SOILLESS SUBSTRATE SCIENCE

How Processed Wood Substrate Affects Damping-Off Disease Suppression

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Why This Matters

- Growers are exploring processed wood as a partial peat substitute. In this radish damping-off model, peat+wood blends were never worse than peat+perlite and were often better, especially with disc-refined (FG) and hammer-milled (PTS) wood.
- Results are crop- and pathogen-specific; treat as promising evidence, but not universal proof. Because of this new substrate mixes such as engineered wood are being considered as a replacement or partial substitution.
- This study helps answer a few preliminary questions about disease spread in processed wood substrates but also serves as a starting point for deeper and more varied analysis of alternative soilless substrates.

Background & Research Insights

- This study observed the effects of Raphanus sativus (Radish) infested with *Rhizoctonia solani* (fungus that causes damping off) in a mixture of three different engineered wood substrates mixed with peat at three different ratios and a control of perlite.
- Evidence from this study suggests that engineered wood substrate mixed with peat does not increase the severity of damping off in Raphanus sativus
  Results suggest that processed wood may be disease-suppressive, but all factors affecting disease rate were not studied. The results were also specific to Raphanus sativus.
- These results should encourage growers, as processed wood substrate mixes do not have a negative effect and may be beneficial for disease rates in some crops. Results may vary with different species of crops but are worth testing

Materials & Inputs Needed

- Substrate(s): 4 different substrates were used:
  - Commercial wood product produced with a disc refiner (disc-refined FG); product produced with a screw extruder (extruded GF); Manufactured hammer-milled material (Hammer-milled PTS); Control blend made up of 70% peat and 30% horticultural perlite (peatlite)

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- Ratios: Substrates were hand-mixed into peat (Canadian raw sphagnum peat) 3.56 kg m^3 at three ratios (10%, 20%, and 30%)
- Additives: Carbonate dolomitic limestone added to adjust pH to 5.8; and wetting agent (PsiMatric, Aquatrols) 100 mL m^{-3}
- Crop tested: *Raphanus sativus* L. “Early Scarlet Globe” radish
- Pathogen: *Rhizoctonia solani* (Rice inoculation)
- Tests: pH, electrical conductivity, and substrate moisture were used to ensure uniformity between treatments and controls

Step-by-Step Guidelines

1. Prepare Substrate Mixes:
    - Obtain each of the wood-processed substrates (disc-refined FG, extruded GF, and Hammer-milled PTS) as well as commercial horticulture perlite.
    - Hand mix each of the substrates with raw Canadian sphagnum peat at ratios of 10:90, 20:80, and 30:70.
2. Analyze Substrate Mixes:
    - Adjust pH to 5.8 by adding carbonate dolomitic limestone.
    - Add wetting agent (PsiMatric, Aquatrols) 100 mL m^{-3} ; seal substrate mixes in 114 L plastic bins and allow them to equilibrate for 7 days.
3. Test and Measure Substrate Mixes:
    - Test pH and Electrical conductivity of 3 samples from each group. Find substrate moisture content with a moisture analyzer and add clear water to achieve a 60% gravimetric substrate moisture content for all treatments.
    - Measure porosity, container capacity, air space and dry bulk density for each treatment.
4. Pathogen Prep. and Inoculation:
    - Take samples from 2-week-old Rhizoctonia solani and autoclave for 60 min at 121 ^oC and 15 psi. Incubate samples for 7 days and then pulverize in a mortar and pestle.
    - Sieve through 2mm mesh and then add .5 g of infested rice per liter of substrate.
5. Crop establishment:
    - Sow thirty-two organic radish seeds (Raphanus sativus L. “Early Scarlet Globe”) by hand in each pot and hand water with 200 mL of clear water.
    - After inoculation, allow pots to sit in 24-hour illumination.
6. Measuring disease severity:
    - Seven days after seeding, measure disease severity on a scale of 1 = symptomless, 2 = small root or stem lesion but not damped-off, 3 = large root or stem lesion but not damped-off, 4 = post-emergence damping-off, 5 = pre-emergence damping-off.
    - Take the average for each pot and then measure fresh above ground biomass for each pot.

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Tips & Pitfalls

- If you're trialing wood in peat: start at 20–30% wood with FG or PTS; expect equal or lower damping-off than peatlite in this model. GF can work but avoid very low (10%) where disease was higher.
- Watch germination & background loss: FG tended to have better germination; GF lower (non-infested). If stands lag, adjust moisture/temperature and recheck seed-to-substrate contact.
- Boundaries: evidence here is for radish + R. solani, 7-day window. Other crops/pathogens may differ, pilot small batches is therefore suggested before scaling.

