

Root Herbivores in an Orchard System: Assessing the Influence of Root Herbivory and Pest Management on Root Dynamics, Soil Fauna, and Soil Carbon Pools

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Objectives

The central objective of our study is to assess the influence of root herbivory on root dynamics and major components of soil carbon cycles. A closely related objective is to assess the influence of root herbivore management (chemical pesticides and biological control) on roots, soil fauna (both root herbivores and non-target fauna), and soil carbon cycles. The field study focuses on spatial and temporal variability in root herbivory within a single orchard-herbivore system, and will be paired with a greenhouse experiment that examines a broader range of tree species and root herbivores in an attempt to identify common influences of these fauna on plant growth and soil-ecosystem function. We are among a small number of research groups world-wide employing the novel mini-rhizotron technique for the non-destructive study of root dynamics and carbon cycling in agricultural systems. The system is generally used in lighter soils, such as sandy-loams. The heavy clay soil in our experimental plots presented us with a serious challenge that gave us an opportunity to design tools and protocols uniquely suited to this soil type. Briefly, when excavating the holes into which the mini-rhizotron tubes were to be inserted, we had extreme difficulty removing the core of the soil from the corer. Thus, we designed and had built a corer that disassembles, so we can remove the soil core. In addition to allowing the installation of the mini-rhizotron tubes, the in-tact cores can be analyzed for root standing crop. We anticipate sharing this expertise with the broader research community in a brief methods paper in the near future. Though development of clay-specific strategies for the mini-rhizotron setup required us to prolong our experimental timeline, during that time we developed proficiency with the mini-rhizotron technique and use of the associated RooTracker software in the context of another related project. Additionally, we have successfully added soil herbivores (larvae of scarab beetles, collected from the field in Arbuckle) to all treatment plots and are proceeding rapidly toward the completion of tube installation. Upon completion, we will begin data collection in the field study. We anticipate setting up the greenhouse study this Spring.

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