



## Pre-seed glyphosate application had little impact on wheat rhizobacterial communities

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After seven years of pre-seed glyphosate application in a wheat-wheat or wheat-pea rotation, in min-till or no-till, there were few effects on the wheat rhizobacterial communities.

Due to widespread adoption of no-till management and use of glyphosate-resistant transgenic crops, glyphosate is the most widely used herbicide worldwide. In this research, the effects of pre-seed glyphosate, tillage, and crop rotation was studied to determine the impact on the diversity and composition of soil bacterial communities in the durum wheat rhizosphere after six and seven years of glyphosate applications. The field trial was conducted at Agriculture and Agri-Food Canada's research farm at Swift Current, Saskatchewan.

There were two crop rotation treatments of continuous durum wheat (W-W) and durum wheat alternated with field pea (P-W). The min-till (MT) treatment include one pass of a tine-harrow cultivator at 2.75 inches (7 cm) prior to seeding, while the no-till (NT) treatment was direct seeded into the previous crop's standing stubble. Glyphosate was applied pre-seed or no glyphosate was applied.

In 2011 and 2012, six and seven years after the start of the trial, soil samples were collected in the wheat phase of the rotations. The samples were taken at the flag leaf growth stage of wheat in July. The soil samples were genetically analyzed to determine the rhizobacterial communities.

### **Few effects on the soil bacterial communities**

After seven years of annual glyphosate applications in a wheat monoculture or pea–wheat rotation in two tillage systems, there were few effects on the soil bacterial communities in wheat rhizosphere.

Twenty bacterial phyla were observed across the treatments. The most abundant phyla were *Proteobacteria* (25.1% relative abundance), *Actinobacteria* (21.7%), *Acidobacteria* (8.7%), *Bacteroidetes* (5.9%), *Firmicutes* (1.4%), *Armatimonadetes* (1.3%), and *Verrucomicrobia* (1.2%).

Glyphosate reduced the relative abundance of *Alphaproteobacteria* in W–W rotation but increased it in P–W rotation, and it reduced the relative abundance of *Opitutus* species.

*Alphaproteobacteria* contain many plant-beneficial soil microorganisms that include rhizobia. *Opitutus* species were a minor component of the bacterial community in these soils with only 0.33% relative abundance, and little is known about them in soil except *Opitutus terrae* found in rice paddy soils.

The W–W rotation had greater relative abundances of the classes *Bacilli* (phylum *Firmicutes*) and *Gammaproteobacteria*, and genera *Bacillus* and *Opitutus* (Phylum *Verrucomicrobia*) compared to the P–W rotation. *Bacillus* species provide many beneficial services to plants, including nutrient acquisition, production of plant hormones and biological control of pathogens.

Relative to minimum tillage, no-till increased the relative abundance of the phylum candidate WPS-1, but it reduced that of *Phenylobacterium* species (class *Alphaproteobacteria*) in W–W rotation. WPS-1 has been related to available phosphorus and copper contents in soil, and *Phenylobacterium* species have been shown to degrade some hydrocarbons in contaminated soils.

Growing season (year) had a bigger impact on the soil bacterial community diversity than the treatments. The most abundant bacteria (*Proteobacteria* and *Actinobacteria*) were more abundant in 2012 when rainfall was 59% below normal, perhaps because the other bacteria were less tolerant of the soil moisture deficit.

The researchers recommend further studies should be conducted that include fungal communities and functional microbial attributes to fully understand glyphosate, tillage, and crop rotation effects on the wheat rhizosphere microbiome in the Canadian prairies.

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Newton Z.Lupwayi, Myriam R.Fernandez, Derrick A.Kanashiro, and Renee M.Petri. Profiles of wheat rhizobacterial communities in response to repeated glyphosate applications, crop rotation, and tillage. *Canadian Journal of Soil Science*. <https://doi.org/10.1139/cjss-2020-0008>