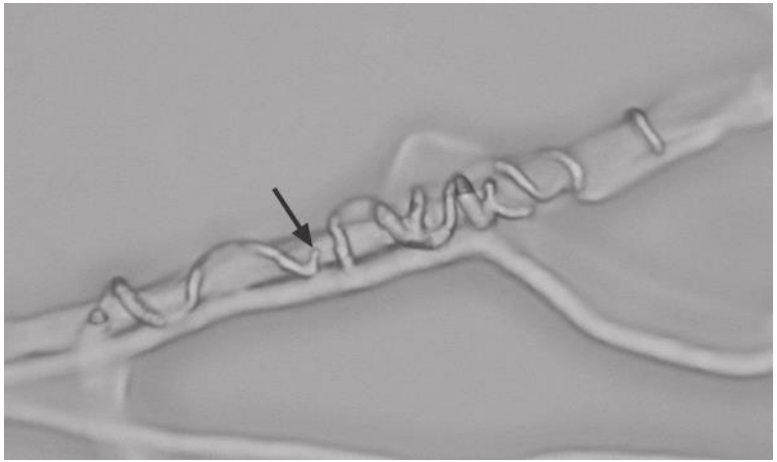
- Contain microorganims such as bacteria, fungi, viruses, protozoa as biocontrol agents that can control pathogen and insect pests



Source: http://organicsoiltechnology.com/bacillus-subtilis-bio-control.html

MODE OF ACTION

- Multiple modes of action:
  - Direct Competition (space, nutrients)
  - Antibiosis (antibiotics or other toxins)
  - Predation
  - Induced resistance
  - Plant growth promotion



Source: https://www.researchgate.net/publication/237091939_Genetic_basis_of_mycoparasitism_A_mechanism_of_biological_control_by_species_of_Trichoderma/figures?lo=1

ADVANTAGES

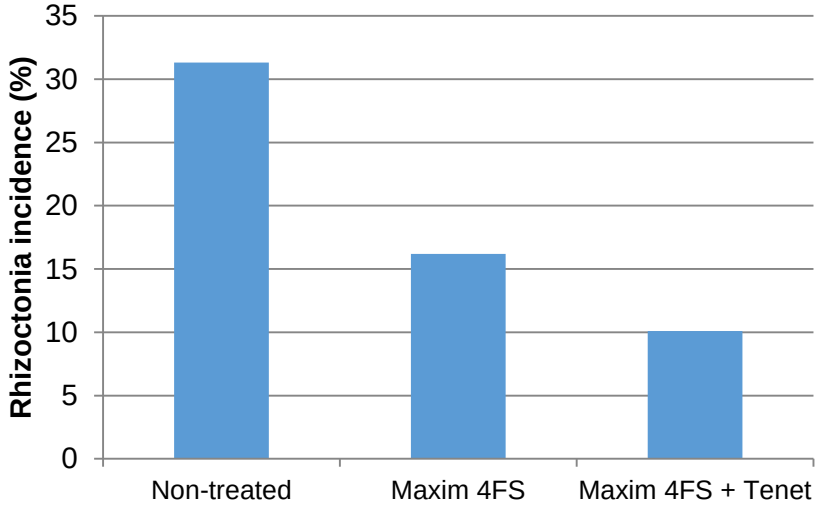
- Shorter re-entry and pre-harvest intervals
- Reduced risk to applicators and the environment
- Typically only affect target pathogens
- May be used as a component of IPM program

