AGRICULTURAL RESEARCH FOUNDATION
FINAL REPORT
FUNDING CYCLE 2013 – 2015

TITLE: Field cultural practices for controlling Phytophthora root rot disease of blueberry

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SUMMARY:
Phytophthora root rot is a serious disease of blueberries wherever the pathogen *Phytophthora cinnamomi* occurs in the soil. While conventional growers can use fungicides to help establish new plantings on sites where the pathogen is present, organic growers lack methods to minimize infection by *P. cinnamomi*. A combination of wide irrigation line placement with sawdust mulch and a gypsum soil amendment reduced infection of field plants by *P. cinnamomi* and provided the best organic treatment for root rot. However, fungicides provided the best overall disease control and resulted in the largest plants. Biocontrol treatments were not effective in treating blueberry root rot.

OBJECTIVES:
1. Evaluate influence of irrigation line placement on Phytophthora root rot severity.
2. Evaluate efficacy of a gypsum soil amendment for suppression of Phytophthora root rot.
3. Evaluate influence of sawdust versus weed mat mulch on Phytophthora root rot severity.
4. Evaluate efficacy of the biocontrol agent *Trichoderma virens* GL-21 for supression of Phytophthora root rot.

PROCEDURES:
Cultural Control
A field trial was planted to evaluate cultural controls for minimizing Phytophthora root rot caused by *Phytophthora cinnamomi* and included: 1) placement of drip irrigation lines adjacent to the crown of the plant versus placement at 8 inches away from the crown; 2) amendment of the soil with gypsum at 1 ton/acre versus no amendment; and, 3) application of a fresh Douglas-fir sawdust mulch versus a black plastic weed mat. Before applying the cultural treatments, the field was initially prepared by applying 1 inch of aged Douglas-Fir sawdust (1 year) across the field and incorporating with a tiller to provide organic matter. Beds were formed (36 inches wide by 12 inches high) and *P. cinnamomi* inoculum was applied and incorporated to ensure infection in all plots. The eight cultural treatments (all combinations of irrigation, gypsum amendment, and mulch) were then applied in a factorial design with six replicate beds and included an additional fungicide treatment (mefenoxam and fosetyl-Al) as a conventional control. Soil and root cores were sampled from the rootzone periodically to monitor infection

incidence. One plant from each plot was harvested in late fall 2012 and 2013 to determine plant growth response and root infection incidence.

Biocontrol

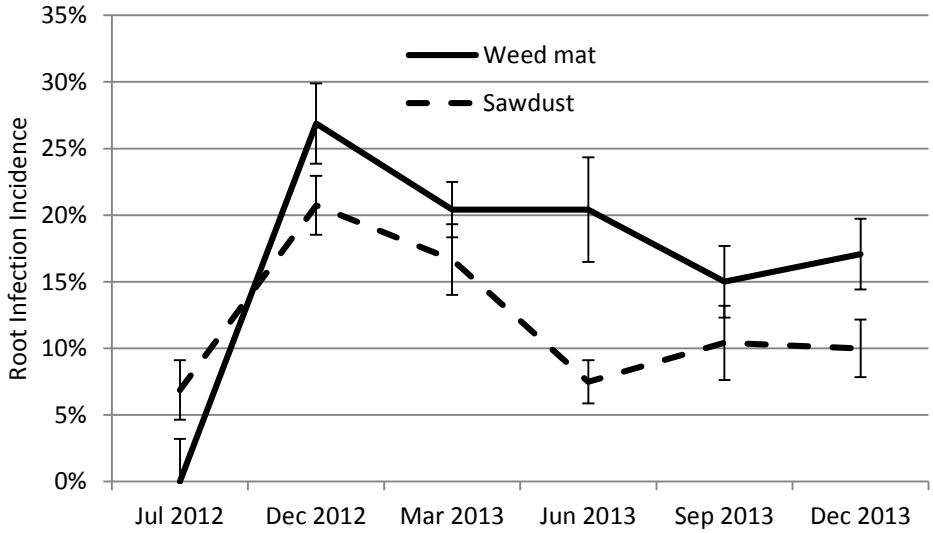
For biocontrol efficacy, two small-scale field trials were established at a grower/cooperator site in 2012 where *P. cinnamomi* was established in the soil. In one trial, a row of 30 established but infected 'Earliblue' blueberry plants were replaced with 1-gal 'Earliblue' plants. The replacement plants were treated with either *Trichoderma virens* (10 plants), conventional fungicides Aliette + Ridomil Gold (10 plants), or served as non-treated controls (10 plants). In the second trial, we replanted a previously failed blueberry establishment area with 'Duke' blueberry plants and treated 10 plants each with one of five treatments: gypsum at 2 tons/acre, *Trichoderma virens*, gypsum + *Trichoderma virens*, a conventional fungicide treatment of Aliette + Ridomil Gold, or they received no treatment (non-treated control). In June, the cooperator informed us the plants in both trials had died because his irrigation lines had failed.