Expected Outcomes

- Across all tests, peat+wood was not worse than peatlite; with and PTS, more wood generally meant less disease; GF showed a best range (20–30%).
- When trying to replicate this experiment growers should expect to see a higher fresh weight yield and lower rates of disease in crops similar to those used in this experiment
- It is important to note this study only looked at relatively low percentages of processed wood mixes, if the percentage of wood was >30% it could lead to different results.

Additional Resources

Poleatewich, A., Michaud, I., Jackson, B., Krause, M., & DeGenring, L. (2022). The effect of peat moss amended with three engineered wood substrate components on suppression of damping-off caused by *rhizoctonia solani*. *Agriculture*, *12*(12), 2092. https://doi.org/10.3390/agriculture12122092

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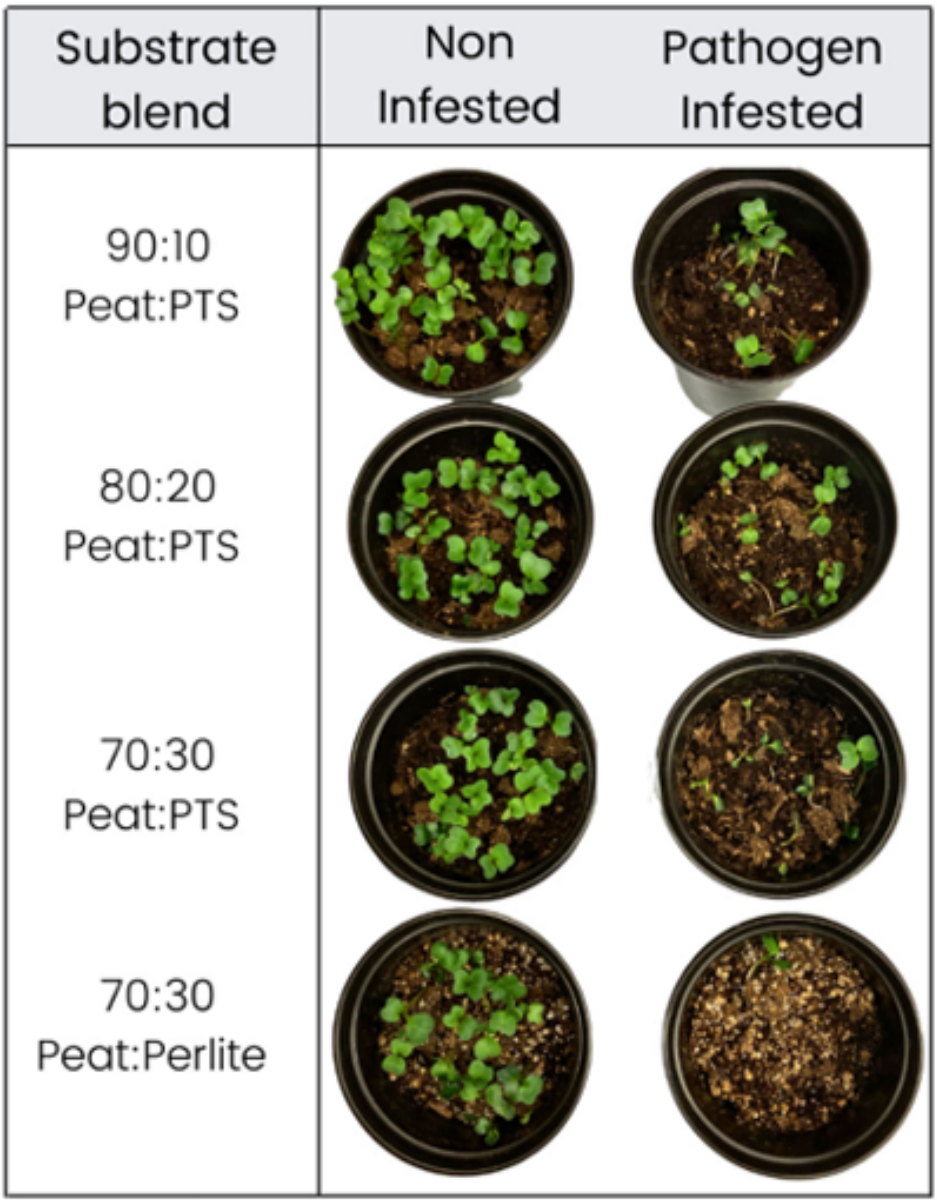
Visuals and Graphs



Radish plants grown in non-infested or Rhizoctonia solani -infested peat blended with hammer milled PTS compared to peat blended with perlite. Images were taken 7 days post-infestation.

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