

# The role of microorganisms in nutrient provisioning in Peola

Janice Parks<sup>1,3</sup>, Danika Dalvia<sup>4</sup>, and Maren Friesen<sup>1,2</sup>

(<sup>1</sup>Department of Plant Pathology; <sup>2</sup>Department of Crop and Soil Science; <sup>3</sup>Molecular Plant Sciences Ph.D. Program; School of Molecular Biosciences<sup>4</sup>)



WASHINGTON STATE UNIVERSITY

## PLANT-PLANT INTERACTIONS AND THE MICROBIOME

Runoff from N fertilizers have harmful environmental impacts<sup>1</sup>

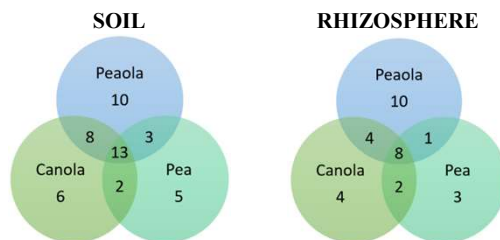
- Groundwater pollution
- Acidification and eutrophication of aquatic ecosystems

Pea-canola intercropping (peola) causes a 65% increase in land productivity without N fertilizer inputs<sup>2</sup>

Bacteria shared across all 3 microbiomes, but peola has unique members

- Some unique members have N fixing potential in both the soil and rhizosphere

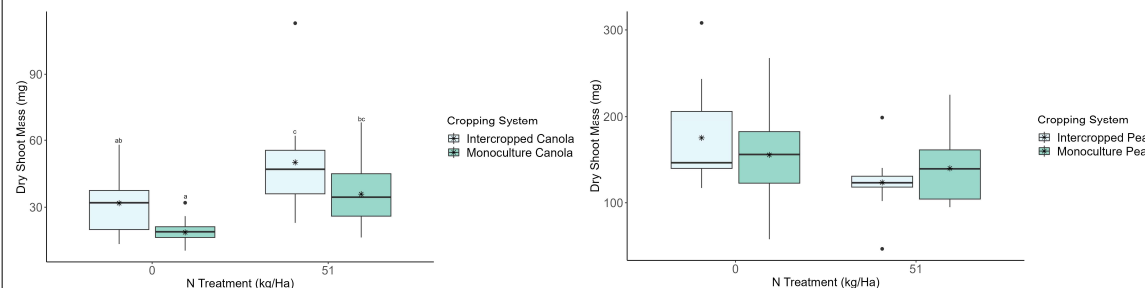
Suggests peola is creating a unique soil environment



Do pea associated microorganisms provide N to canola?

- *Pea associated rhizobia and AMF are providing N to canola through the release of symbiotically fixed N and the mineralization of N from degrading organic matter*

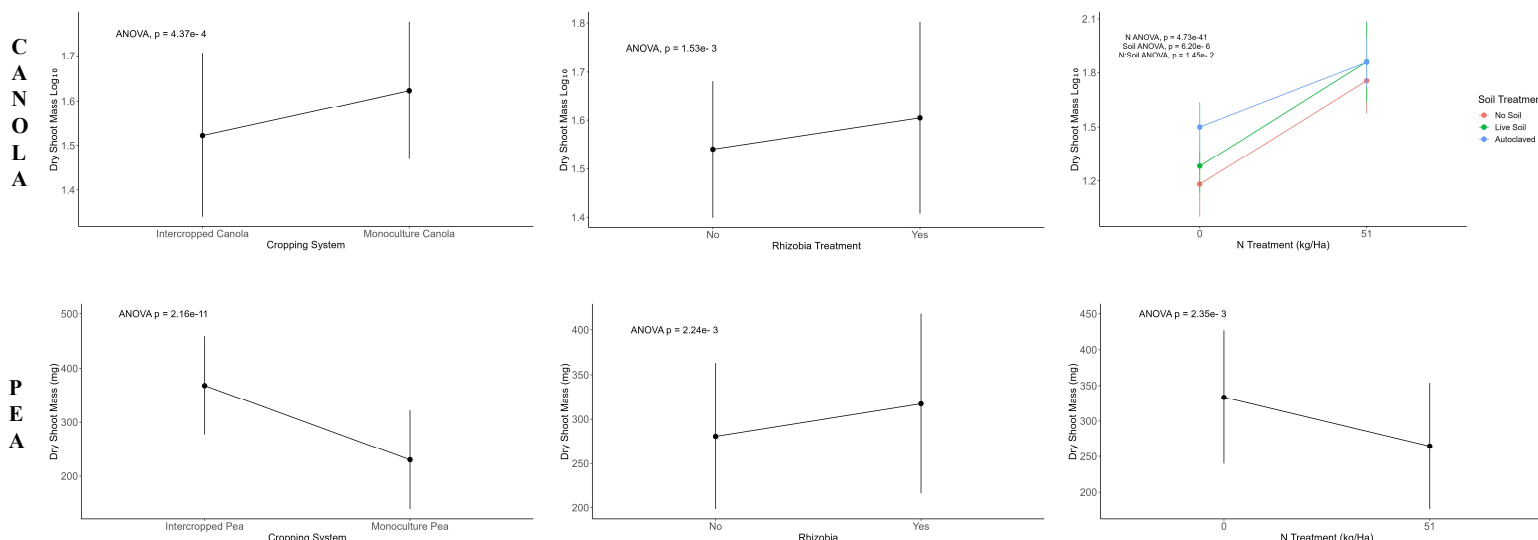
## INITIAL GREENHOUSE EXPERIMENT SUGGEST NUTRIENT PROVISIONING



Significant differences ( $P < 0.05$ ) are designated by different letters

- N treatment (ANOVA,  $P = 0.000253$ ) and pea (ANOVA,  $P = 0.00644$ ) found to significantly impact canola growth independently of each other (ANOVA,  $P = 0.533$ )
- Intercropped canola with no fertilizer treatment not being significantly different from monoculture canola with fertilizer treatment is suggestive of N being provided to canola in the intercrop
- Pea was unaffected by the intercrop and N

## MICROORGANISMS, N APPLICATION, AND CROPPING SYSTEM HAVE SIGNIFICANT IMPACTS ON PLANT GROWTH



The cropping system, N application, rhizobia treatment, and the soil microbiome were manipulated in this greenhouse experiment

- Intercropping was detrimental to canola growth but beneficial to pea
- Rhizobia improved the growth of both canola and pea
- N treatment was beneficial to canola growth with the magnitude dependent on soil treatment
- N treatment was detrimental to pea growth
- Soil treatment had no significant impact on pea growth

## CONCLUSIONS AND NEXT STEPS

Intercropping, rhizobia, and N application have a significant impact on plant growth. However, the impacts of intercropping on plant growth are currently inconclusive from the two experiments. Further greenhouse experiments should be performed to draw conclusions.

## CONTACT INFORMATION

Janice Parks:

Email: [janice.parks@wsu.edu](mailto:janice.parks@wsu.edu)

Maren Friesen:

Email: [m.friesen@wsu.edu](mailto:m.friesen@wsu.edu)

## REFERENCES

- <sup>1</sup>Erisman J., Galloway J., Seitzinger S., Bleeker A., Dise N., Petrescu R., Leach A., de Vries W. Consequences of human modification of the global nitrogen cycle. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 2013;368(1621):20130116. doi: 10.1098/rstb.2013.0116
- <sup>2</sup>Madsen I., Ford J. Peaola yield and land equivalent ratio experiments. 2021 *Dryland Field Day Abstracts*. 2021:66-67