Therefore, two separate greenhouse trials were established to evaluate the effectiveness of biocontrol treatments against blueberry root rot. In the first, nursery plugs of cultivar 'Draper' inoculated with *P. cinnamomi* at 2 propagules/gram of soil were treated with one of five biocontrol treatments according to manufacturer's directions (*Streptomyces lydicus*, *Trichoderma virens*, *Trichoderma asperellum + Trichoderma gamsii*, *Pseudomonas fluorescens*, *Bacillus subtilus*). Non-treated, but inoculated plants served as negative controls. In the second trial, two biocontrol treatments (*Trichoderma virens*, *Bacillus subtilus*) were compared to a fungicide control and a nontreated control in plants inoculated with *P. cinnamomi* at 0.5 propagules/gram of soil.

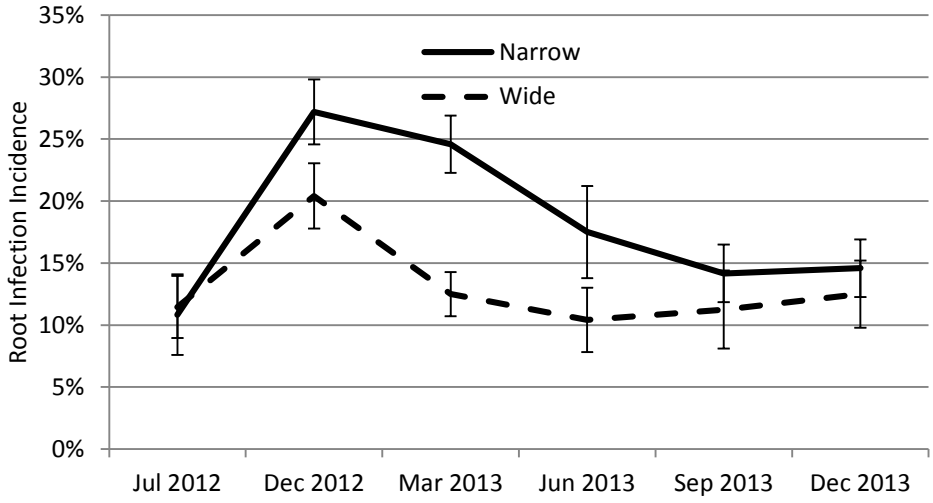
SIGNIFICANT ACCOMPLISHMENTS:

Cultural Control

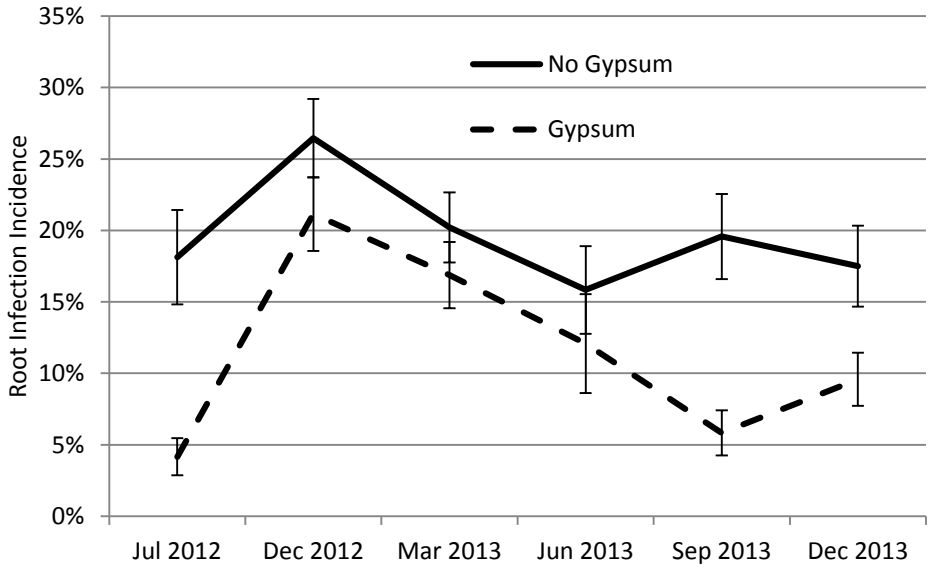
1. Plants with weed mat had significantly higher root infection than those with sawdust mulch during the summer when the pathogen was the most active. Plastic weed mat provided the higher soil temperatures preferred by this pathogen.



2. Plants with widely-spaced drip lines had significantly less root infection than those with drip lines located adjacent to the crown in Dec. 2012 and in Mar. 2013.

