## BELOW- AND ABOVE-GROUND HERBIVORE INTERACTIONS IN CEREAL CROPS

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Soil-dwelling insect pests pose special problems in many agricultural ecosystems. They often have cryptic life cycles, making their sampling difficult and damage hard to anticipate. Their management is therefore often based on preventative insecticides applied at planting or cultural practices. Wireworms, the subterranean larvae of click beetles have re-emerged as problematic pests on a wide variety of field crops in North America and globally. The "low pest status" of wireworms from 1950's until recently resulted in very little work on the biology and ecology of these species. There is a deficit in fundamental knowledge to develop new management tools and the producers are faced with the daunting challenge.

Below-ground and above-ground interactions between different pest species in the agricultural ecosystems are complex and regulate most of the developmental responses of important crop plants such as wheat. We have explored how wireworm presence influences interactions with other wheat pests. The system included wheat plant *Triticum aestivum* L., two wireworm pest species *Limonius californicus* (Mannerheim) and *Limonius infuscatus* Motschulsky, and the Bird cherry-oat aphid *Rhopalosiphum padi* (Linnaeus, 1758), one of the most abundant aphid pest species of wheat in the Pacific Northwest. These experiments were designed to examine how the two major pest wireworm species of the Pacific Northwest cereal crops affect wheat yield and how will they react to each others presence. Moreover, we investigated how below-ground feeding by wireworms affect aphid behavior and development. Furthermore, aphid influence on wheat yield was recorded. Results showed that different wireworm species impact wheat stand and yield unequally, such that management practices will need to vary across regions. Moreover, research showed that wireworm feeding may cause induced defensive responses in plants protecting them from aphids. This suggests that wireworms may directly or indirectly impact entire communities in wheat cropping systems. These findings support the development of novel strategies of integrated control of major wireworm pest species in the Pacific Northwest field crops.

Furthermore, we have explored the impact of climatic variability on the interactions between these pests and the ecosystems in which they live. This addresses not only the basic ecological questions related to the role of climate on species interactions, but also will aid in developing management strategies across regions with varying climatic conditions. Results from these experiments will be presented and discussed.