Title: **Sticky Roots--Implications of Widespread Viral Infection of Plants for Soil Carbon Processing in the Rhizosphere**

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Project Abstract: Mineral-associated organic matter (MAOM) is a dominant component of total soil carbon that can be protected from decomposition for millennia. We are striving to understand mechanisms by which plant roots can dislodge organic matter (OM) from soil minerals. Model compounds common in rhizodeposits can destabilize MAOM, spurring its mineralization by microbes and, potentially, pulling associated nutrients into actively cycling pools. The importance of MAOM dynamics has spurred its inclusion in DOE's ELM model. We are using a novel tool to perturb belowground function: viral infection. Phloem flow is increased by infection, leading to roots becoming "sticky." Infection also decreases root:shoot ratio, so shoot nutrient demand must be met by more intensive mining of soil per unit root.

In TES Exploratory project (DE-SC0019142), we have experimented with a simple one virus (Barley Yellow Dwarf Virus)–one plant (*Avena sativa*) system. Infected plants exhibited reduced photosynthesis, plant biomass, and root:shoot ratio. Phloem contents (leaves, stems, and roots) sampled using aphid stylectomy and analyzed by GC-MS included sugars, organic acids, and amino acids. Analysis by FTICR-MS of liquid gathered from around roots of infected and uninfected plants grown hydroponically (therefore with no water or nutrient limitations) suggested a shift of rhizodeposit constituents toward amino sugars and carbohydrates with infection. Microdialysis sampling in soil microcosms, followed by LC-MS/MS, revealed altered metabolite abundances upon root growth nearby. Using synthetic MAOMs produced with ^{13}C- labeled glucose, we found that the chelator oxalic acid was most effective at mobilizing MAOM in soil slurries. In unsterilized soil, glucose and catechol were most effective, suggesting stimulation of microbial activity may have led to local conditions that mobilized MAOM.