

Composting Deactivation of CWD Prions



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Dealing with Prions/Mortalities

- typical methods unsustainable
 - burial not practical, especially in winter
 - landfilling is problematic and incineration is costly
 - transport of carcasses between counties is problematic
- disposal must be quick, cost-effective, safe
- previous composting research has been inconclusive
 - Xu et al. 2014 (BSE)
 - Huang et al. 2007, Xu et al 2012 (Scrapie)
- alternative method is composting biopiles

Objectives

Current Research:

Specific Aim 1: Adapt RT-QuIC for the detection of CWD prions in environmental samples

Specific Aim 2: Compost CWD infected deer remains in a Summer and Winter Wisconsin climate

Specific Aim 3: Assess the composting process for bacterial indicator and CWD prion deactivation in soil, leachate and compost samples

Materials, Methods & Monitoring













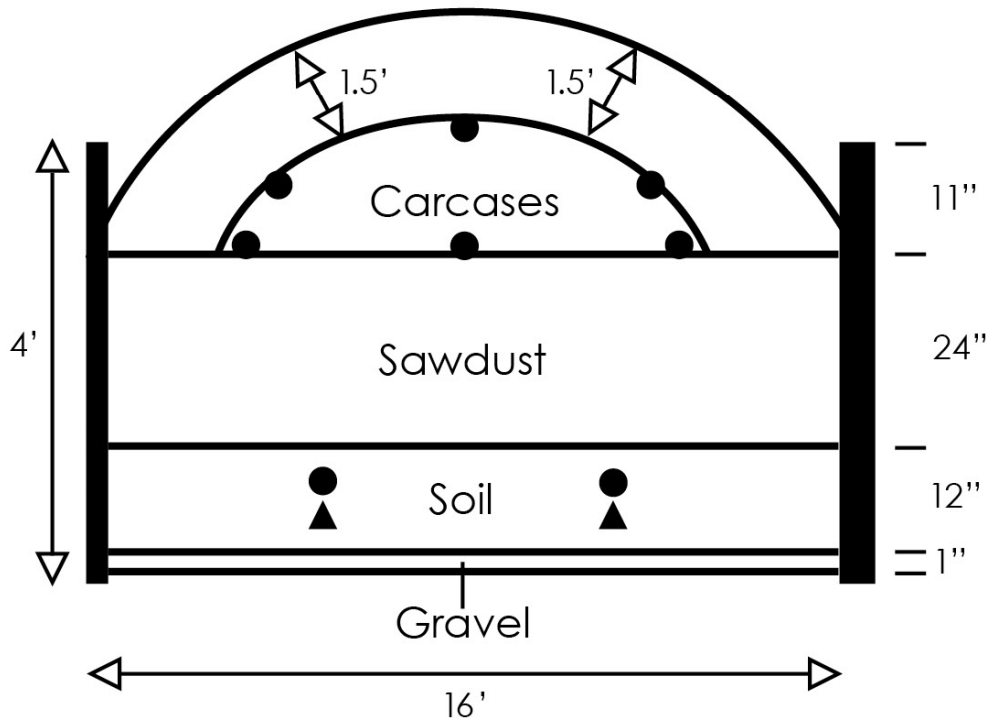


Sampling & Monitoring

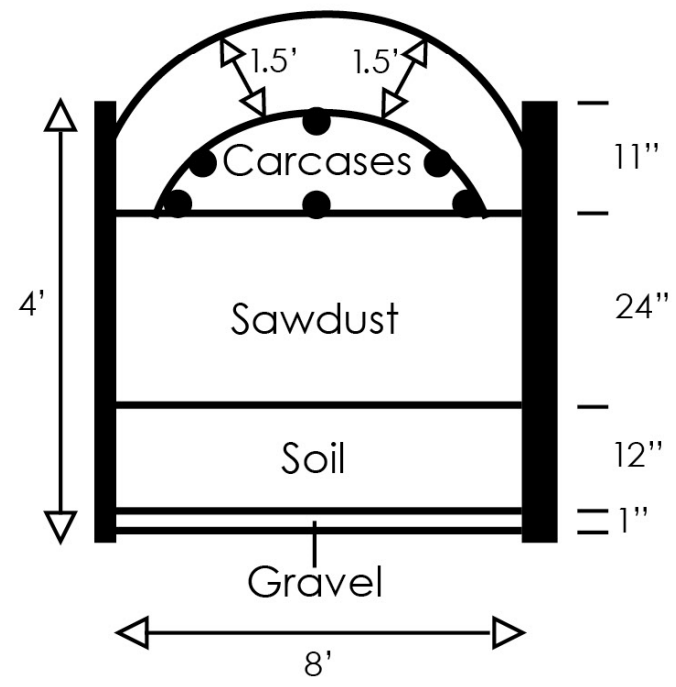
- ongoing measurements
 - compost & soil temperature
 - soil moisture content, effluent
 - indicator bacteria (*E. coli* NAR, others)
- weather & environmental parameters
 - air temperature, precipitation
- visual observations, odor, vermin



