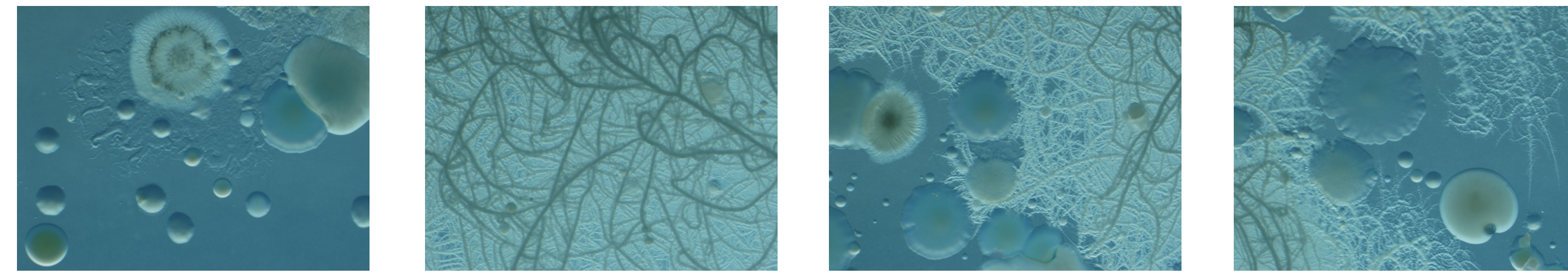


# Effects of crop diversity on plant-soil-microbial interactions



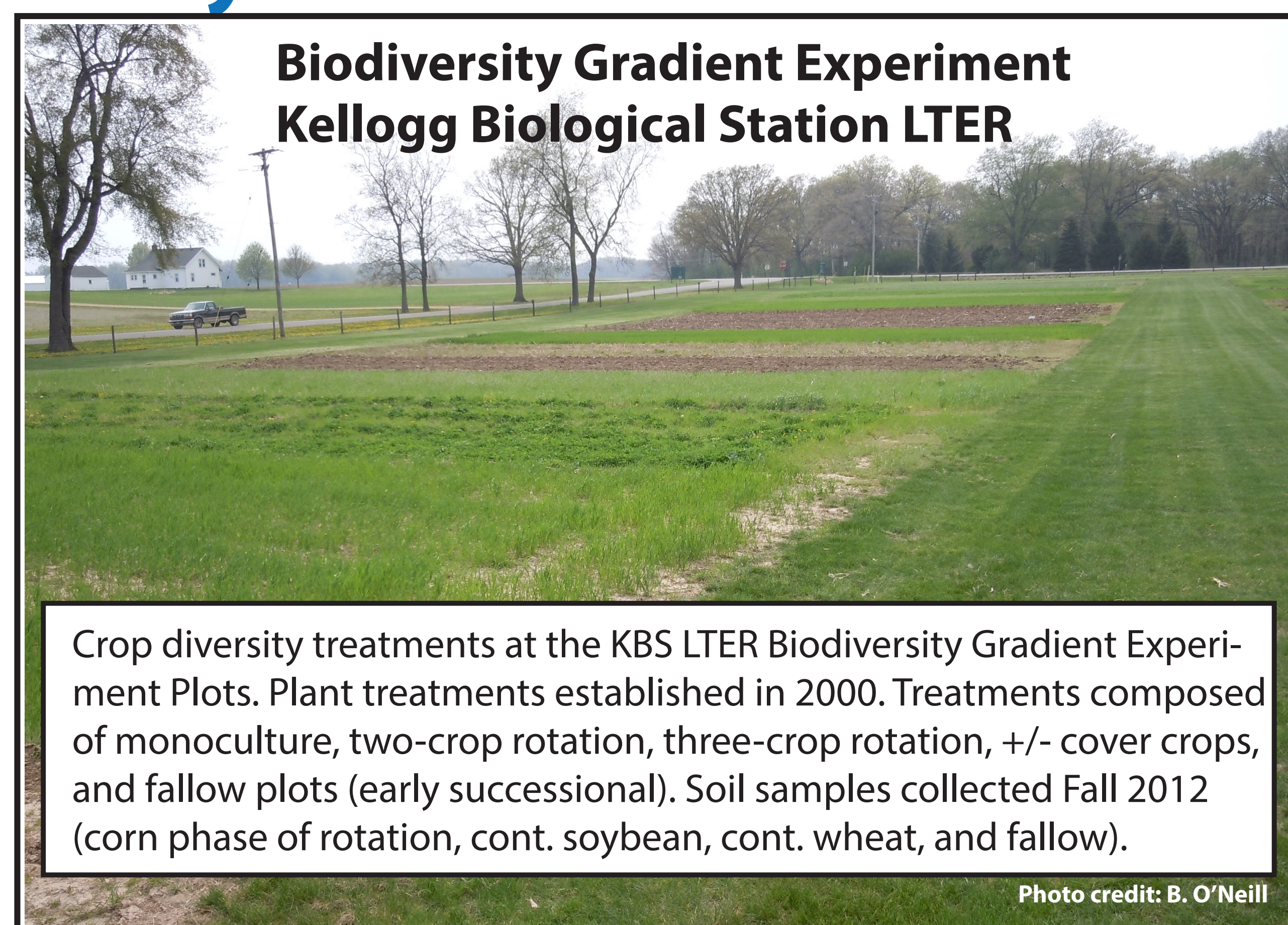
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## Background