DISADVANTAGES

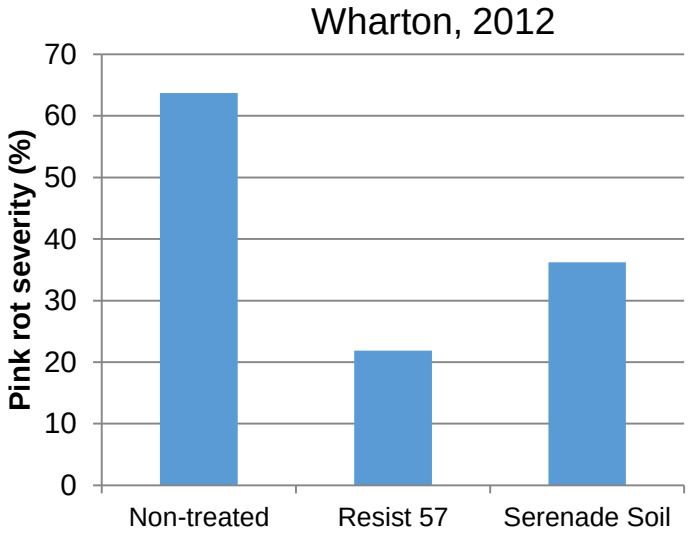
- Used as a preventative, not to cure disease
- Shorter shelf life and specific storing conditions
- May need to be applied multiple times
- Efficacy is not always consistent

RESEARCH OBJECTIVES

- Determine if microbial biopesticides provide economical/consistent control of the Early-die complex
- Determine the optimum application timing/method



Kirk, 2010



2016 & 2017 FIELD STUDIES

- Planted with cut certified Russet Norkotah seed
- Plots were 6 rows wide (18’) by 40’ long
- Included a non-treated check and a fumigated check (40 gal/ac metam sodium)

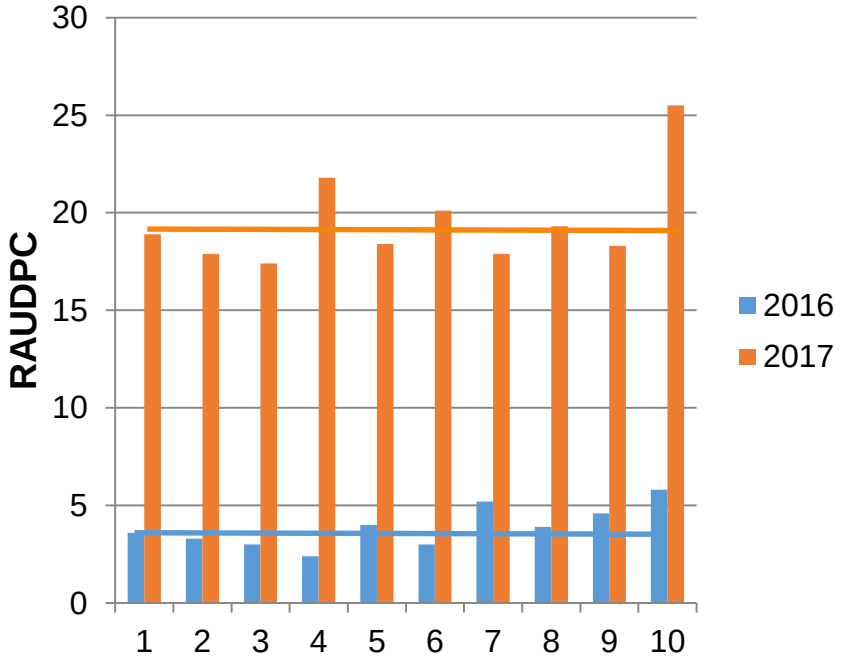
MATERIALS AND METHODS

- Serenade Soil (*Bacillus subtilis* QST 713) and Bio-Tam (*Trichoderma asperellum* and *Trichoderma gamsii*)
- In-furrow at planting and/or chemigated 4 times throughout the growing season beginning June 7th

MATERIALS AND METHODS

- Soil and stem samples were evaluated using a real-time polymerase chain reaction (qPCR)
- Visual symptoms of Verticillium wilt (*Verticillium dahliae)* were rated throughout June, July, and August.
- Conducted UAV flights to evaluate the normalized difference vegetation index (NDVI) as an indicator of the relative amount of live green vegetation in each plot
- Determined yield, tuber size and specific gravity at harvest

