

# Biofilm Production in Rhizobia Influences Clover Drought Response

Faith Smith<sup>1</sup>, Kevin Ricks<sup>2</sup>, and Dr. Anthony Yannarell<sup>3</sup>

Parkland Community College, Urbana, Illinois<sup>1</sup>

Program of Ecology, Evolution and Conservation Biology, University of Illinois at Urbana-Champaign<sup>2</sup>

Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign<sup>3</sup>



## Introduction

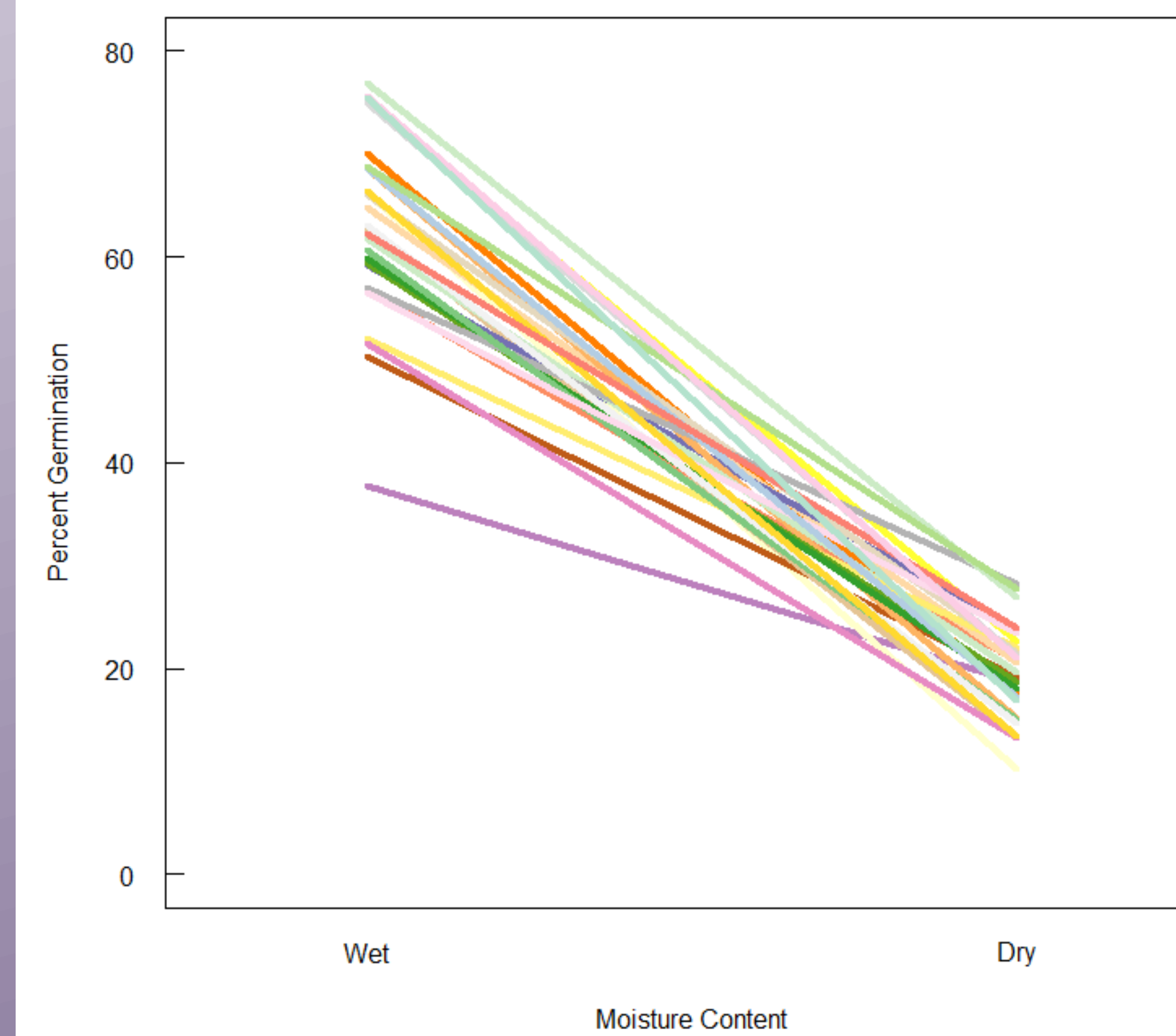
- **Background:** Rhizobia serve as model system for examining how phenotypic changes in rhizobia influence the plant
  - Rhizobium-legume symbioses result in the formation of nodules on the root systems of host plants
- Compositional and functional changes in microbial communities facilitate the host plants' response to environmental stressors (i.e.; drought stress)<sup>1</sup>
- Physiological effects of soil moisture on microbial communities result in specialized communities that can tolerate much low soil-moisture habitats while others are limited to high soil-moisture environments.<sup>1</sup>
- This suggests microbial communities can assist in maintaining plant fitness when exposed to nonideal environmental conditions.<sup>1,2</sup>

