Preliminary Report
Suitability of Recycled Organic Materials as Growing Media, Micronutrient and Phosphorus Sources for Container Nursery Stock Production

Principle Investigators:

Dr. Rita L. Hummel
Washington State University Puyallup Research and Extension Center
7612 Pioneer Way, Puyallup, WA 98371-4989
Phone 253-445-4524
Fax 254-445-4569
E-mail hummelrl@wsu.edu

Dr. Craig Cogger
Washington State University Puyallup Research and Extension Center
7612 Pioneer Way, Puyallup, WA 98371-4989
Phone 253-445-4512
Fax 254-445-4569
E-mail cogger@wsu.edu

Summary of Research Progress:

Current container-crop production practices call for the extensive addition of water and fertilizers to soilless media and growers are very concerned with the potential for water pollution. A production system that utilizes the natural fertility of high quality composts would enhance the nutrient use efficiency of container crops and could reduce the potential for water contamination. This need to protect water quality has become even more important with the listing of salmon as endangered species in the Pacific Northwest. In the call for research proposals, the Northwest Nursery Crops Research Center listed “Nutrient and water use efficiency in container grown-crops” as a priority research area, thus indicating the importance of these issues to growers in the Pacific Northwest.

The first two objectives of this research are to determine the potential of yard debris, biosolids and animal manure composts to 1) serve as growing media, and 2) to supply micronutrients and phosphorus to plants grown in containers. The final objective of this research is to measure nitrates, soluble salts, and pH of water leached from the composts. To achieve the project objectives a factorial combination of growing media, micronutrient and phosphorus fertilizer treatments were applied to two woody nursery crops. The factorial treatments consisted of 8 growing media x 2 micronutrient rates x 2 phosphorus rates for a total of 32 treatments. There were 8 single-plant replicates for each species and treatment combination.

The growing media used in this experiment were obtained from the following commercial sources in Washington State: Groco, a biosolids compost from King County; Cedar Grove, a recycled yard debris compost from Maple Valley; a dairy manure compost from Smit Dairy in Whatcom County; and Tagro, a thermophilically digested class A biosolids product blended with bark from the Tacoma Central Wastewater Treatment Plant. Douglas-fir bark, fine grade for potting mixes, was obtained from Puyallup Bark and Garden Supply, Puyallup, Washington, for use as the control growing medium and for mixing at 50% by volume with the Groco, yard debris and dairy manure composts. This produced 8 different growing media coded as follows: Bark, Groco, GrocoB, Yard, YardB, Dairy, DairyB and TagroB. The initial pH of the experimental media ranged from 4.9 to 8.6 (Table 1). To insure uniformity of micronutrient availability, the pH of the media containing the dairy, Groco and yard waste composts was adjusted prior to potting. The pH, electrical conductivity (EC), nitrate (NO_3), aeration porosity and water holding capacity of the experimental growing media are shown in Table 1.

In May 2003, uniform rooted liners of *Rhododendron* 'Roseum Two' and lilac, *Syringa vulgaris* 'President Grevy', were obtained from Briggs Nursery, Olympia, Washington, and potted into 1 gallon containers filled with the experimental growing media. Prior to potting, growing media in the plus micronutrient treatment were amended with Micromax micronutrient mix at the rate of 1.75 lbs/yd^3. Growing media in the minus micronutrient treatment had no Micromax added. All plants were fertilized after potting by topdressing with Polyon® coated fertilizers containing nitrogen and potassium. The N rate was 1.5 lbs/yd^3 for rhododendron and 2.5 lbs/yd^3 for lilac. The fertilizer N to K ratio was approximately 3 to 2. After potting, Polyon® coated mono-ammonium phosphate was applied to plants in the plus phosphorus (P) treatment while plants in the minus P treatment had no P fertilizer added. Plants were grown according to standard nursery practices under overhead sprinkler irrigation on a gravel nursery bed.

During the growing season, plant growth was recorded at 3-week intervals by measuring shoot heights and widths at the widest and narrowest part of the canopy. From this data a shoot growth index (SGI) was calculated as follows: SGI=[(widest width+narrowest width)/2+height]/2. Leachate was collected from containers at approximately 4 week intervals using the pour-through method and soluble salts, pH, and nitrates were measured. Leaf color was quantified using a Minolta Chroma Meter CR-200b.

