Growth and Nutrient Use of Ericaceous Plants Grown in Media Amended with Sphagnum Moss Peat or Coir Dust

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Abstract. Using several different ericaceous ornamental species, we compared the growth, mineral nutrition, and composition of plants in response to growing media amended with varying proportions of sphagnum moss peat (peat) or coir dust (coir). Plants were grown for 16 weeks in media consisting of 80% composted Douglas fir bark with 20% peat, 20% coir, or 10% peat and 10% coir. Sixteen weeks after planting, decreases in extractable P were larger in peat-amended medium than the coir-amended medium, while decreases in extractable NH$_4^+$-N and NO$_3^-$-N were larger in the coir-amended medium. In general, leaf and stem dry weight, the number of leaves and stems, and total stem length increased with increasing proportion of coir in the medium while root dry weight either increased (Kalmia latifolia), decreased (Rhododendron, Gaultheria), or was not influenced by increasing the proportion of coir in the medium. The composition of the growing medium also influenced aspects of plant marketability and quality including: leaf greenness (SPAD), plant form (e.g., number of leaves per length of stem), and partitioning of biomass (e.g., root to shoot ratio). Nutrient uptake and fertilizer use was significantly different between the media types. Depending on the cultivar, we found that the coir-amended medium resulted in higher uptake or availability of several nutrients than peat-amended medium. Uptake or availability of N, P, K, Ca, and S was enhanced for several cultivars, while uptake or availability of Mg, Fe, and B was similar between media types. Most cultivars/species growing in the coir-amended medium had higher production or accumulation of proteins and amino acids in stems than plants growing in peat-amended medium, while the production of proteins and amino acids in roots was lower in plants growing in coir-amended than in peat-amended medium. For the cultivars/species we tested, coir is a suitable media amendment for growing ericaceous plants and may have beneficial effects on plant quality.

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Coir dust [coconut mesocarp residue (coir)] is the pith and residual fibrous material that constitutes the mesocarp of the coconut fruit (Cocos nucifera). Coir has been shown to have ion exchange and gas absorptive properties that can be utilized to adsorb N in its NH$_4^+$ and NO$_3^-$ forms, protecting it from loss into the environment (Evans et al., 1996; Handreck, 1993a; Kithome et al., 1999a, 1999b). Coir tends to have a higher P content than peats (Evans et al., 1996; Handreck, 1993b) and coir from certain sources contains a higher number of free-living nitrogen-fixing, phosphate solubilizing, and acid phosphatase producing rhizobia (Linderman and Marlow, personal communication). Although coir has been reported to have a good buffering capacity (Kithome et al., 1999a, 1999b), others indicate that coir increases medium pH over time (Offord et al., 1998). Coir also has been reported to have a higher (Evans and Stamps, 1996; Stamps and Evans, 1997) or similar (Meerow, 1994) moisture holding capacity when compared to peat.

Coir has successfully been used in cutting and seed propagation (Farnsworth and Guan, 1995; Reddell et al., 1999) and for the production of a variety of annual and perennial plants (Evans and Stamps, 1996; Meerow 1994; Offord et al., 1998; Stamps and Evans, 1999). However, little literature is available on the effects of coir in the production of woody perennial plants (Evans and Iles, 1997; Knight et al., 1998; Meerow, 1994), especially those which grow best at low pH in well-drained media, e.g., the family Ericaceae. The objectives of this study were to determine whether growth, nutrient use, and storage components of ericaceous plants differ when grown in media amended with varying proportions of sphagnum peat or coir.