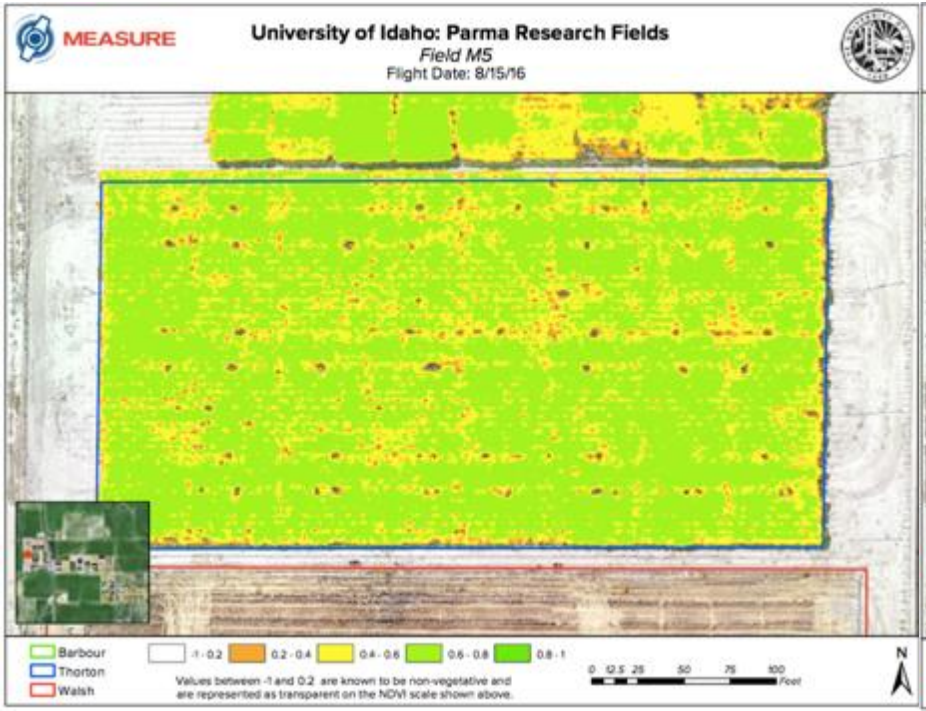
EARLY DIE SYMPTOMS

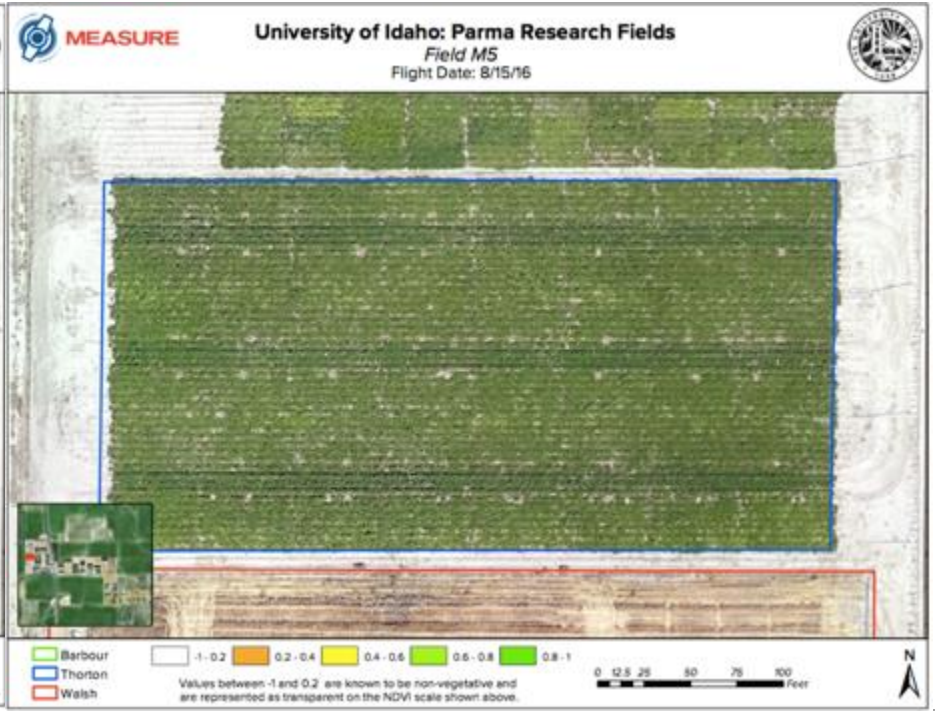


1 Non-treated
2 Fumigated check
3 Bio-Tam in-furrow (IF)
4 Bio-Tam chemigation - low rate (CL)
5 Bio-Tam IF + CL
6 Bio-Tam chemigation - high rate (HL)
7 Serenade in-furrow (IF)
8 Serenade chemigation - low rate (CL)
9 Serenade IF + CL
10 Serenade chemigation - high rate (HL)

