



Investigating Phosphorus Availability in Biosolids Amended Agricultural Soils

A NEBRA FUNDED RESEARCH PROJECT

SUMMER 2021

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Project Goal

“To research and study phosphorus (P) availability and transport in biosolids amended agricultural soils.”

Specifically:

- Data from 2 farms
- P availability, mobility, testing, and regulations
- Biosolids vs. traditional fertilizers





Introduction



Relevant Forms of P

- ❖ Total P
- ❖ Insoluble P
- ❖ Labile P
 - Water Extractable P
 - Plant Available P



Methods



LIT REVIEW



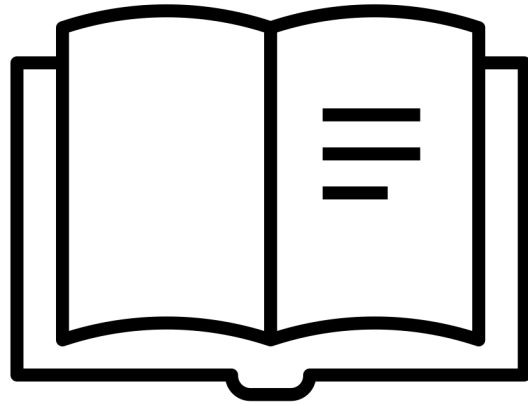
DATA ANALYSIS



SOIL TESTING



Literature Review Findings

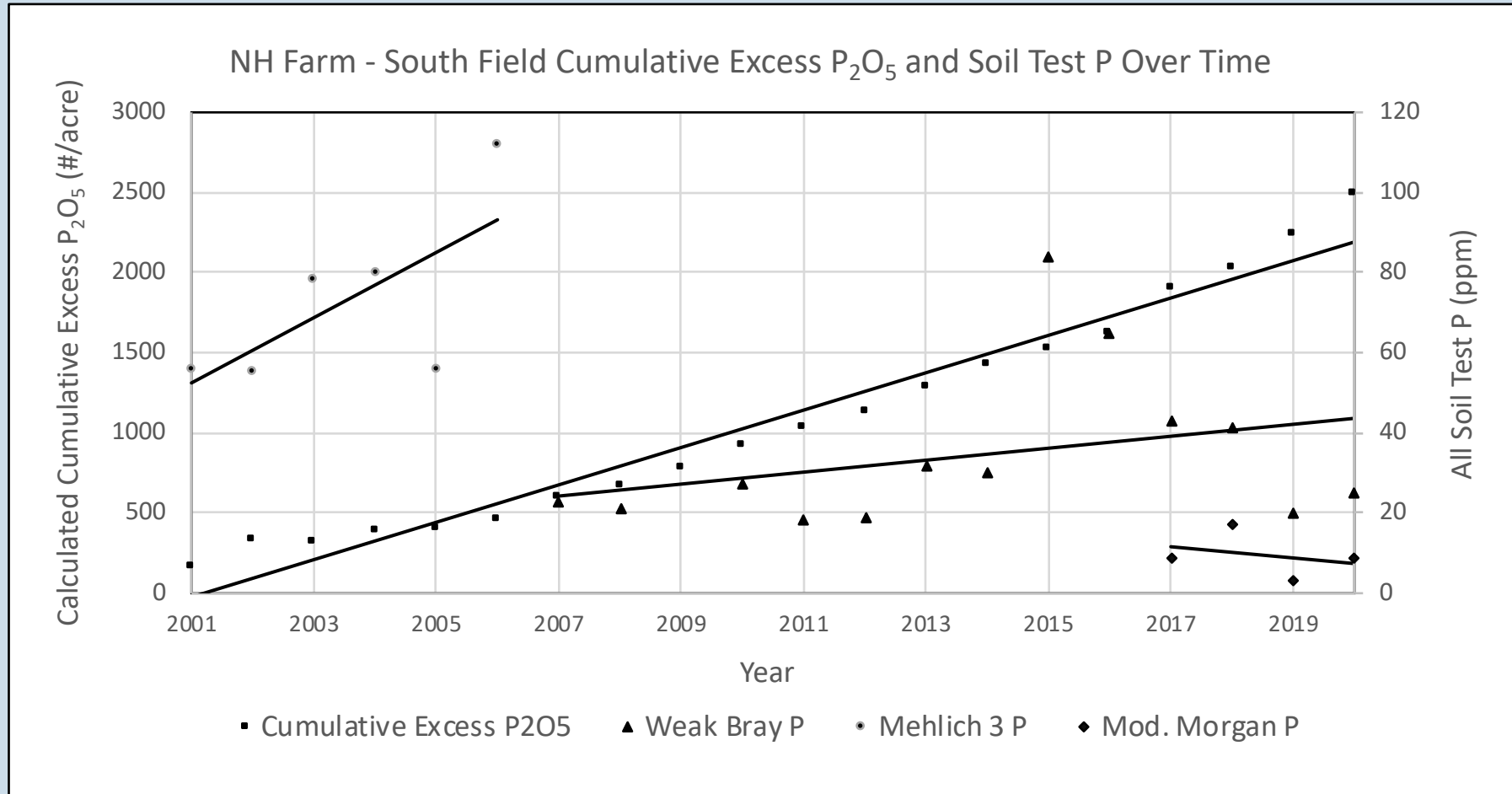


- N:P ratio
- Comparisons
- P Concentration Regulations
- WWTP Additives
- PSI regulations

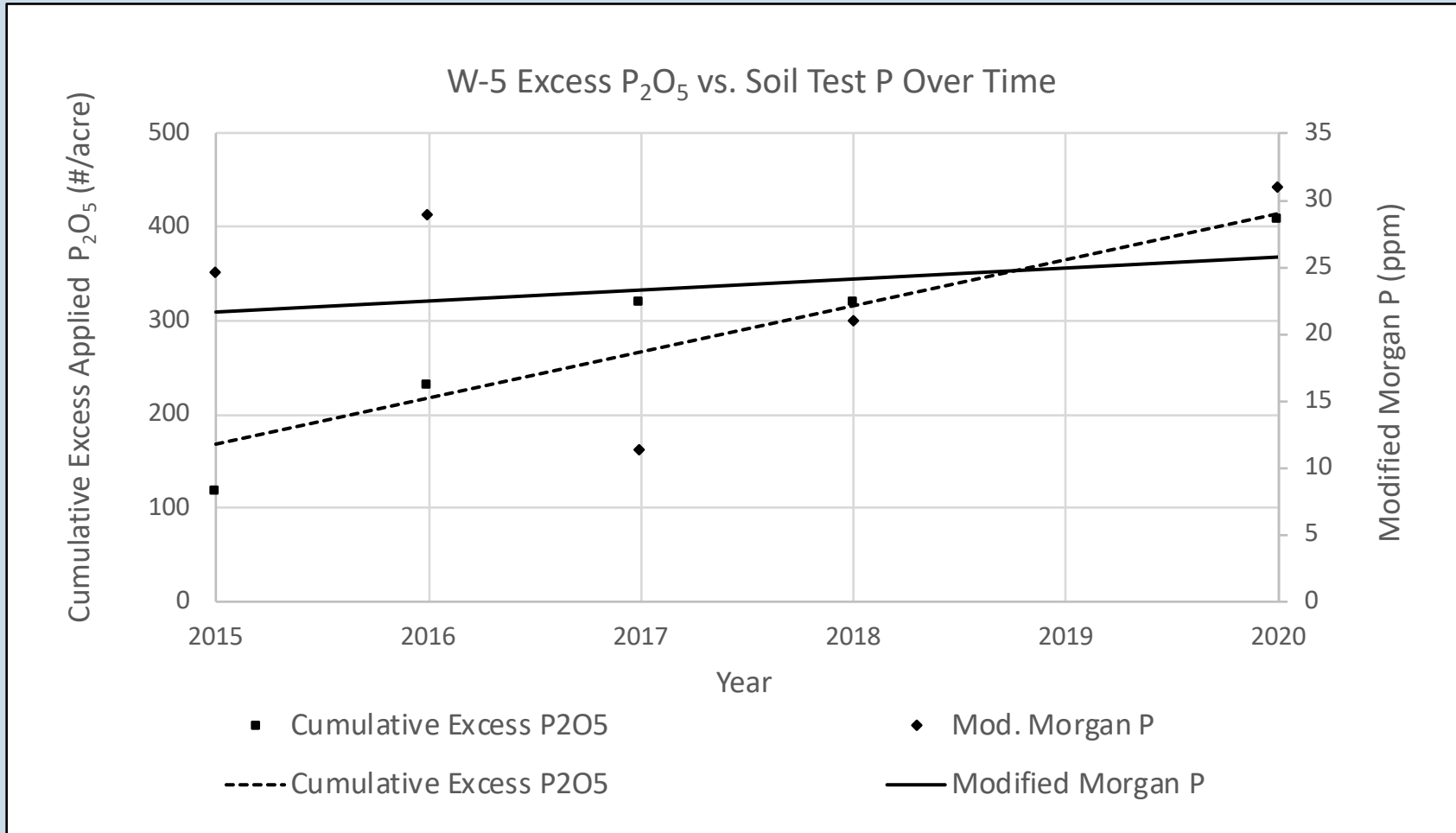
$$\text{PSI} = \text{P}_{\text{M3}} / [\text{Fe}_{\text{M3}} + \text{Al}_{\text{M3}}]$$