- Manipulation of agricultural management can have lasting impacts on microbial community structure and function.
- Plant-microbe interactions directly influence community composition above and belowground; plants influence soil microbial community composition, and this microbial shift can affect plant growth rates.
- Microbes influence plant growth and reproduction through solubilization of mineral nutrients in soil,  $N_2$  fixation, plant growth promotion, and plant pathogen suppression.
- Plants contribute different root exudates providing a variety of substrates to soil microbes.
- Long-term effects of plant inputs contribute significantly to soil microbial biodiversity in support of ecosystem functions (e.g., crop productivity) in some cases.

**Objective: To investigate the impact of long-term crop diversity on soil microbial diversity**

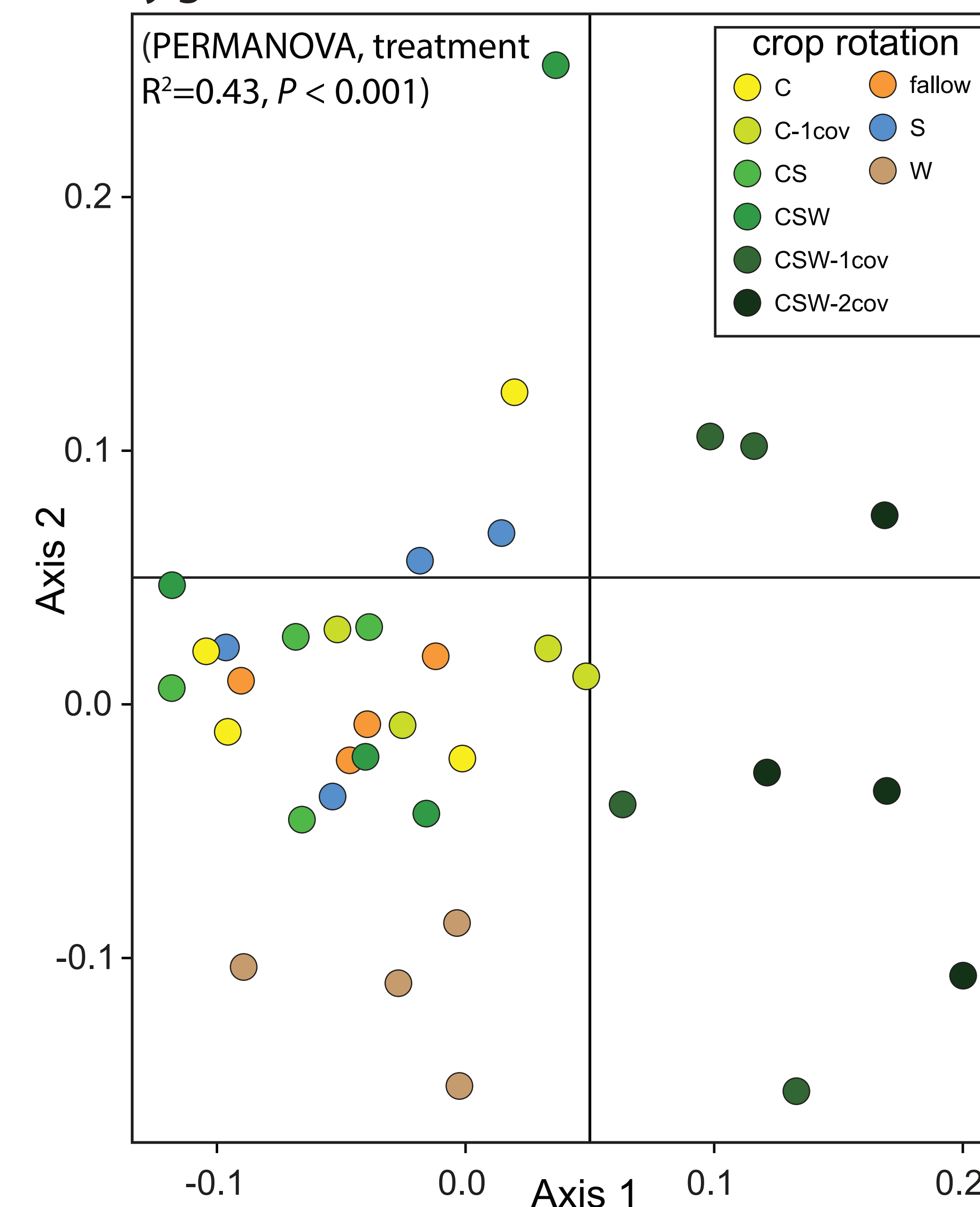
## Study Site



## Results

Figure 1. Non-metric multidimensional scaling plot of soil bacterial community composition along a crop diversity gradient. Symbols are colored according to crop diversity treatment.

- **Bacterial communities significantly differed along crop diversity gradient.**



### Redundancy Analysis

bacterial community ~ crop biomass + cover crop biomass + weed biomass; cover crop:  $R^2 = 0.13$ ; weeds:  $R^2 = -0.02$ ; crop:  $R^2 = -0.02$ ; RDA model,  $P = 0.025$