- Temperature probe locations
- ▲ Soil moisture probe locations



SIDE VIEW



FRONT VIEW







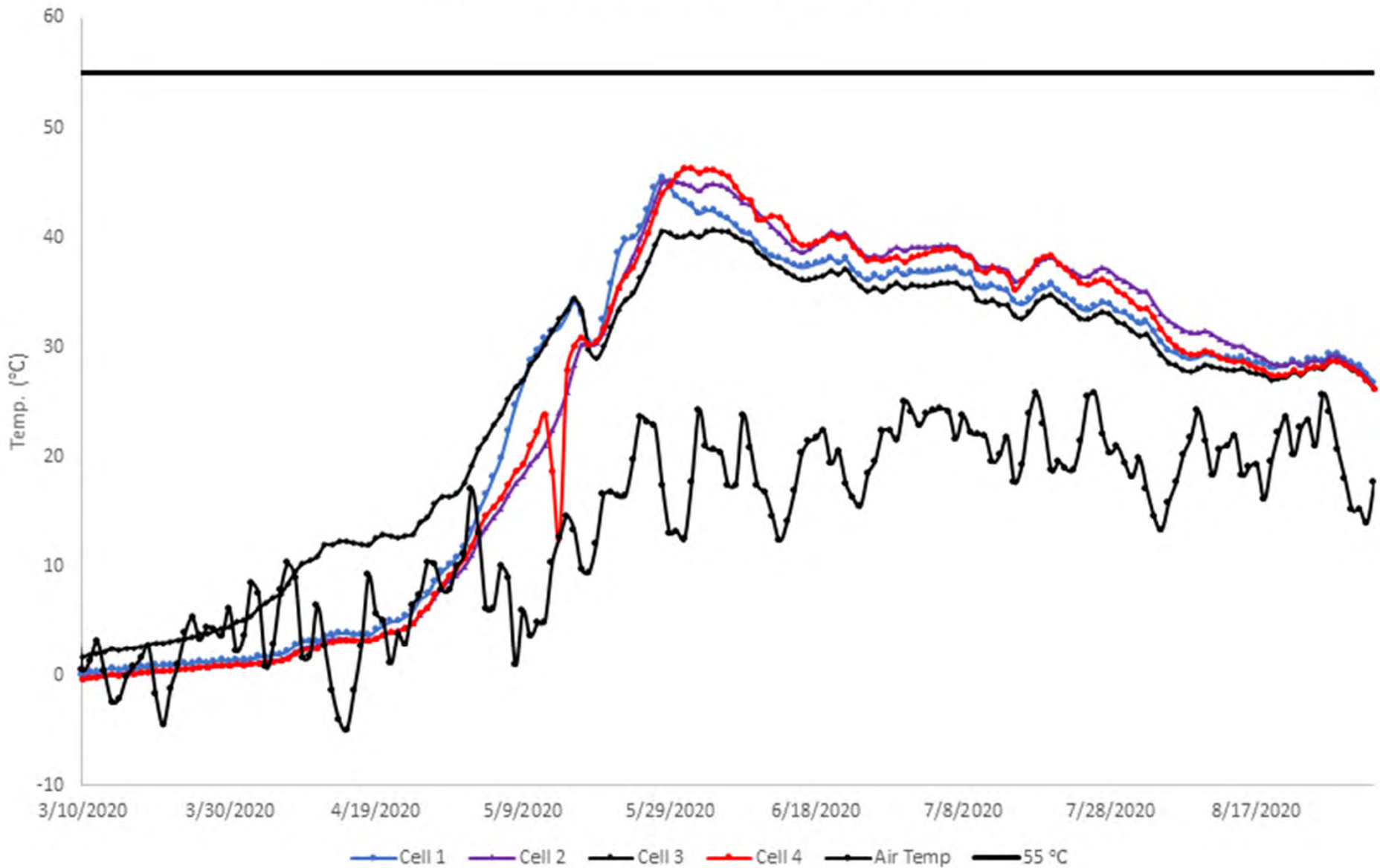




Ending Experiment #1

- Were desired compost temperatures attained?
- Did the CWD prion degrade, persist or leave the composting environment?
- How is the performance of RT-QuIC for analyses?

Average Cell and Ambient Air Temperature



Experiment 1 never reached desired peak average temperatures but we still obtained good data

