

Title: Management of blueberry (*Vaccinium* spp.) replant disease with pine bark soil amendment and pre-plant fumigation.

2014 Final Report

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Objectives: To evaluate integrated management of blueberry replant disease with pine bark amendment and preplant fumigant nematicides.

Justification: Blueberry (*Vaccinium* spp.) replant disease continues to be a major problem as growers are replacing older plantings with increasing frequency. Blueberry replant disease is characterized by poor growth, yellowing, stunting, and severely reduced yields in replanted areas (Brannen et al. 2014). Previous field trials have shown plant mortality rates as high as 71% in southern highbush plantings. Experiments with pre-plant fumigant nematicides demonstrated that plant growth, vigor, and yield were significantly higher where nematode densities were reduced by treatment with preplant soil fumigants (Noe et al. 2014). A systematic survey of blueberry farms in Georgia showed that more than half the plantings had significant numbers of *M. ornatum* present in the soil (Jagdale et al. 2013).

Previous projects funded with support from the Southern Region Small Fruit Consortium have evaluated preplant fumigant nematicides, soil solarization, and cultivar selection to manage plant-parasitic nematodes on blueberry replant sites. A project was begun in 2014 to evaluate combined treatments of soil fumigants and pine bark soil amendments to reduce population densities of *M. ornatum* in blueberry replant sites. The general benefits of pine bark soil amendment for blueberry production are well known and documented, but the possible additional benefit in sustainable management of blueberry replant disease has not been studied. Additional management options are needed for long-term blueberry production on replant sites. It is likely that a successful long-term solution for replant disease, especially on southern highbush, will include a combination of tactics, including preplant soil fumigation, pine bark soil amendments, and selection of the most tolerant/ resistant blueberry varieties.

Methodologies: We evaluated the efficacy of pine bark soil amendment with and without preplant soil fumigation for the management of replant disease on rabbiteye and southern highbush blueberry varieties.

Research plots were established on two sites in Clinch County, GA, that are naturally infested with *M. ornatum* and have previously shown symptoms of replant disease. Treatments applied to the rabbiteye site included preplant application of Telone II (1-3-dichloropropene, Dow AgroSciences), Pic-chlor 60 (56.7% chloropicrin, 37.1% 1-3 dichloropropene, various reformulators), and Trifecta (1-3 dichloropropene, chloropicrin, and dimethyl disulfide, proprietary reformulation, TriEst Inc.). Each fumigant was applied with and without pine bark soil amendment at a rate of 280 m³/ha, and control plots were installed with no pine bark or pre-plant fumigant. The same treatments were applied to the southern highbush site, except that Pic-chlor 60 was not used. All of the plots were bedded and covered with plastic film. At the rabbiteye site six replications of each treatment were arranged in a randomized design, whereas at the southern highbush site eight replications were used. Each plot consisted of 10 plants within in a row spaced 0.9 m apart, and rows were 3.7 m apart. One site was planted with rabbiteye varieties Prince and Vernon in April 2013, and the other site was planted with southern highbush varieties Farthing and Legacy in April 2014. Nematode assays and assessments of plant size and vigor were conducted at regular intervals and will be continued until the experiment is terminated. Nematode populations were assayed by systematically collecting 10 soil cores per plot from the blueberry root zones. Each sample was mixed, and a 100 cm³ subsample was

removed for assay. Plant-parasitic nematodes were collected from the soil by sieving and centrifugation, and the nematodes were identified and counted with a stereomicroscope. Plant vigor ratings and plant sizes were determined on the nematode sampling dates. Research plots were cultivated and managed as is typical for the area. These experiments will be extended for a period of 4-5 years to determine the long-term performance of each preplant treatment, and to allow determination of yield potential with the nematodes present. Data were analyzed with analysis of variance, followed by mean separation to determine the differences among treatments.

Results: In the plots planted with rabbiteye cultivars, population densities of the ring nematode, *Mesocriconema ornatum*, were reduced to near non-detectable numbers after treatment with soil fumigants, ($P < 0.05$) (Fig.1). Nematode populations increased significantly by the end of the first growing season, but were lower overall in bark-treated plots as compared to non-bark plots ($P < 0.05$). Nematode assay counts increased to even greater levels in the second growing season, although significant preplant-fumigant treatment effects remained, and nematode numbers remained lower overall in bark-treated plots as compared to non-bark plots ($P < 0.05$).

