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FOREST RESOURCES

Using Southern Yellow Pine Biochar and Wood Vinegar to Remediate Poultry Litter Compost

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Outline

- Background
- Objectives
- Methods
- Current Results
- Conclusion



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Background

- Utilize forest product and agricultural waste streams
 - Biochar
 - Wood Vinegar
 - Poultry litter



Biochar

- Highly porous material produced by pyrolysis of biomass
- Very absorbent and adsorbent
- Large water holding capacity
- Retains nutrients
- Sequesters carbon



Wood Vinegar

- A liquid containing acetic acid compounds
- Distilled during pyrolysis
- Insecticide
- Fungicide
- Promotes healthy root development



Poultry litter

- High disposal costs
- Environmental pollution
- Foul odor
- Pathogens
- Antibiotic-resistant bacteria



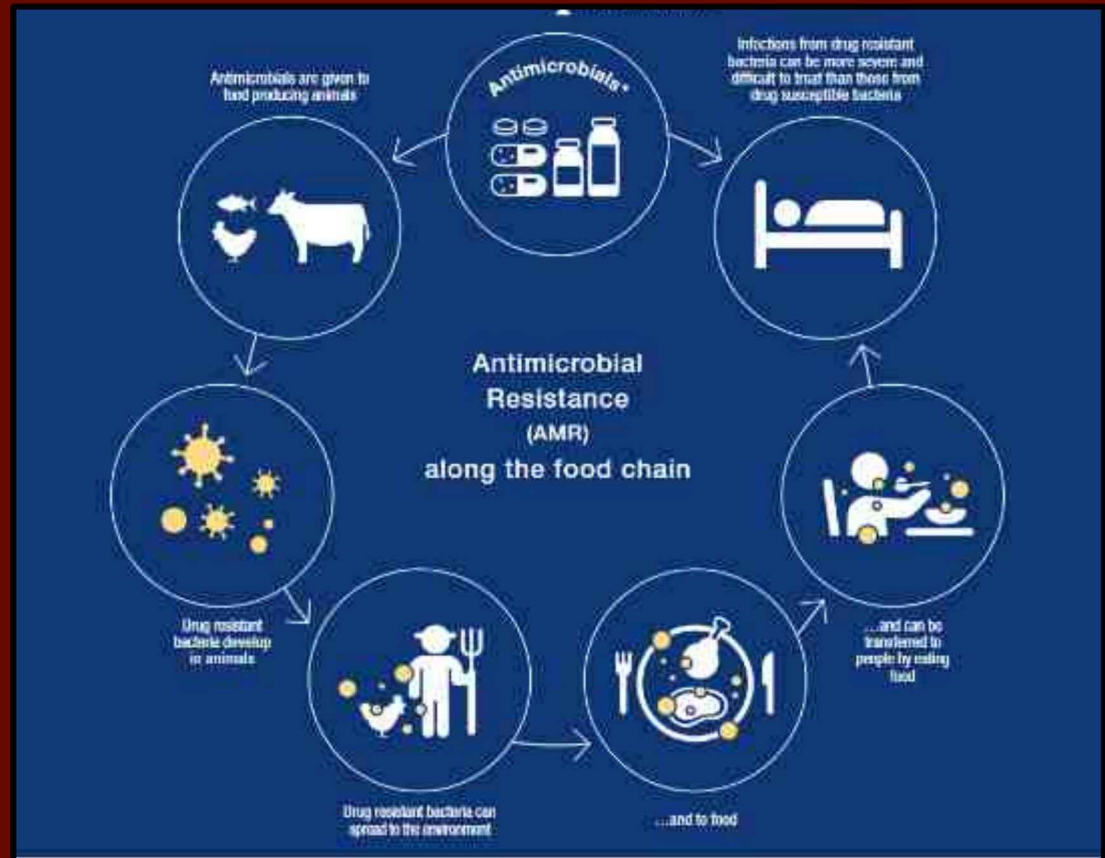
Composting Poultry Litter

- Transform waste into a stable and nutritious fertilizer
- Kills pathogens
- Economic waste disposal method
- Some drawbacks
 - Leaches nutrients
 - Releases pollutants
 - Does not significantly reduce all ARGs and MGEs



Antibiotic Resistance

- Spread and evolve through mobile-genetic elements (MGEs)
 - Plasmids, transposons, **integrons**
- Transfer between benign and pathogenic bacteria



