

Rhizosphere Soil Microbial Communities of Winter Canola and Winter Wheat at Six Paired Field Sites in Eastern Washington



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With increasing acreage of canola in the Inland Pacific Northwest, it becomes necessary to investigate the effect of this relatively new rotational crop on soil microbial communities and the performance of subsequent crops. Canola plants contain glucosinolates (GSLs), which upon cell rupture and during the decay of residue hydrolyze to produce isothiocyanates (ITCs). The production of ITCs is the mechanism responsible for the “biofumigation effect.” The biofumigation effect is generally considered positive; however, the non-selectivity of ITCs has potential to impact beneficial soil organisms. Canola root GSLs and ITCs often have greater concentration and toxicity in the root. Toxicity and proximity of ITCs to soil microorganisms would potentially create changes in the rhizosphere soil microbial community. Results from a related field study near Reardan, WA suggest that winter canola influenced the bulk soil microbial community as a whole. Suppression of fungal members of the microbial community including mycorrhizae was observed. The objective of this research is to determine the differences and similarities in the rhizosphere microbial communities of canola and wheat. Canola and wheat rhizosphere soil (Fig. 1A) was collected from six farms in Adams and Douglas Counties. Each farm is a paired site with winter canola and winter wheat grown in adjacent fields having similar soil properties and crop history. Each sample was a composite of rhizosphere soil of five plants at two landscape positions. Fall samples were collected in November of 2015 and another spring sampling in March 2016. Samples from the farms of Derek Schafer, Rob Dewald, and Curtis Hennings near Ritzville, WA and Doug Poole, Tom Poole, and Denver Black near Mansfield, WA were collected. Rhizosphere microbial community composition was determined using phospholipid fatty acid (PLFA) analysis. PLFA data showed differences in the microbial community associated with landscape position and no significant differences between crops at the fall sampling. PLFA data from spring samples showed significant differences in the microbial communities between the canola and wheat treatments (Fig. 1B) while the differences associated with landscape became negligible. These data suggest that initial microbial communities were similar and only varied with expected differences in landscape. As the crops develop, microbial communities shift and the influence on the rhizosphere becomes apparent. Given the importance of microbially-mediated soil processes, any decline in members of the community or the community as a whole could potentially impact the performance of subsequent crops.

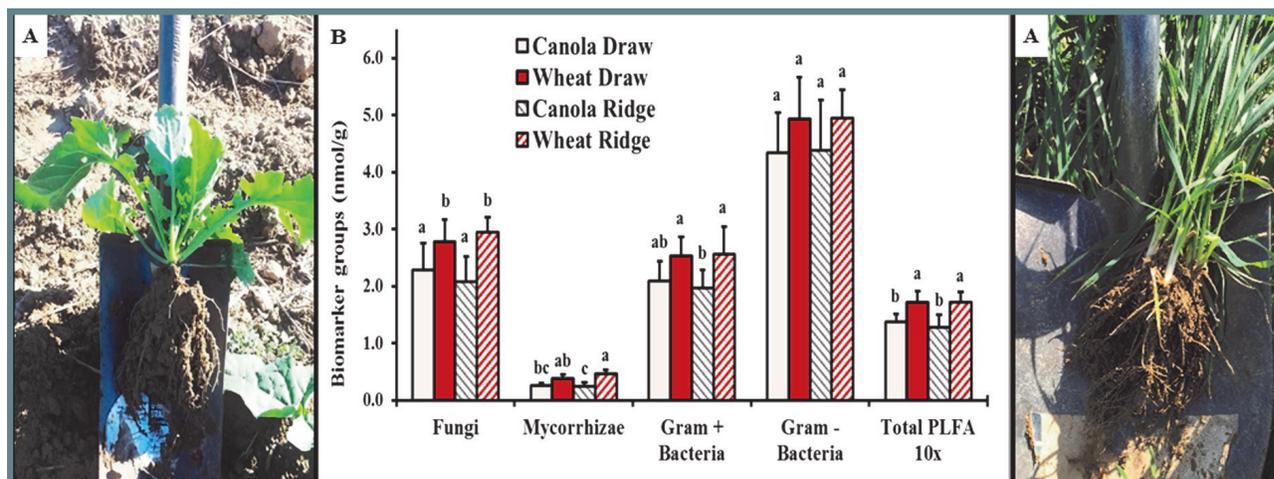


Figure 1. Differences in microbial community groups as determined by PLFA biomarkers. Pictures show the collection of canola and wheat rhizosphere samples. Rhizosphere soil is defined here as soil adhering to canola or wheat roots after extraction.