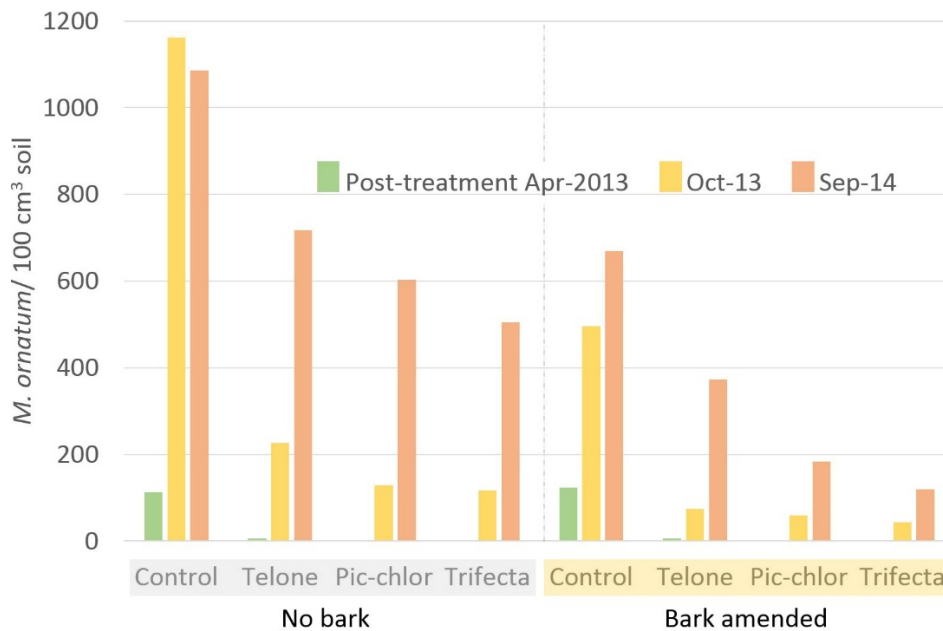


Figure 1. Evaluation of preplant soil fumigants and pine bark soil amendment on a rabbiteye blueberry replant site in Clinch County, Georgia. Population densities of the ring nematode, *Mesocriconema ornatum*, were reduced to near non-detectable numbers after treatment with soil fumigants, but the nematode populations increased significantly by the end of the first growing season and continued to increase during the second growing season. Overall, nematode assay counts were lower in plots amended with pine bark than in no-bark plots.

Rabbiteye blueberry plant volumes at the end of the second growing season were higher in bark-amended plots than in non-bark amended, with mean volumes of 39,188 cu. in. and 26,905 cu. in. in bark and no-bark plots, respectively, $P < 0.05$. Plant survival was also increased in bark-amended plots, with 92 and 85 percent survival in bark and no-bark plots, respectively, $P < 0.05$. The southern highbush site was planted in April, 2014, and only preliminary results are available from these plots. However, even over this relatively short amount of time, plant volumes and plant vigors were higher in plots treated with any of

the preplant soil fumigants as compared to control plots by the end of the first growing season. Likewise, population densities of the ring nematode were lower in plots treated with preplant soil fumigants, as compared to the control plots. Nematode counts at this site were relatively low, and no significant effects from bark application were observed during the first growing season. These plots will be monitored for an additional 4-5 years to assess treatment effects on plant growth and yield.

Conclusions: Adding pine bark soil amendment to a robust protocol of preplant soil fumigation provides a more sustainable level of management for blueberry replant disease. However, even though the addition of pine bark enhanced the level of nematode control obtained with soil fumigation, the soil population densities of ring nematodes came back at an alarming rate over the first 2 years in the rabbiteye plots. It is likely that additional post-plant management options will be needed to control ring nematodes over the long term. Although it is still early in the research design, we anticipate that the nematode population resurgence, and resulting plant damage, will be as least as large, if not larger in southern highbush.

Impact Statement: This project has demonstrated the utility of soil amendment with pine bark on replant sites to enhance and extend the effectiveness of preplant soil fumigation for the management of blueberry replant disease. Extending the productive life of a planting is essential to the profitability and grower return on the sizeable investment made in a new blueberry planting.

Citations:

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- Noe, J.P., P.M. Brannen, W.T. Holladay, G.B. Jagdale. 2014. Management of blueberry replant disease caused by *Mesocriconema ornatum* in the early establishment phase of growth. Phytopathology. 104(S3):183.