

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

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## 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.

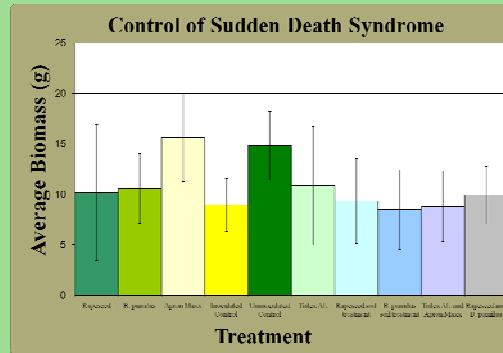
-Fungi were placed at the furthest point from the bacteria and incubated for 3 days.

-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.



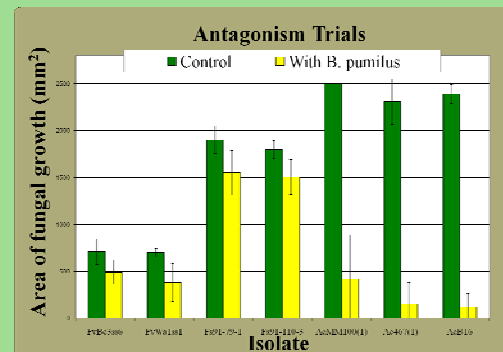
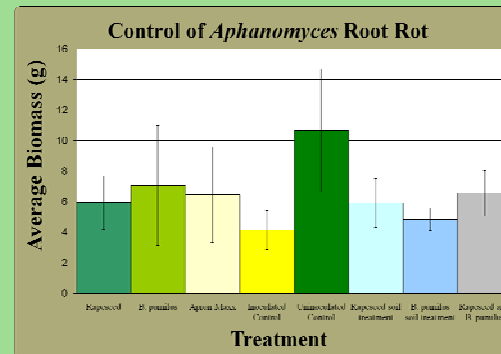
Soybean plants at left show symptoms of Sudden Death Syndrome; plants on right are uninoculated controls



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

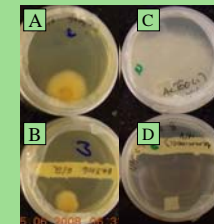
-No treatment reduced disease severity to a level that was comparable to the uninoculated control.

-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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