In midsummer, recently matured leaves from 4 randomly selected replicate plants were collected, dried, ground and sent to a commercial laboratory for analysis for macro and micronutrient contents. Tissue total N was determined using a LECO combustion analyzer. Tissue P, K, Ca, Mg, Fe, S, Cu, Zn, and Mn were determined using x-ray fluorescence. At the end of the growing season in October, final shoot growth measurements were taken and plant quality was rated using a visual scale from 0 (dead plant) to 5 (superior quality plant) with a rating of 3 considered salable. Root growth of all plants was rated from 1 (no roots visible at the periphery of the root ball) to 4 (solid root mass at the periphery of the root ball) then stems were cut at the soil line and the tops oven-dried and weighed.

The presence of interactions when plant growth data was subject to analysis of variance (ANOVA) as a 3-factor factorial experiment (7growing media by 2 P treatments by two micronutrient treatments) necessitated conducting one-way ANOVAs to test the significance of each factor separately. When results of one-way ANOVA indicated significance, growing media mean separations were done using a Tukey's studentized range test (HSD). Student's t-test was used to compare the plus and minus P treatments and the plus and minus micronutrient treatments. Results of the analyses for lilac and rhododendron end of growing season SGI, dry weight, shoot quality and root growth ratings are shown in tables 1-4.

Results of plant growth analysis indicated the first objective, to determine the potential of yard debris, biosolids and animal manure composts to serve as growing media has been met. As shown in Tables 2 and 4, when lilac and rhododendron plants were grown according to standard nursery practices with both P and micronutrients added (the plus P, plus micro treatment), all of the compost growing media produced plants at least equivalent to the Bark control in SGI, dry weight, shoot quality and root growth. In some composts (Tables 2 and 4), growth of plants in the plus P, plus micro treatment was significantly greater than that of the Bark control plants.

The potential for the composts to supply micronutrients and phosphorus to plants grown in containers is shown in the results of the minus P/minus micronutrient treatments. For minus P/minus micro lilacs (Table 2), plants in media containing compost were significantly greater in all growth measurements than plants in the Bark control; however, some composts produced better lilacs than did others. For minus P/minus micro rhododendrons (Table 4), SGI, dry weight and shoot quality of plants in Groco, GrocoB, and TagroB were significantly greater than plants in Bark while dry weight of plants in YardB was also greater than plants in Bark. Root growth of minus P/minus micro rhododendron in compost media was similar to that in Bark with the exception of Yard where the root mass was not as dense at the periphery of the root ball.

In order to test the importance of P to the growth of plants in the different media, Student's t-tests were performed for each growing medium-micronutrient treatment combination. Results of these plus and minus P comparisons are shown in Tables 2 and 4. In Bark media, both with and without micronutrients, adding P significantly improved growth of lilac and rhododendron plants. Results of the plus and minus P comparisons for the compost growing media were variable. However, in this experiment there was no measurable benefit in either micronutrient treatment from adding P to lilac and rhododendron in Groco and GrocoB or to rhododendron in TagroB.

Results of student's t-tests for the significance of micronutrient additions to lilacs and rhododendrons in the different growing medium/P treatment combinations are shown in Tables 3 and 5. Lilacs showed no significant benefit from the addition of micronutrients in any of the treatments (Table 3). Rhododendrons in the plus P treatment (Table 5) did not benefit from the addition of micronutrients. In the GrocoB medium the plus P/plus micro rhododendrons had lower SGI, dry weight and shoot quality than the plus P/minus micro plants. In the minus P treatment, rhododendron SGI and dry weight of plants in

Bark and Dairy increased with the addition of micronutrients while SGI of plants in Yard and dry weight of plants in DairyB and YardB were increased. Shoot quality and root growth of DairyB rhododendrons in the minus P treatment increased when micronutrients were added.

The results of this research indicate that the composts tested could effectively serve as growing media for the production of containerized lilac and rhododendron plants. Plant growth results testing the efficacy of the composts as P and micronutrient sources were more complex, varying with the species, compost and parameter measured. In general Groco and GrocoB provided adequate P for both species and TagroB provided adequate P for rhododendron. Micronutrient fertilizer did not significantly enhance lilac growth or quality in this experiment. Analysis of leaf color and tissue nutrient content data is ongoing and will provide additional understanding of the treatment effects.

The final objective of this research was to measure nitrates, soluble salts, and pH of water leached from the composts. This data to meet this objective has been collected, is undergoing statistical analysis, and will be included in a final report on this research project.