Soilborne Pathogen and Nematode Management through Removal of Root Inoculum in Continuous Red Raspberry Systems

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Background and Rationale
- Red raspberry (Rubus idaeus) is a major crop in the Pacific Northwest (PNW) of the US with 10,800 acres harvested in 2014 and an estimated production value of $68.8 million (NASS, 2015).
- Two of the known soilborne microorganisms affecting raspberry production in this region are the oomycete, Phytophthora rubi (casual agent of Phytophthora root rot; Fig. 1) and the plant-parasitic nematode, Pratylenchus penetrans (otherwise known as root lesion nematode).
- The industry relies heavily on soil fumigation for management of soilborne pathogens and pests, with growers typically fumigating fields in the fall or spring prior to replanting in continuous systems.
- Large amounts of root and crown material remain in fields prior to renovation, which could serve as a source of inoculum and bridge for soilborne pathogens and pests (Fig. 2).

Objectives and Hypothesis
- The primary objective of this project is to demonstrate and evaluate the efficacy of raspberry root inoculum removal as a pre-plant management technique for reducing soilborne pathogen and pest populations.
- The long-term objective of our work is to develop tools for the integrated management of soilborne pathogens and pests, including alternatives to soil fumigation.
- Our hypothesis is that root inoculum removal will reduce populations of soilborne pathogens and pests, thereby enhancing the utility of other management techniques.

Materials and Methods
- Experiment 1.
  - Three root removal devices were compared for speed and efficacy of root removal in commercial fields. Devices tested includes: Lundby plant lifter, beach cleaner, and potato harvester (Fig. 3).
- Experiment 2.
  - To evaluate the effects of root removal on soilborne pathogens and pests, a split-split plot experiment was established in a commercial field of ‘Meeker’ red raspberry in Aug. 2014 in Whatcom County, WA.
  - The main plot factor was fumigation (with or without, using Telone® C-35) and the split plot factor was root removal (with or without removal using a Lundby plant lifter), replicated six times. Main plots were 30.5 x 9 m and the split plots 15 x 9 m in size.
  - Data to be collected includes: changes in soilborne disease (Fusarium and Pythium, proxies for P. rubi) and P. penetrans populations, plant growth, and yield. This experiment will continue until 2018.

Preliminary Results
- All three devices removed 98% of the root/crown material (Fig. 4). The average speed of the plant lifter, beach cleaner, and potato harvester were 0.4 km/hr, 0.6 km/hr, and 1.6 km/hr, respectively.

Figure 3. Three root removal devices tested in 2014, including: A) potato harvester; B) Lundby plant lifter; and C) beach cleaner. Both the potato harvester and plant lifter were locally available, whereas the beach cleaner was purchased by a local grower.

Figure 4. Volume of roots remaining before (A) and after (B) root removal in a 0.1 m² excavated plot.