Source: www.cdc.gov

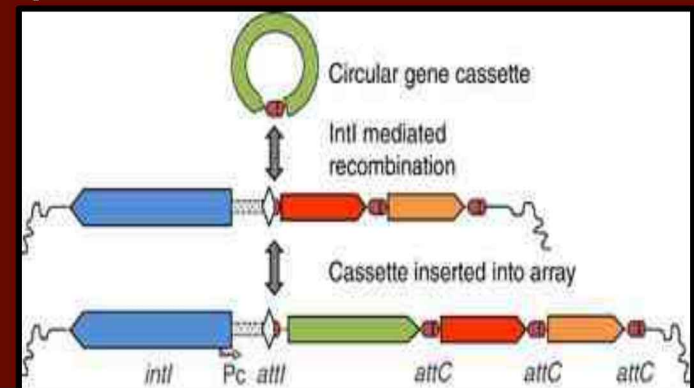


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Class 1 integrons

- Genetic sequence in some bacteria
- Captures and integrates ARGs
 - Integrase
- Function of natural selection
- Not significantly reduced by composting



Objectives

- Investigate how southern yellow pine biochar and wood vinegar affects:
 - nutrient quality
 - class 1 integron (*intl1*) expression
 - compost maturity rates
- ...in poultry litter compost



Methods

- Preliminary Study - Detect *intl1*
- Set up compost blends
- Sample at day 0, 45, and 90
 - Nutrient analysis: NPK, C:N, TKN
 - Microbial analysis: bacteria and fungi
 - Screen for *intl1*
 - pH, moisture content, weight loss
- Compost maturity tests
- Day 90 - Greenhouse study



Preliminary Results

- 36/38 (95%) of PL was positive for *int11* (Fig 1)
- 10/16 (62%) of PL + 10% BC was positive for *int11* (Fig 2)

Fig 1: *int11* isolated from PL



Fig 2: *int11* isolated from PL + 10% BC



Compost Set up

- 11 kg total material
- 8 treatments, 5 reps
 - Poultry Litter (PL, control)
 - 5% Biochar (BC)
 - 10% BC
 - 20% BC
 - 2% Wood Vinegar (WV)
 - 5% BC + WV
 - 10% BC + WV
 - 20% BC + WV



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Figure 3: Day 0 Treatment Average for Aerobic Bacteria Counts (CFU/g)