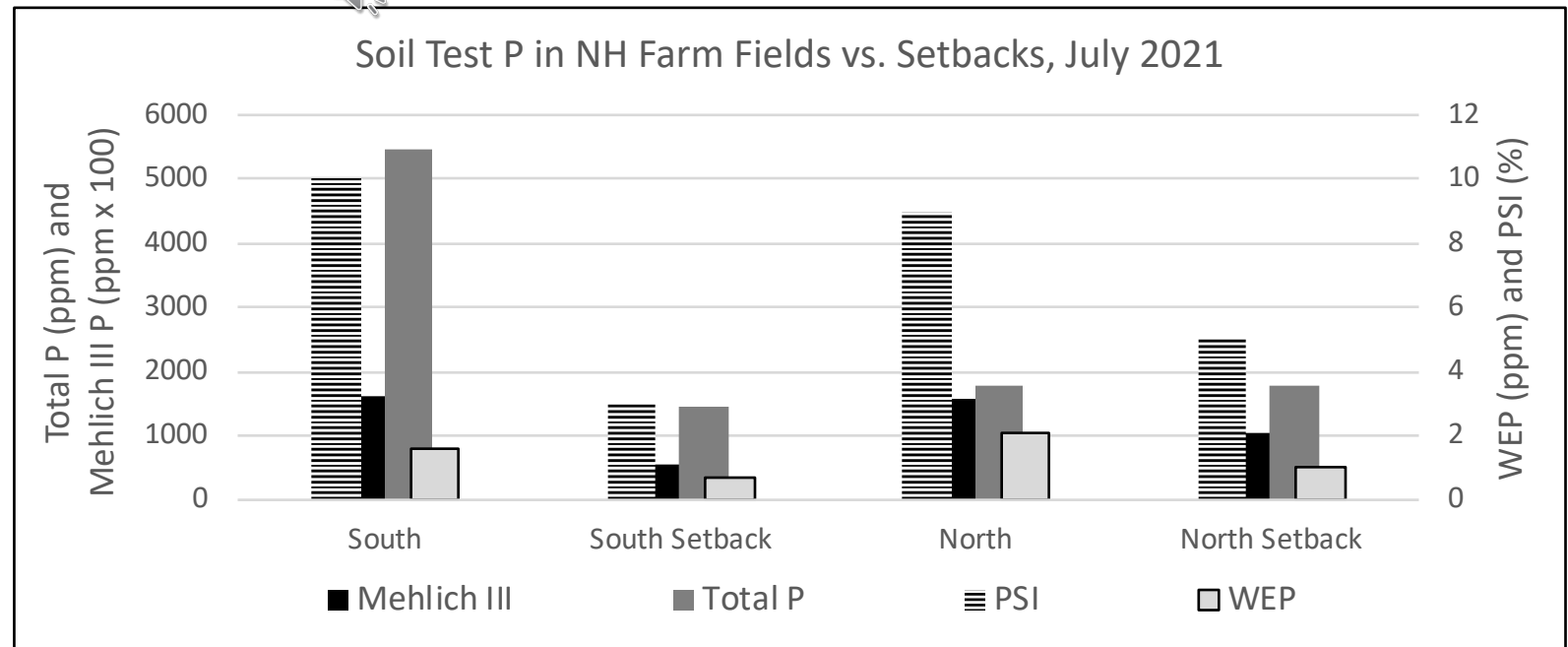