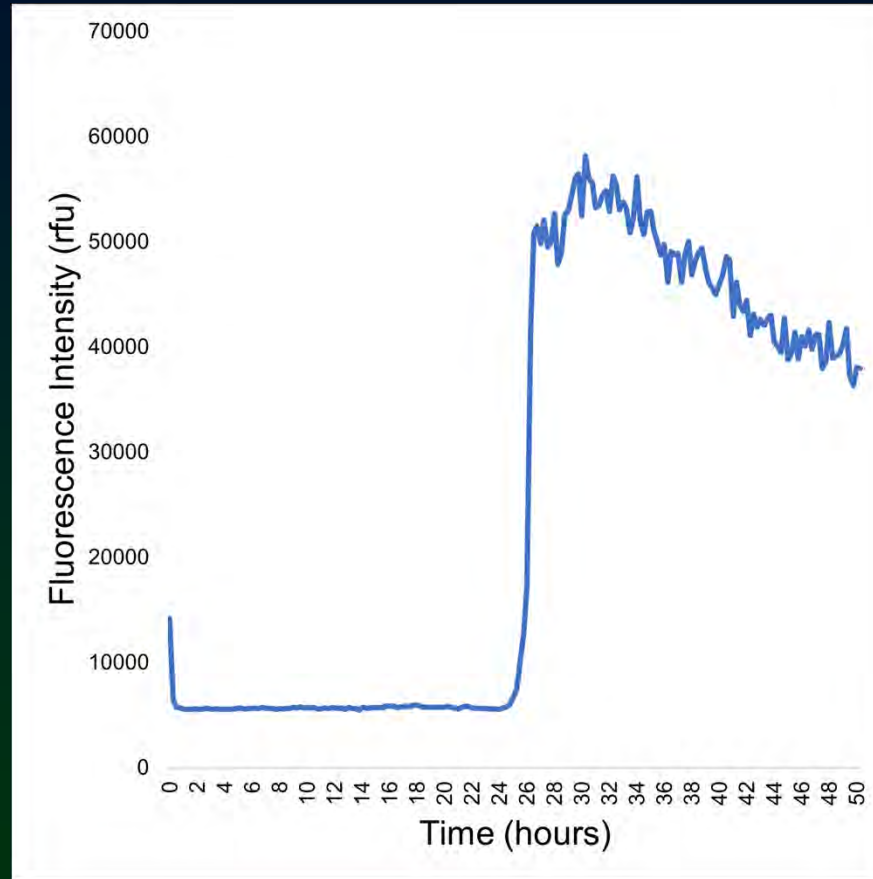


CWD Sampling



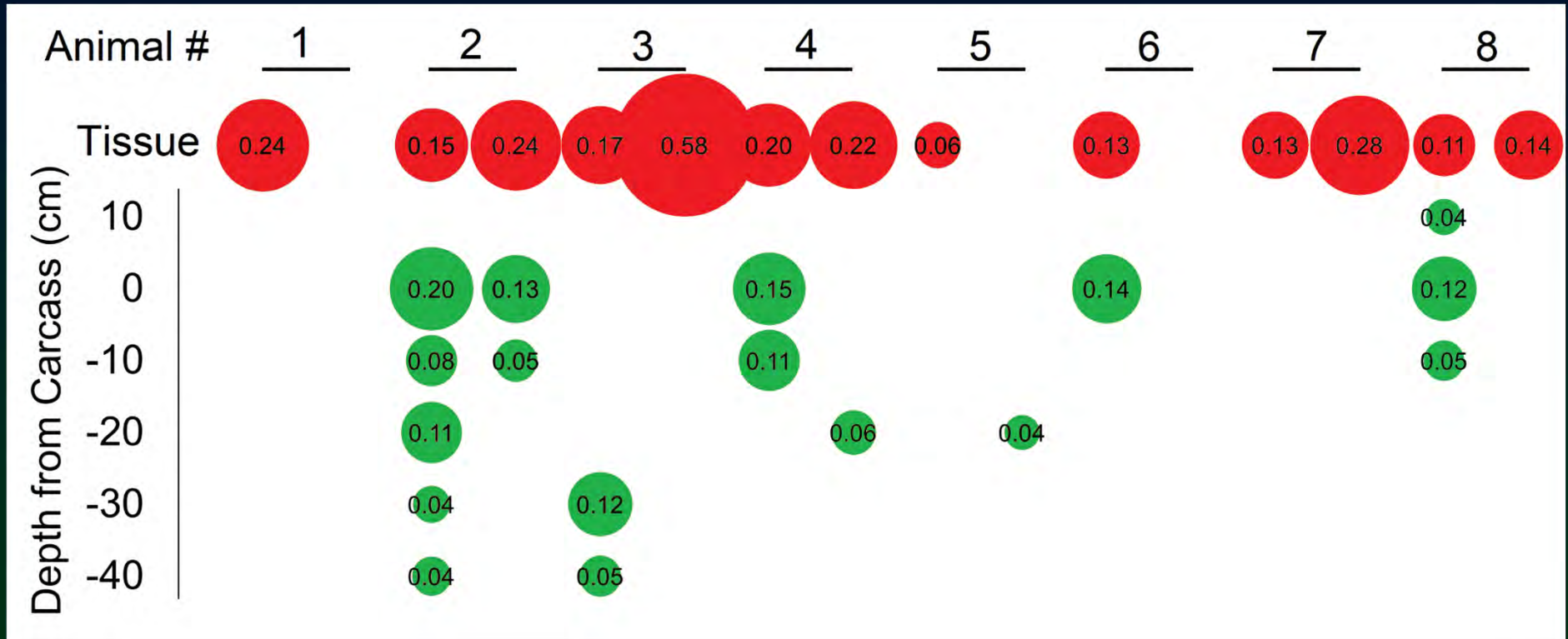


Time to Threshold: A proxy for prion abundance