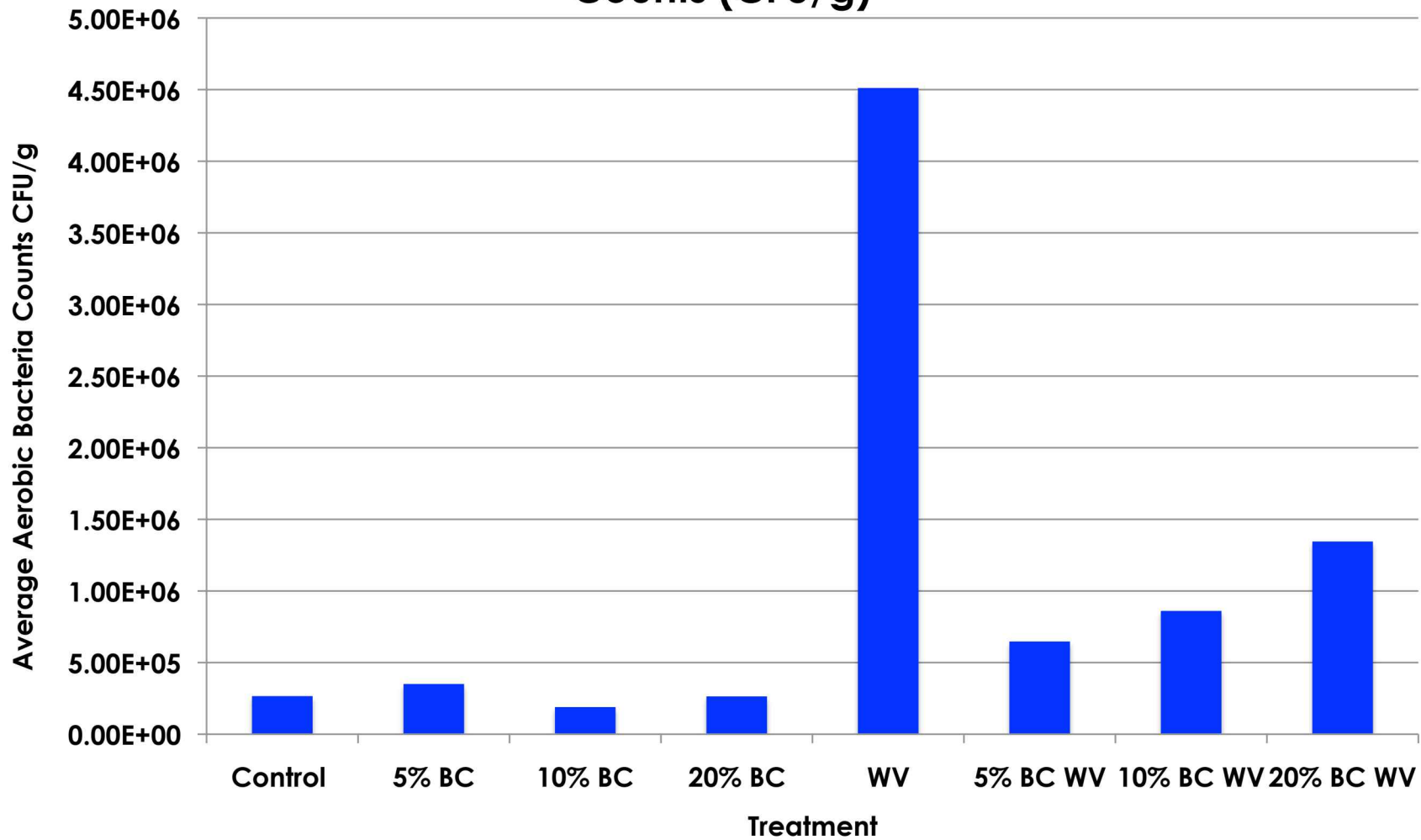


Figure 4: Day 0 Treatment Average for Total Fungi Counts (CFU/g)