## Project Description

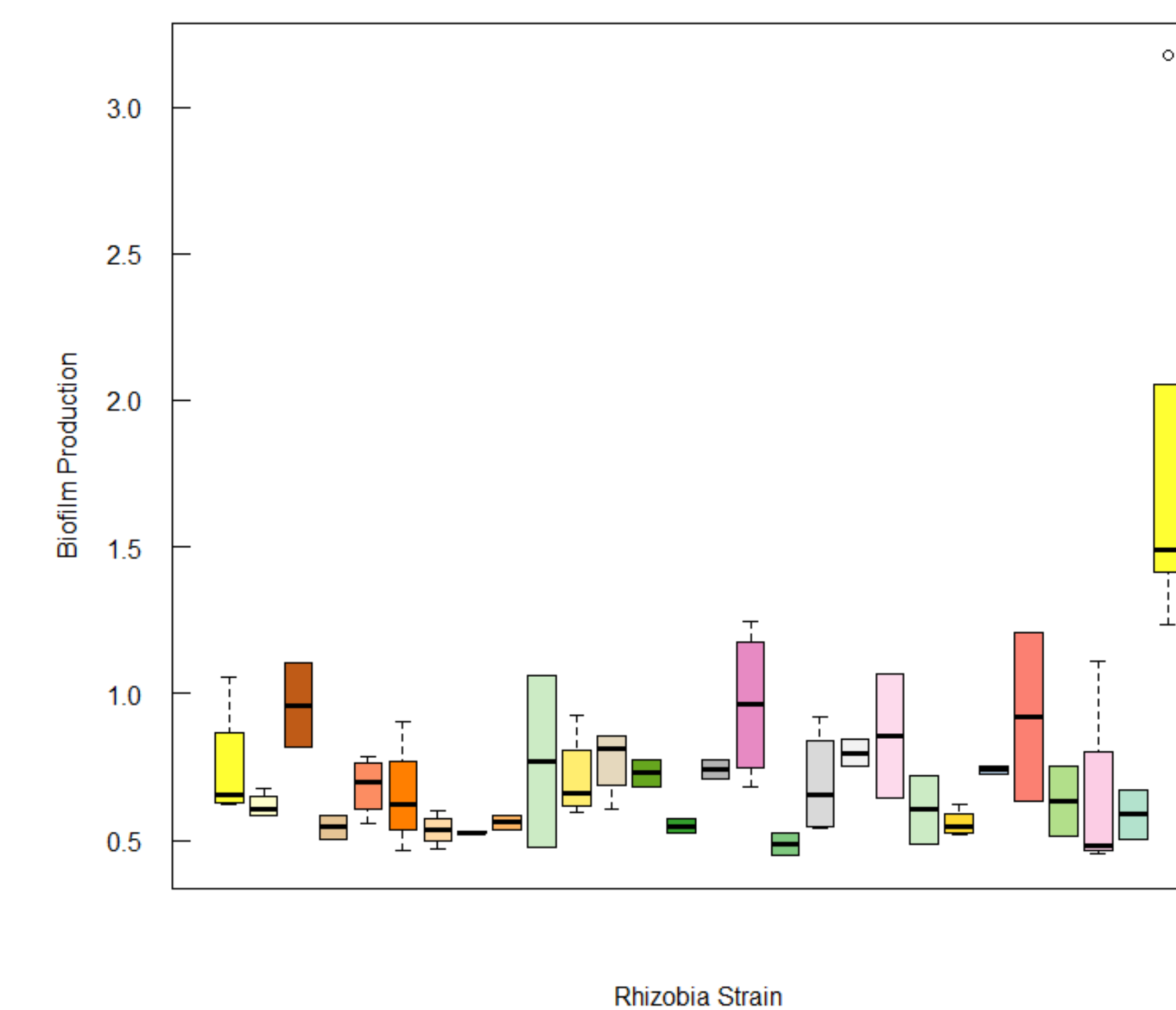
### Goals

- Phenotype 28 strains of rhizobia and how they influence plant germination under wet vs dry conditions:
- Assessing rhizobia phenotypes associated with drought tolerant trait:
- -Identify rhizobia biofilm production
- -Identify rhizobia moisture niche
- **Hypothesis:** Rhizobia impacts on plant germination under dry conditions is influenced by drought tolerant traits in rhizobia.

## Results



Percent germination under wet vs. Dry conditions by rhizobia strain



Biofilm production by rhizobia strain

## Conclusions

- The influence on germination of clover plants by rhizobia strains differed between wet and dry conditions but was not directly correlated to biofilm production but by the plasticity of rhizobia under wet vs dry conditions.

## Future Work

- Further examining phenotypes of rhizobia strains and impacts on plant fitness under drought

## References

1. Lau, J. A.; Lennon, J. T. Rapid Responses of Soil Microorganisms Improve Plant Fitness in Novel Environments. *Proc. Natl. Acad. Sci. U. S. A.* **2012**, *109* (35), 14058–14062.
2. Batstone, R. T.; O'Brien, A. M.; Harrison, T. L.; Frederickson, M. E. Experimental Evolution Makes Microbes More Cooperative with Their Local Host Genotype. *Science* **2020**, *370* (6515), 476–478.

## Methods

### Germination

- 28 rhizobia strains x 10 reps (5 wet 5 dry) + 20 controls (10 wet,10 dry) 100 clover seeds, counted daily for 7 days

### Biofilm Production

- 28 strains x 6 reps + sterile controls + standard curve in 2 x 96 well plate, incubated, and read on plate reader after 48 hours



Clover growing in magenta box for germination protocol