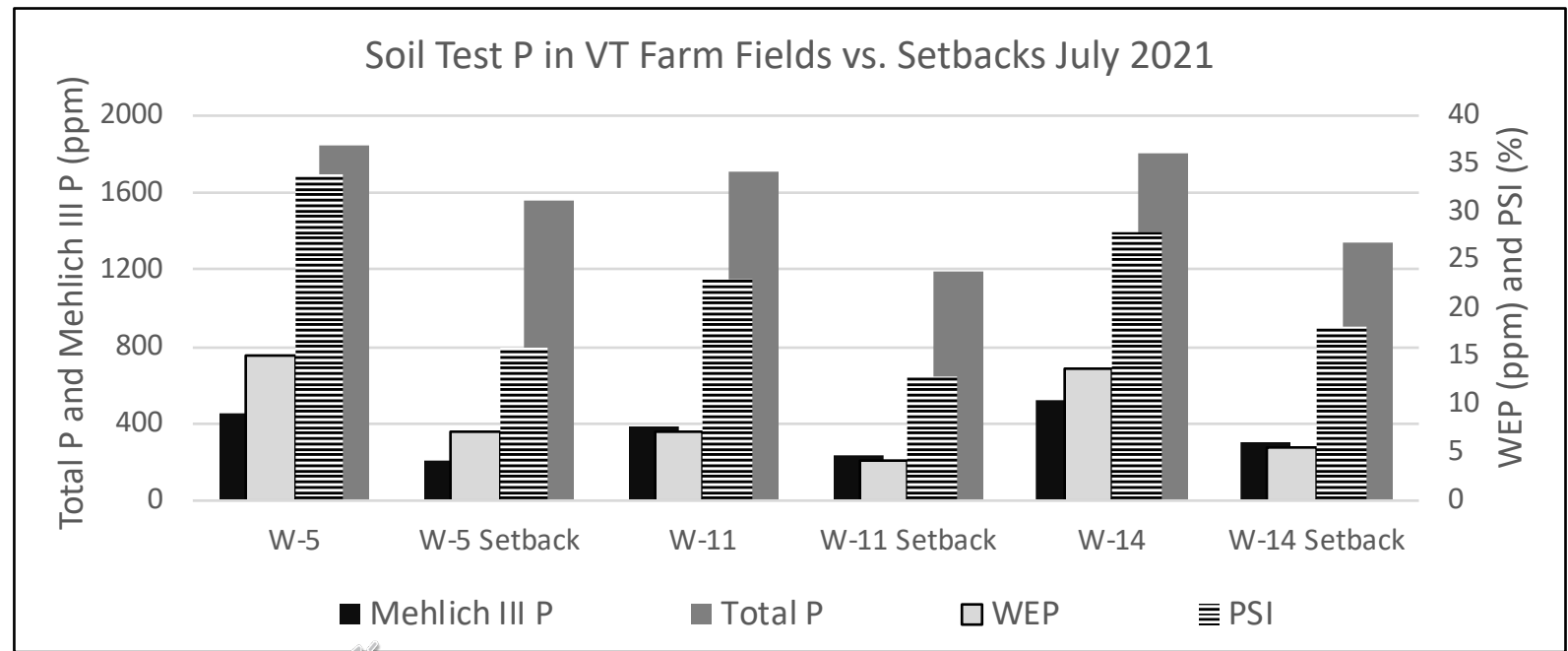
Preliminary Results: P Availability