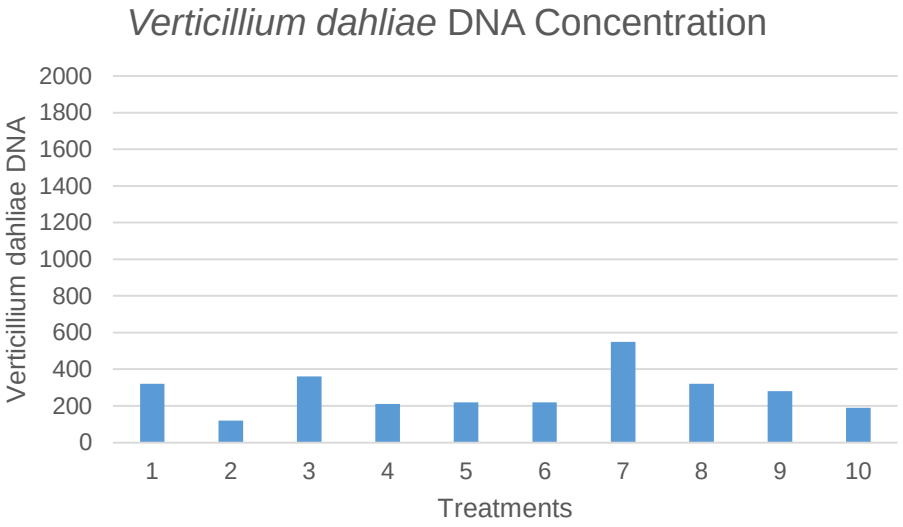
*There were no significant differences among treatments