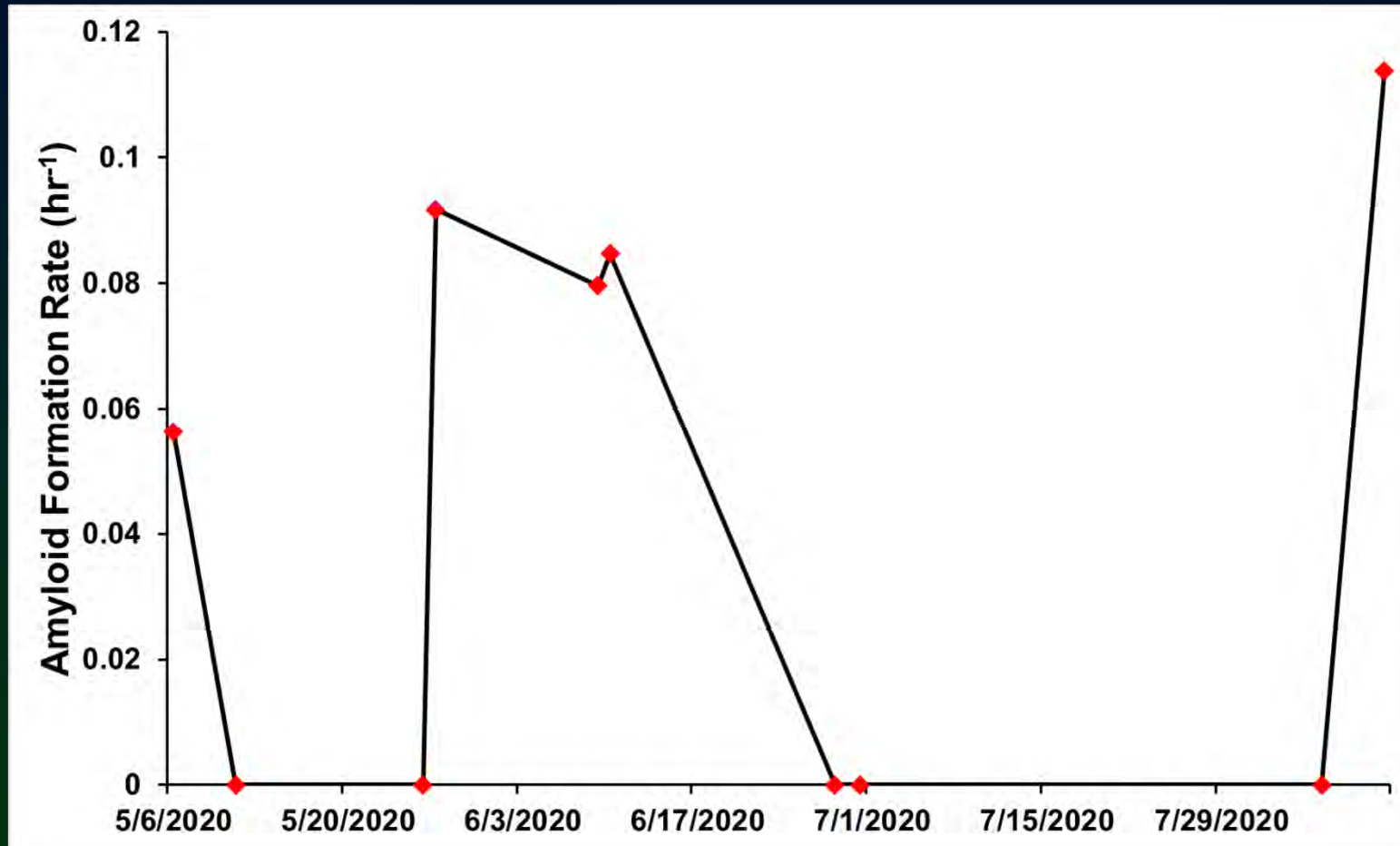
A faster time to threshold implies a larger concentration of seeding material

Results from Compost and Tissues



All remaining animal tissues seeded RT-QuIC. Seeding material migrated down compost layers to soil layers. All dialysis controls remained positive.

