

Non-Conventional Methods of Soil-borne Fungal Disease Management in Soybean and Pea

Anna L Testen¹ and Dean K Malvick², Ph. D.

1. College of Biological Sciences 2. Department of Plant Pathology, University of Minnesota Twin Cities

Introduction

- Soybean (*Glycine max*) and pea (*Pisum sativum*) are susceptible to many soilborne fungal diseases.
- Fusarium virguliforme* causes sudden death syndrome in soybean.
- Aphanomyces euteiches* causes *Aphanomyces* root rot in pea.
- These diseases result in significant yield and monetary loss annually.
- Few conventional (chemical) treatments are available for managing these pathogens and those that are available are often ineffective.
- Use of biological control and natural antifungal compounds may provide a sustainable, organic method for managing soilborne fungal diseases of soybean and pea.

Hypothesis

Bacillus pumilus GB34, a biological control agent, and rapeseed meal will reduce disease severity of select fungal diseases of soybean and pea.

Materials and Methods

Greenhouse Trials

-Soybeans were inoculated with *F. virguliforme* using the sorghum layer method.

-One week old pea seedlings were inoculated using an *A. euteiches* slurry injected around the seedlings' roots.

-Greenhouse trials ran 40-44 days at which time average (per plant) fresh plant biomass, root rot severity and foliar symptoms were measured for each treatment.

Antagonism Trials

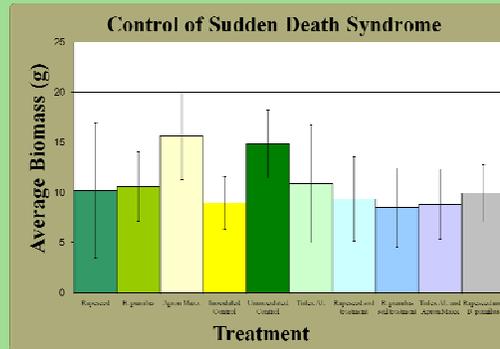
-A straight line of *B. pumilus* was streaked onto nutrient agar and incubated overnight.

-Fungi were placed at the furthest point from the bacteria and incubated for 3 days.

-Growth was measured every 24 hours.

- ### Greenhouse Treatments
1. Ground rapeseed seed treatment
 2. *Bacillus pumilus* seed treatment
 3. Apron Maxx seed treatment
 4. Control + pathogen
 5. Control + no pathogen
 6. Trilex AL seed treatment (soybean only)
 7. Ground Rapeseed soil treatment
 8. *Bacillus pumilus* soil treatment
 9. Trilex AL + Apron Maxx (soybean only)
 10. Rapeseed and *B. pumilus* seed treatment

Results



-Average biomass of the uninoculated control and ApronMaxx treatment was significantly higher than the inoculated control.

-All other treatments (except the *B. pumilus* soil treatment and combined fungicide treatment) showed slight increases in average biomass than the inoculated control.



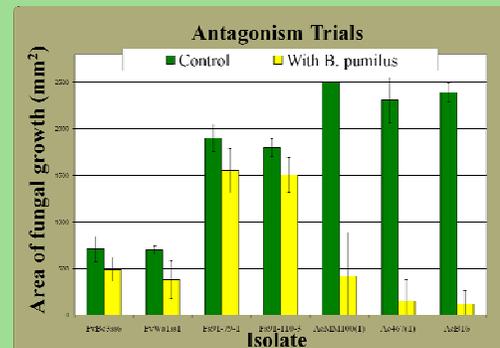
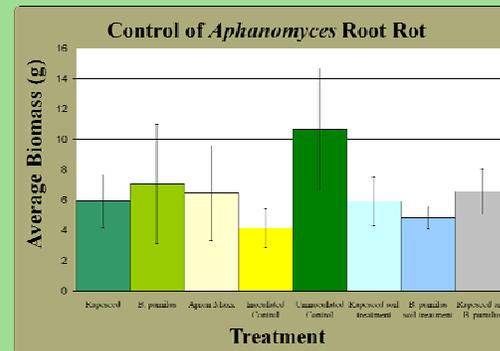
Soybean plants at left show symptoms of Sudden Death Syndrome; plants on right are uninoculated controls



Pea plants at left show symptoms of *Aphanomyces* root rot; Plants at right are uninoculated controls

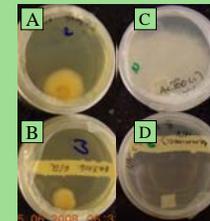
-No treatment reduced disease severity to a level that was comparable to the uninoculated control.

-All treatments showed a slightly greater average biomass than the inoculated control.



-The average area of growth of all fungi was reduced in the presence of *Bacillus pumilus*.

-The greatest reduction in fungal growth was seen in *Aphanomyces* isolates.



A) Growth of FvBe3ss6 without and B) with *B. pumilus*
C) Growth of AeMM100(1) without and D) with *B. pumilus*

Discussion

-Only Apron Maxx was able to reduce disease severity of *F. virguliforme* to a level that was comparable to the uninoculated control.

-No other treatment was able to reduce disease to this extent in either crop studied.

-Apron Maxx was not effective in controlling *Aphanomyces*, an oomycete.

-*B. pumilus*, rapeseed meal and Trilex AL were shown to reduce disease severity to a similar degree in soybean and pea greenhouse trials.

-*B. pumilus* was shown to greatly reduce *Aphanomyces* growth in vitro.

-Other factors, such as induced systemic resistance, may be involved in disease reduction due to *B. pumilus*.

Conclusion

-Conventional (chemical) methods showed the greatest efficacy in controlling *F. virguliforme*.

-Non-conventional methods showed some efficacy in controlling *A. euteiches* in in-vitro assays and greenhouse trials.

-The non-conventional control methods *B. pumilus* and rapeseed meal show potential for being implemented in organic production systems.

-These studies, however, cannot indicate how *B. pumilus* and rapeseed would perform in a field setting and further field studies would need to be performed.

References

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Acknowledgements

I would like to thank Dr. Dean Malvick for his guidance throughout this project. I would also like to thank all members of the Malvick Lab, especially Ann Impullitti and John Bienapfl, for help with troubleshooting and suggestions for my project.