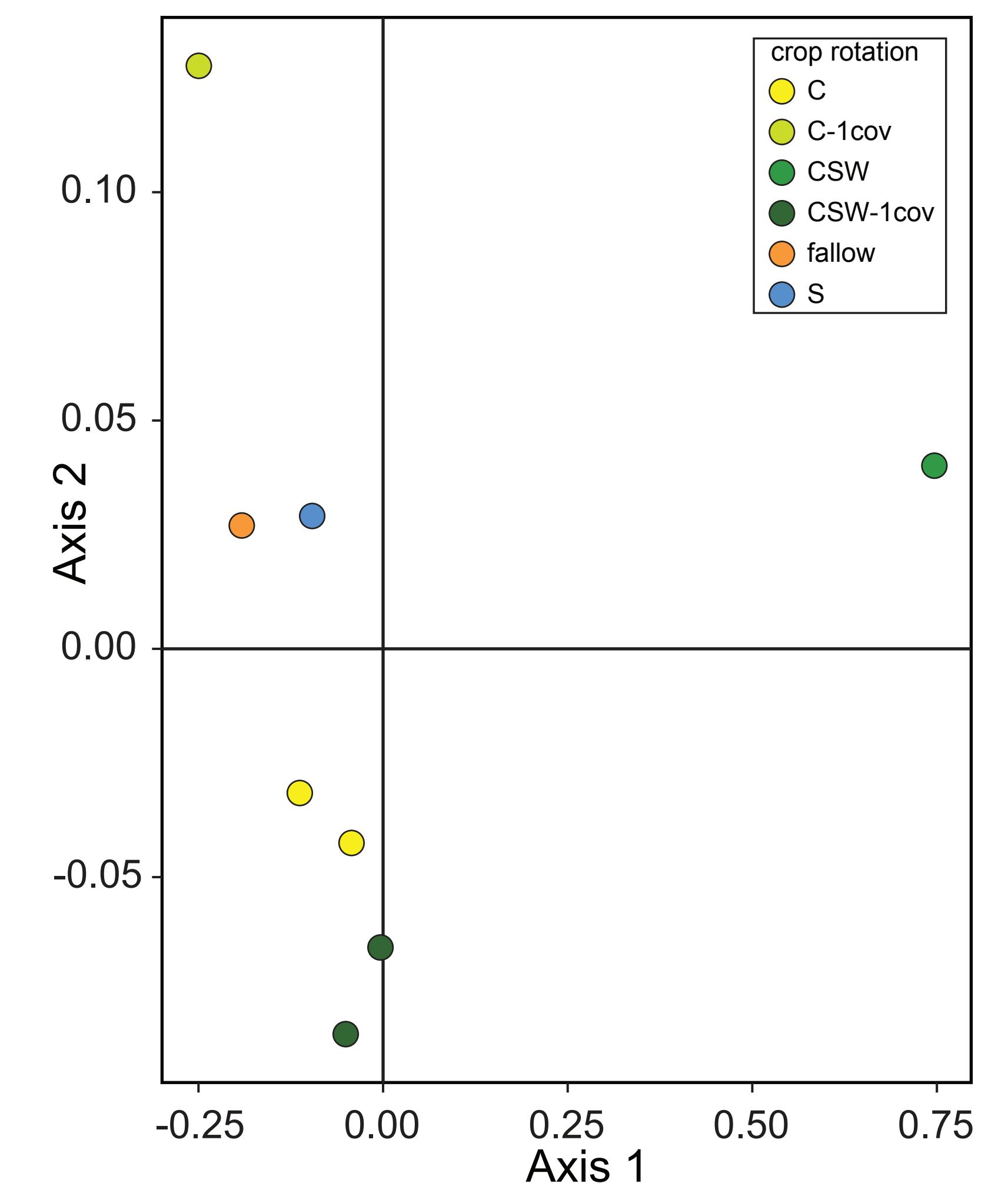
- **Cover crop biomass significantly impacted bacterial community composition.**

Table 2. Summary of permutational multivariate analysis of variance (PERMANOVA) results showing the contribution of soil factors on bacterial community variation at the KBS Biodiversity Gradient Experimental plots.

- **Total soil carbon significantly explained bacterial community variation.**

Soil factor	df	Sum Sqs	F-Model	R <sup>2</sup>	P-value
soil moisture	1	0.016	1.705	0.054	0.123
sand	1	0.005	0.556	0.017	0.767
pH	1	0.016	1.697	0.053	0.129
nitrate	1	0.004	0.453	0.014	0.865
ammonium	1	0.004	0.473	0.015	0.857
<b>total carbon</b>	1	0.026	2.782	0.087	0.019

Figure 2. Non-metric multidimensional scaling plot of the microbial functional group associated with fungal pathogen biocontrol along a crop diversity gradient (preliminary data). Symbols are colored according to crop diversity treatment. The *phlD* gene target represents microbes capable of producing secondary metabolite 2,4-diacetylphloroglucinol (DAPG) responsible for the suppression of fungal pathogens. Communities somewhat differed along crop diversity gradient (PERMANOVA, treatment  $R^2=0.89$ ,  $P=0.04$ ).



## Summary

- Initial research findings indicate that crop diversity influenced bacterial community composition.
- Presence of cover crops in rotation significantly accounts for variation in soil microbial community.
- Crop diversity impacts on microbial biocontrol function are detected but inconclusive.
- Plants and microbes drive nutrient cycling in this long-term crop diversity gradient since no other synthetic or organic amendments are applied.
- Differences in plant contributions to soil organic matter pools can be a possible mechanism driving shifts in microbial community patterns.
- Examining long-term nutrient inputs on microbial carbon usage and biocontrol function is ongoing.

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