Results from Cell #5 Effluent



Detectable seeding activity was found for the duration of composting in Cell #5

Nutrient Analyses

- pH and Electrical Conductivity
- Extractable Nitrogen
- Extractable Ammonium
- Extractable Phosphorus
- Extractable Potassium
- Total Nutrients and Heavy Metals
- Total Carbon and Nitrogen
- % Water Content





Current Experiment #2



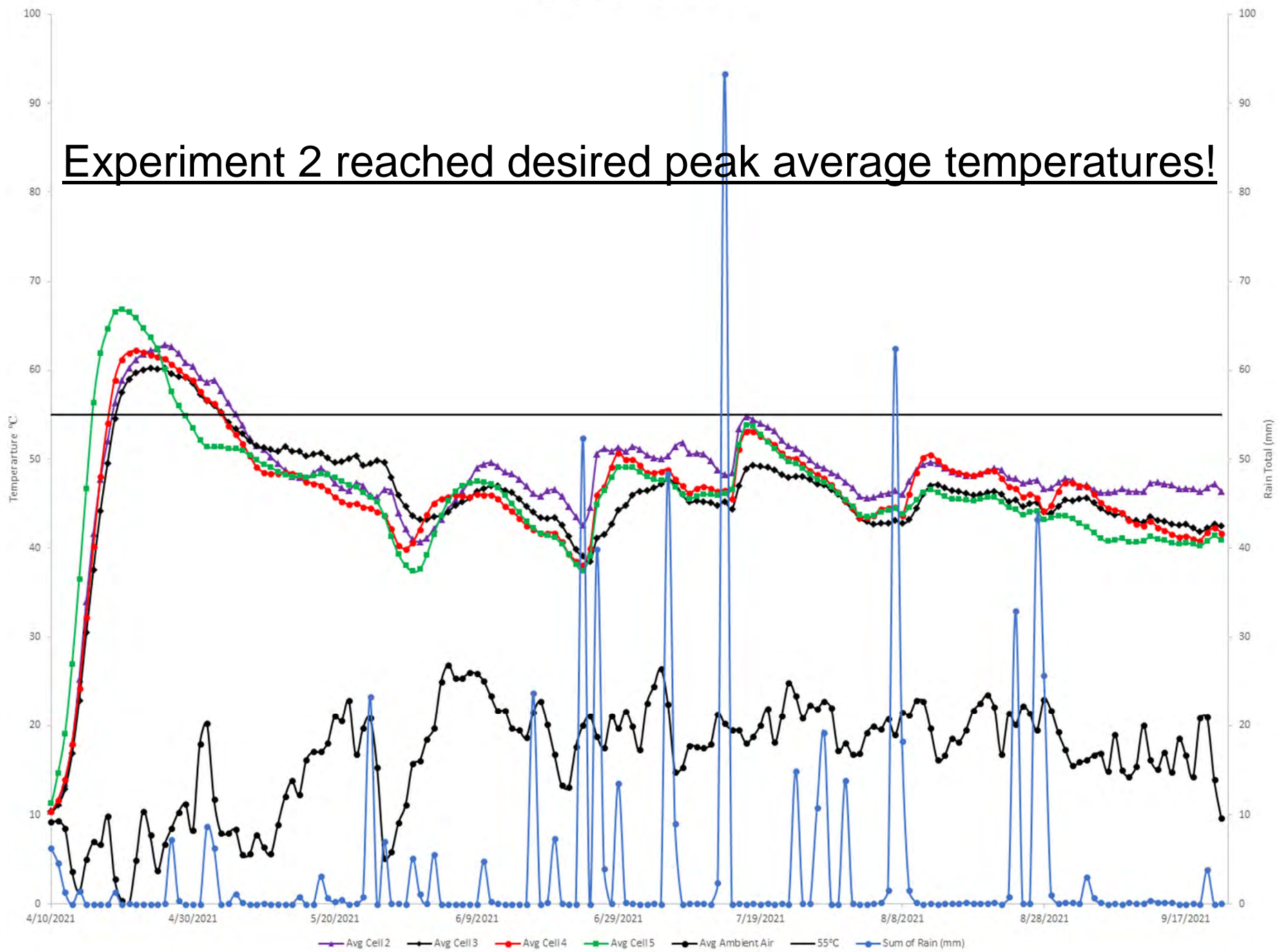






Average Daily Temperatures °C

Experiment 2 reached desired peak average temperatures!



Plus Up – Experiment #3

- Continue expanded bacterial analyses
 - indicator bacteria (Total coliforms, *E. coli*, *E. Faecalis*, *E. coli* NAR)
- Chicken feathers
 - to encourage establishment of keratin degrading microbial community (i.e. \uparrow β -sheet content proteins that may lead to prion degradation)
- Re-build CWD negative cell

Other future possibilities

- Biochar addition in effluent barrels to immobilize prion
- Inoculate with thermophilic bacteria or their proteases
- Modify soil type, C-substrate type, etc.



Ongoing Benefits

- Leveraging MI funding for future opportunities
 - APHIS, NSF, Alberta funding opportunities
- Manuscripts
 - Use as DNR reports and outreach/extension
- Ongoing collaborations
 - MI and WI Departments of Natural Resources
 - Michigan State University, UW-Madison, UW-Stevens Point
 - WI Department of Agriculture, Trade and Consumer Protection
 - Composting Research and Education Foundation
 - Agriculture and Agri-Food Canada, University of Alberta, CFIA
 - University of Vermont

Outreach Presentations

Oral

- Wisconsin Integrated Resource Management Conference. Green Bay, WI. 23-25 Feb. 2022.
- US Composting Council's 28th Annual Conference and Tradeshow. Austin, TX. 24-27 Jan. 2022.