Preliminary Results: P Availability



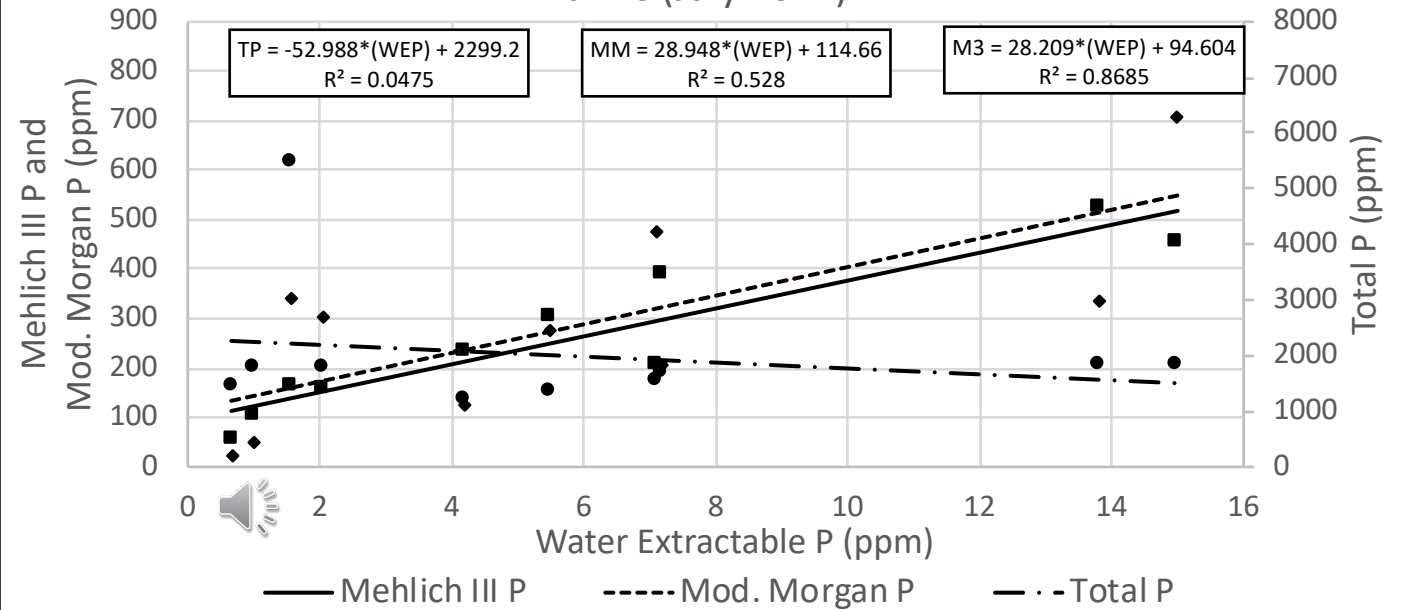
Preliminary Results: P Mobility



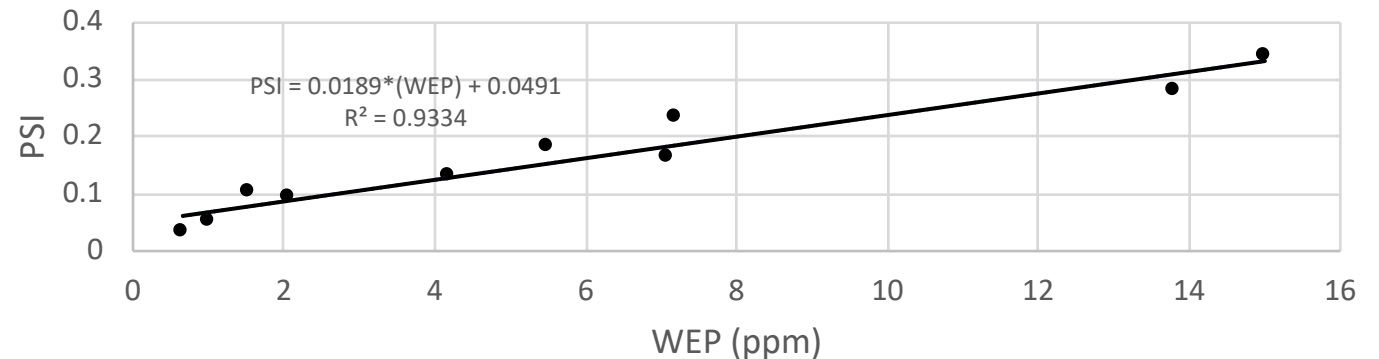
Preliminary Results: P Test Correlations

$$PSI = P_{M3} / [Fe_{M3} + Al_{M3}]$$

Total P, Mehlich III P, and Mod. Morgan P vs. WEP for Both Farms (July 2021)



PSI vs. WEP for Both Farms (July 2021)



Summary

The Goal

Literature Review

Soil Testing

Data Analysis

Results & Comparison



Future Recommendations

- Further investigate farms with detailed biosolids application and soil testing data
- Focus on PSI as an environmental risk indicator for biosolids amended soils
- Focus on Mehlich III P tests as plant available P indicators for biosolids amended soils



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NH Farm

VT Farm

NEBRA and
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References

- Boudeman, L., Davis, B., McNeill, A., Beecher, N., Rubin, R. P., Stephanoff, B., & Brisolaro, K. (2014). *Fact Sheet - Phosphorus in Biosolids: How to Protect Water Quality While Advancing Biosolids Use*. Water Environment Federation.
- Elliot, H., & O'Connor, G. (2007). Phosphorus management for sustainable biosolids recycling in the United States. *Soil Biology and Chemistry*, 1318-1327.
- Ketterings, Q., & Barney, P. (2006). *Agronomic Fact Sheet Series - Fact Sheet 15*. Retrieved from Cornell.edu: <http://nmsp.cals.cornell.edu/publications/factsheets/factsheet15.pdf>
- Penn, C., & Sims, T. (2002). Phosphorus Forms in Biosolids-Amended Soils and Losses in Runoff: Effects of Wastewater Treatment Processes. *Journal of Environmental Quality*, 1349-1361.
- Sharpley, A., & Moyer, B. (2000). Phosphorus Forms in Manure and Compost and Their Release during Simulated Rainfall. *The Journal of Environmental Quality*, 1462-1469.
- Shober, A., & Sims, T. (2003). Phosphorus restrictions for land application of biosolids: current status and future trends. *Journal of Environmental Quality*, 1955-1964.
- Tian, G., Cox, A., Kumar, K., Granato, T., O'Connor, G., & Elliot, H. (2016). Assessment of plant availability and environmental risk of biosolids-phosphorus in a U.S. Midwest Corn-Belt Soil. *Journal of Environmental Management*, 171-176.

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