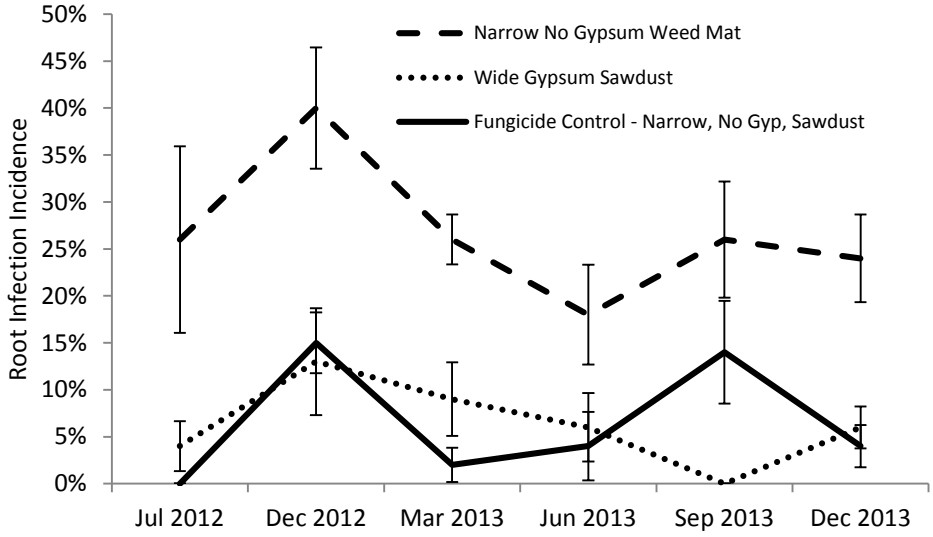


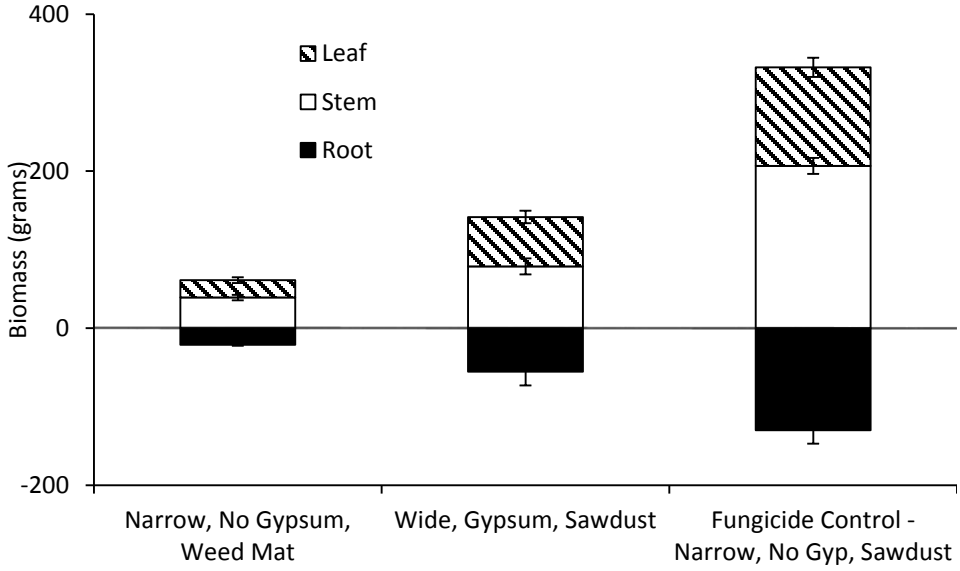
3. Plants amended with gypsum had significantly less root infection than those without gypsum in July and December in 2012 and in September and December 2013.



4. Plants with weed mat, narrow drip lines, and no gypsum had the most root infection among all of the whereas plants with sawdust mulch, widely spaced drip lines, and gypsum amendment had the least infection among all of the combinations of cultural treatments.

5. The fungicide treatment was the best disease control method. Although root infection in fungicide-treated plots was as low as that in plots with sawdust mulch, widely spaced drip lines, and gypsum amendment (the best cultural treatment combination), fungicide-treated plants were approximately twice as large as any of the plants from any cultural treatment by the end of the experiment.





Biocontrol

6. None of the biocontrol treatments provided effective control against *P. cinnamomi*.

BENEFITS & IMPACT:

These results provide organic blueberry growers with a combination of cultural treatments that are effective in reducing blueberry root rot. However, none of the cultural treatments provided as much disease control as a fungicide treatment. Therefore, as a first choice in blueberry root rot disease control, organic growers should avoid sites where *P. cinnamomi* is present. Conventional growers can integrate cultural methods of wide drip line spacing, sawdust mulch, and gypsum soil amendment with fungicide application to provide an integrated pest management option for Phytophthora root rot control.

ADDITIONAL FUNDING RECEIVED:

Weiland, J., Yeo, J., Sullivan, D., and Bryla, D. 2013. Non-fungicide control of phytophthora root rot disease of blueberry in field settings. Funded by the Oregon Blueberry Commission for $3700.

Sullivan, D., Yeo, J., Umble, J., Bryla, D., and Weiland, J. 2012. Control of Phytophthora Root Rot of Blueberry using Biocontrol Agents, Biofungicides, and Varietal Resistance. Funded by the Agricultural Research Foundation for $12,500.

FUTURE FUNDING:

None requested.