Materials and Methods

Plant culture and experimental treatments. Eleven different ericaceous plants from six genera were used in this study: Kinnikinnick [Arctostaphylos uva-ursi (L.) Sp., ‘Massachusetts’ (AU)], Azalea [Rhododendron sp. ‘Strawberry Ice’ (AZ)], Mountain Laurel [Kalmia latifolia L. ‘Freckles’ (KF)], ‘Olympic Fire’ (KO), ‘Pink Charm’ (KP), Salal [Gaultheria shallon Pursh. (GS)], Pieris [Pieris japonica D. Don. ‘Snowdrift’ (PJ)]. Rhododendron [Rhododendron sp. ‘Scillactination’ (RS), ‘Creté’ (RC), and ‘Trinidad’ (RT)], and Lingonberry [Vaccinium vitis-idaea L. ‘Ern’ edanck’ (VV)]. In late February, rooted tissue culture plantlets were obtained from Briggs’ Nursery (Olympia, Wash.) and transplanted into 0.64-L pots (Gage Dura Pot @GDP400) in a mix containing different ratios of composted Douglas fir bark (Whitney Farms, Independenc, Ore.), sphagnum peat (Sunshine Grover Grade White; SunGrow, Hubbard, Ore.), and coir (CocoLife Bold; Coconut Palm Resources, Hillsboro, Ore. (Sri Lanka product source) amended with 5.5 g L$^{-1}$ of a slow-release fertilizer (Osmocote Plus 15–9–12; Scotts Co., Marysville, Ohio) per pot. Equal amounts of fertilizer were mixed into media on a pot-per-pot basis to ensure uniform distribution. Experimental treatments consisted of three different media formulations (by volume): 80/20 bark/peat mix, 80/10/10 mix of bark/peat/coir, and 80/20/10 mix of bark/coir. Plants were maintained in a greenhouse for 16 weeks, 16 h light (16 h light/8 h dark), average day/night temperatures of 21/16 °C (75/65 °F), and watered using calibrated drip irrigation to ensure all treatments received the same amount of water. Watering frequency was specific to each cultivar and determined based on a substrate moisture as measured in relative units using a portable soil moisture meter (Ben Meadows Co., Canton, Ga.). When substrate moisture within a cultivar reached a level of 6 (relative units), plants were watered until water freely flowed from the bottom of the pot. Differences in substrate moisture between treatments were not detectable within the sensitivity range of the portable soil moisture meter. Periodic pest control measures were performed as needed and included dibenzuron for fungus gnats (Bradysia sp.) and Neoseiulus cucumeris predators for thrips (Frankiniella sp.).

Media composition. At planting, five replicate samples of each of the three different media compositions were analyzed for pH (Wescor Model 5500 pH meter), electrical conductivity (EC) (25°C), and moisture (Wescor Model 5100 moisture meter) using 0.64-L pots. The results of these analyses were used to develop media formulations for the study. At harvest, pot moisture was measured using a hygrometer and, based on the harvest date, fertilizer was applied on a supplemental basis using slow-release fertilizer (Osmocote Plus 15–9–12; Scotts Co., Marysville, Ohio) per pot. Equal amounts of fertilizer were mixed into media on a pot-per-pot basis to ensure uniform distribution. Experimental treatments consisted of three different media formulations (by volume): 80/20 bark/peat mix, 80/10/10 mix of bark/peat/coir, and 80/20/10 mix of bark/coir. Plants were maintained in a greenhouse for 16 weeks, 16 h light/8 h dark), average day/night temperatures of 21/16 °C (75/65 °F), and watered using calibrated drip irrigation to ensure all treatments received the same amount of water. Watering frequency was specific to each cultivar and determined based on a substrate moisture as measured in relative units using a portable soil moisture meter (Ben Meadows Co., Canton, Ga.). When substrate moisture within a cultivar reached a level of 6 (relative units), plants were watered until water freely flowed from the bottom of the pot. Differences in substrate moisture between treatments were not detectable within the sensitivity range of the portable soil moisture meter. Periodic pest control measures were performed as needed and included dibenzuron for fungus gnats (Bradysia sp.) and Neoseiulus cucumeris predators for thrips (Frankiniella sp.).
Different media formulations were analyzed for extractable phosphorus (mg·kg⁻¹ P), calcium (mg·kg⁻¹ Ca), ammonium nitrogen (mg·kg⁻¹ NH₄-N), and nitrate nitrogen (mg·kg⁻¹ NO₃-N) using standard methods (Berg and Gardner, 1979). Extractable Ca was determined with atomic absorption spectrophotometry following extraction with ammonium acetate. The pH was also determined for all media samples. Water holding capacities determined from a 6-in (15-cm) column for similar media formulations were 23.2% for bark (100%), 35.6% for bark/coir (80/20 (v/v)), 34.5% for bark/peat (80/20 (v/v)), and 34.3% for bark/peat (80/20 (v/v)).