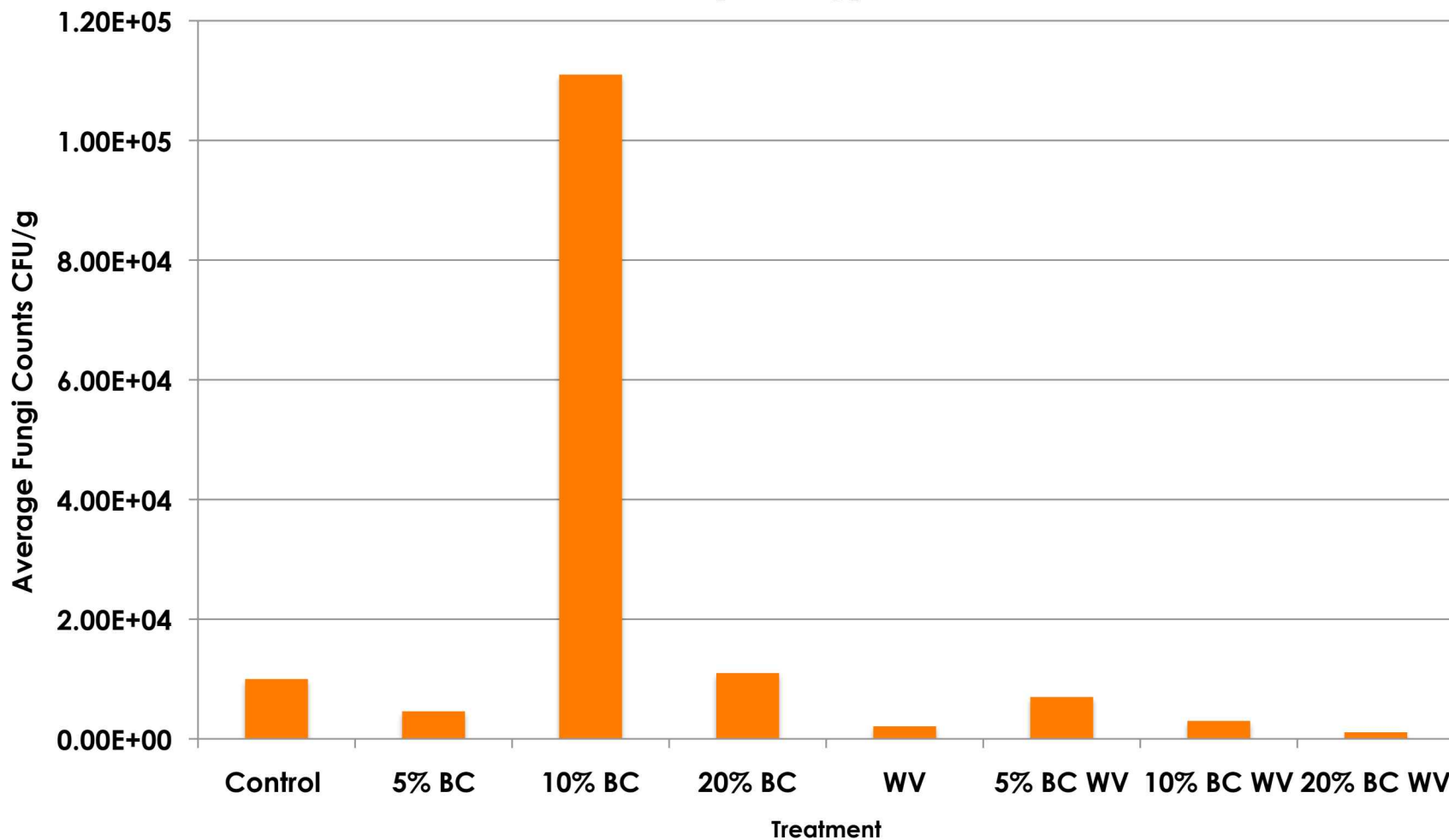
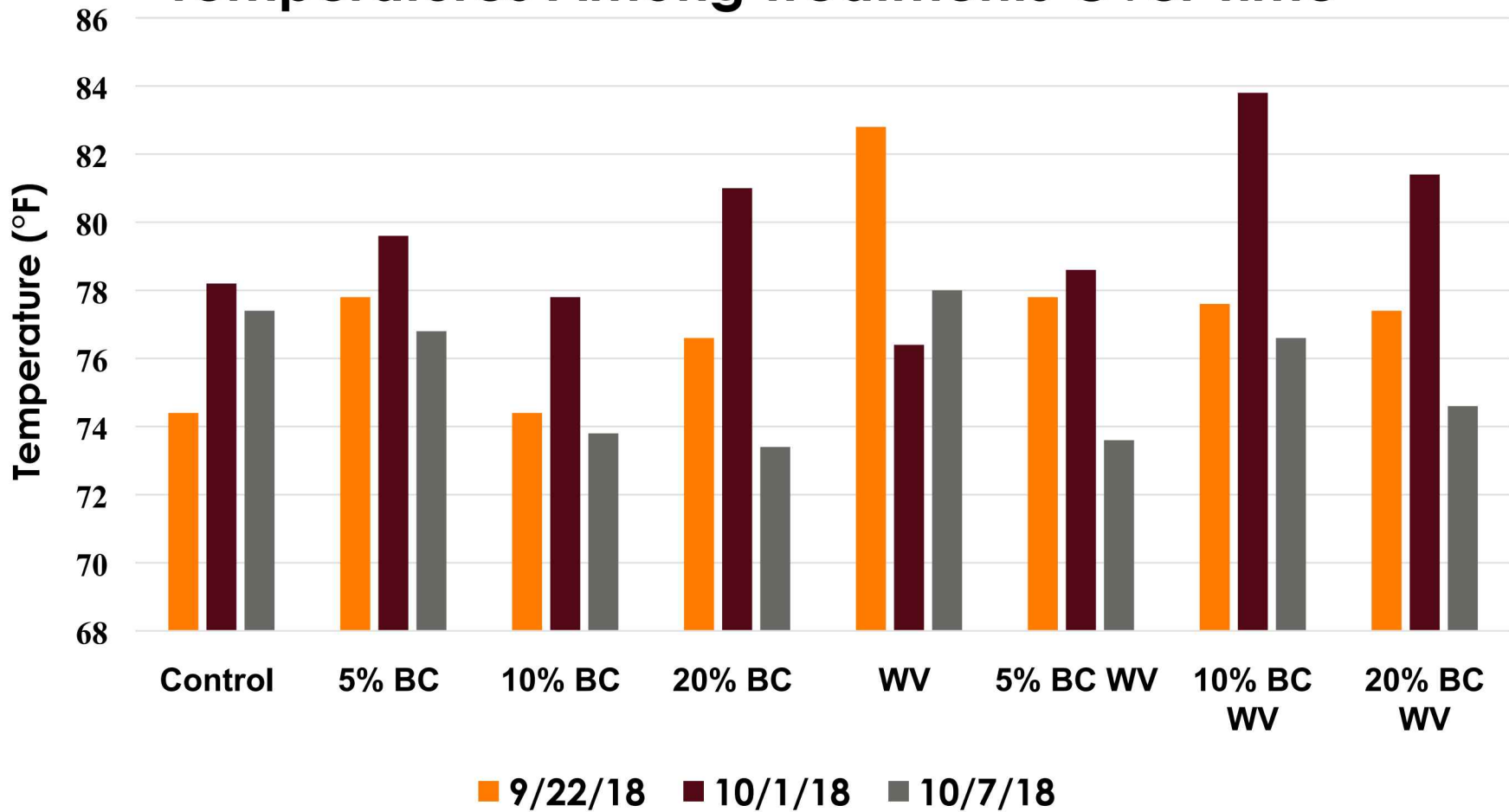


Figure 5: Comparison of Compost Temperatures Among Treatments Over Time



Conclusion

- Biochar may have an inhibitory effect on *int11*
- Wood vinegar may promote bacterial growth
- Wood vinegar may inhibit fungal growth



Acknowledgements

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Bioproducts for providing wood vinegar and
biochar
- BioCycle Refor



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Thank you!



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