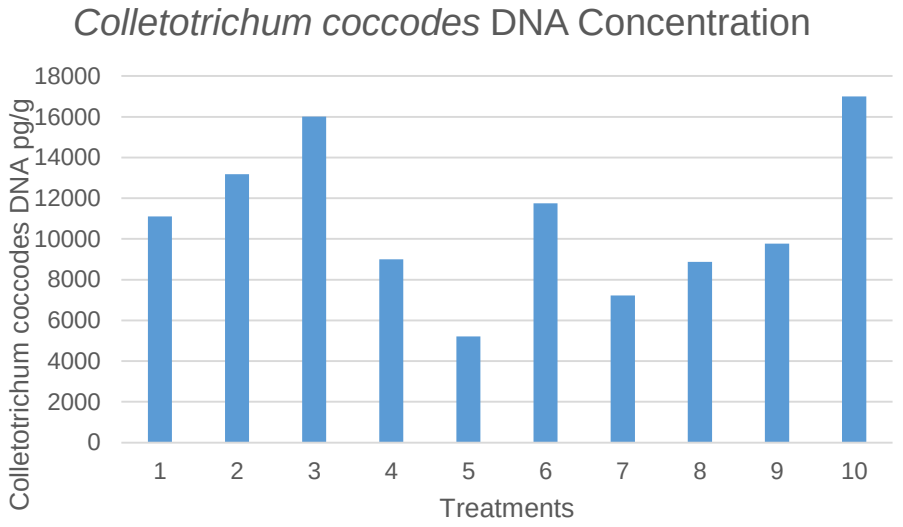
2016 FIELD STUDY-NDVI RESULTS





qPCR RESULTS





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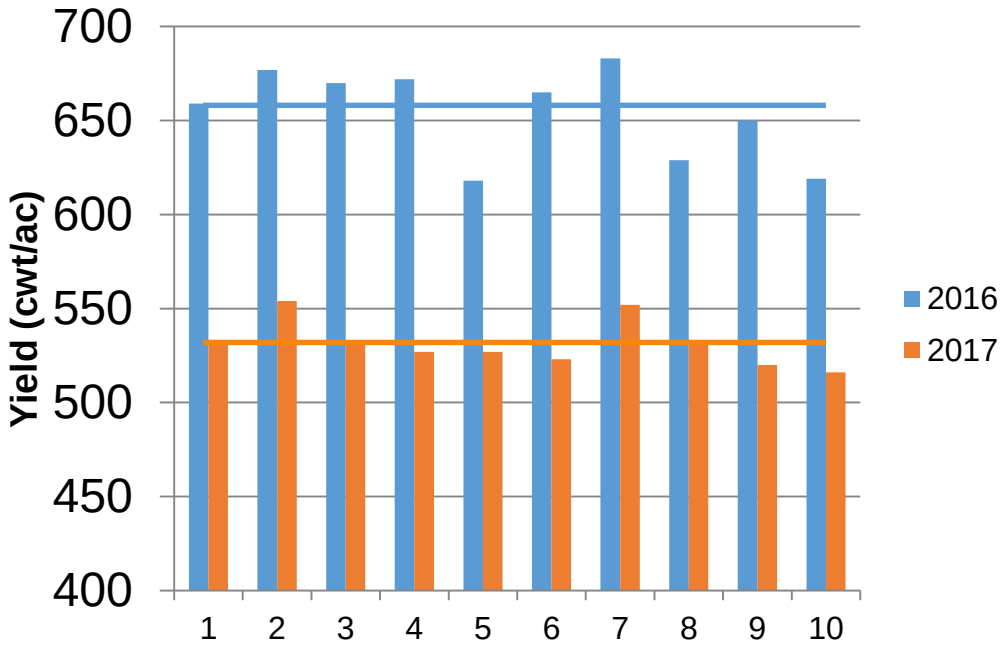
YIELD RESULTS



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*There were no significant differences among treatments

SUMMARY/CONCLUSION

- Under our field conditions biological pesticides did not reduce early die symptoms
- Early die incidence was low to moderate
- Still more research needed to understand the mode of action and efficacy.

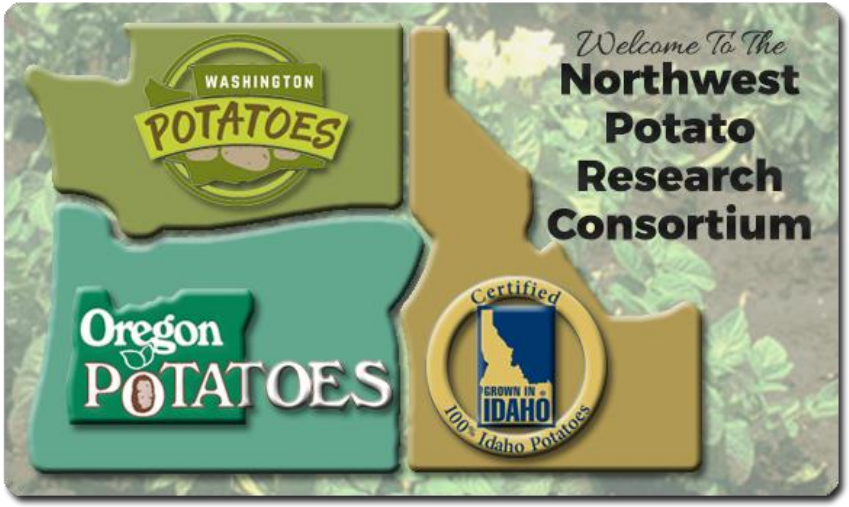
Source: http://npic.orst.edu/envir/soil.html

Potato Early Die Trial – Parma, ID
on August 25, 2017

1 = Untreated check
13 = Serenade + Velum Prime
14 = Elatus

ACKNOWLEDGEMENTS

- Northwest Potato Research Consortium
- Nick Vincent
- Ransey Portenier
- Oksana Adams
- Dr. Phillip Wharton
- Dr. James Woodhall



Source: http://www.nwpotatoresearch.com

QUESTIONS?

Source: https://www.potatopro.com/news/2012/idaho-potato-commission-celebrates-75-year-anniversary