Root Health Management in Raspberry

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The Pacific Northwest of the US encompasses 90% of processed raspberry acreage nationwide. The duration of harvestable plantings has declined from >10 to approximately 5 yrs. Root rot damage by *Phytophthora rubi* (Pr) and *Pratylenchus penetrans* (Pp) has been associated with this decline, but soil characteristics that promote these pathogens are not well understood. Currently, broadcast pre-plant fumigation is used to manage soil borne pathogens; a practice that is expensive and chemically intensive. For my PhD research I propose to i) assess the effect of *P. rubi* and *P. penetrans* on root rot development, ii) develop a quantitative assay for Pr in raspberry soil and roots and iii) investigate alternatives to fumigation for pre-plant management.

Ten fields with root rot symptoms were sampled (10 sites per field; 10 soil cores (15-cm deep) per site) within Skagit and Whatcom Counties in October 2008. Soil samples were sieved (2-mm diam.) and root fragments were collected. Root sections (1-cm) were surface-sterilized and cultured on P_5ARP agar medium to recover Pr. A subsample of root sections was also evaluated by ELISA (10 sites/ field) and PCR (3 sites/field) for presence of *Phytophthora* spp. and Pr, respectively. Population densities of Pp were determined from root and soil samples. A composite soil sample from each field was sent to a commercial laboratory for chemical analysis. All fields had sites that were positive for *Phytophthora* spp. (30-100% of sites per field) and seven fields were found to have excessively high (>1,000 g/root) levels of Pp. Sampled fields had a wide range in pH (4.2 to 6.8), organic matter (3.3-8.7%) and available nitrate (2-145 ppm). Further analyses are in process to confirm the presence of Pr, relate soil information to pathogen incidence and understand the contribution of these pathogens to raspberry root rot and decline.

Soil solarization is an important component of soil borne disease management systems in many regions. Solarization (SOL) and a combination of SOL plus dripline fumigation (Inline™ Telone:chloropicrin 61:33, 400 L/HA) were investigated as alternatives for control of Pr and Pp in northwestern WA. Field plots were established at Washington State University-Northwestern Washington Research and Extension Center in Mount Vernon, WA in June 2007. Plots (3 x 30 m) were set up as a randomized complete block with five replications. Nylon mesh bags of Pr inoculum were placed at 15, 30 and 45-cm depths and harvested in March 2008. Pathogen survival in these bags was assessed in a greenhouse bioassay with tissue culture-propagated raspberry plants. Soil samples for nematode population density assessment were collected after SOL and fumigation in Oct 2007. Raspberry root samples were collected in November 2008 for Pp quantification. At 15, 30 and 45-cm, SOL plots accumulated 358, 38 and 0 hrs of heat units above 29 ^{o}C, respectively. The average root rot rating at all three depths for SOL (6.6) was significantly ($P < 0.05$) higher than the UTC (5.7) and similar to SOL-Inline (6.3). Root and shoot dry weights were not different between treatments. The Pp population density per g soil was significantly ($P < 0.05$) lower in SOL-Inline (8) compared to SOL (82.8) or the UTC (142.2). *Pratylenchus penetrans* per gram of fresh root was significantly lower in SOL (14.5) and SOL-Inline (1.7) compared to the UTC (62). Combining SOL with additional soil management techniques, such as dripline fumigation, may increase the effectiveness of this technology. Further work is underway to explore the use of organic amendments with SOL for increased control of Pr and Pp in raspberry systems.