- Agronomy, Crop & Soil Science Societies of America Annual Meetings. Salt Lake City, UT. 7-10 Nov. 2021.
- International Symposium on Animal Mortality Management. Virtual. 18-19 May 2021.
- Wisconsin Integrated Resource Management Conference. Virtual. 22-25 Feb. 2021.
- US Composting Council's 29th Annual Conference and Tradeshow. Virtual. 26-28 Jan. 2021.
- Agronomy, Crop & Soil Science Societies of America Annual Meetings. Virtual. 9-13 Nov. 2020.
- Wisconsin Integrated Resource Management Conference. Wisconsin Dells, WI. 26-28 Feb. 2020.
- US Composting Council's 28th Annual Conference and Tradeshow. Charleston, SC. 28-31 Jan. 2020.
- Agronomy, Crop & Soil Science Societies of America Annual Meetings. San Antonio, TX. 10-13 Nov. 2019.

Poster

- Agronomy, Crop & Soil Science Societies of America Annual Meetings. Salt Lake City, UT. 7-10 Nov. 2021.
- The Wildlife Society's 28th Annual Conference. 1-5 Nov. 2021.
- UWSP CNR Undergraduate Student Research Symposium. Stevens Point, WI. 9 Apr. 2021.
- University of Wisconsin Undergraduate Student Research Symposium. Virtual. May 2021.
- Agronomy, Crop & Soil Science Societies of America Annual Meetings. San Antonio, TX. 10-13 Nov. 2019.

A photograph of four individuals wearing full-body white protective suits and respirators with pink filters. They are standing in a field with a line of trees in the background under a cloudy sky. The person on the far left is wearing a green t-shirt with 'RUE' visible. A blue banner with white text is overlaid at the top, and a blue banner with white text is overlaid at the bottom.

Questions?

Acknowledgments:

MI and WI Dept. Natural Resources, Composting Res. and Educ. Found.
Michigan State University, UW-Madison, UW-Stevens Point
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