Sixteen weeks after planting, when plants were removed from the media, substrate loosely adhering to roots was removed from plants by gentle shaking and mixed with remaining substrate in the pot. Five replicate samples of substrate were taken from pots of each media formulation. The pH was also determined for all media samples. Water holding capacities determined from a 6-in (15-cm) column for similar media formulations were 23.2% for bark (100%), 35.6% for bark/coir (80/20 (v/v)), 34.5% for bark/peat (80/20 (v/v)), and 34.3% for bark/peat (80/20 (v/v)).

Leaf greenness and mycorrhizal colonization. Fifteen weeks after planting, leaf greenness was estimated by measuring the optical density difference at 650 and 940 nm with a silicon photodiode using a SPAD502 meter (Minolta Corp., Ramsey, N.J.) on five replicate plants per treatment. Three replicate measurements from adjacent leaves were taken at five equally distributed positions in the canopy of each plant. Readings are expressed in SPAD units.

Sixteen weeks after planting, ericoid mycorrhizal colonization of fresh roots was assessed for all plant except A. uva-ursi on 1-cm sections after clearing and staining (Philips and Hayman, 1970), replacing lacto-phenol with lacto-glycerin. Percentage of root length colonized by ericoid mycorrhizal fungi (hyphal coils in epidermal cells) was estimated using a light microscope (Biermann and Linderman, 1980). Mycorrhizal colonization of A. uva-ursi roots was assessed by counting the percentage of root tips colonized by mycorrhizal fungi (Scagel and Linderman, 1998).

Morphology and tissue composition. Sixteen weeks after planting, the aboveground portion of five replicate plants per treatment were removed, and the number of leaves, the number of stems, and stem lengths were recorded for each plant. Substrate adhering to roots was removed by washing and samples of roots were taken for assessing mycorrhizal colonization. Samples of leaf, stem, and root tissue were taken for nutrient, amino acid, and protein analyses from tissue samples pooled for each plant across all ages of tissue. The remaining roots, leaves, and stems were dried to a constant dry weight at 60 °C and dry weights were obtained.

Stem, leaf, and root samples were analyzed for phosphorus, potassium, calcium, magnesium, manganese, iron, copper, boron, zinc, carbon, nitrogen, and sulphur content using standard methods (Gaulak et al., 1997). N and S were determined after automated combustion

Results and Discussion

**Media pH.** Most members of the Ericaceae are calcifuge plants that grow naturally within the plant canopy. Variables derived to assess changes in dry weight partitioning and plant form were square-root transformed, and percentage rooting and root colonization were arcsine transformed prior to analysis to correct for unequal variance and best model fit (Peterson, 1985). Back-transformed least squares means of actual data are reported in tables and figures.

Plant composition (nutrient, protein, and amino acid) data were analyzed using vector analysis, a technique that allows for simultaneous comparison of plant growth, nutrient concentration, and nutrient content in an integrated graphic format (Haase and Rose, 1995). Nutrient, protein, and amino acid data for plants growing in peat-amended and coir-amended media were compared after normalization using the peat-amended medium as the control treatment, similar to the vector analyses methods used by others (Swift and Brockley, 1993; Valentine and Allen, 1990). Changes in dry weight and concentration are plotted, with curved content isolines included for interpretation. The interpretation of vector shifts due to a change in media composition is similar to that described in Valentine and Allen (1990) and shown in Fig. 3 as reference.
Available nutrients in media. A number of factors interact to affect the level of nutrients available for plant uptake from container media throughout crop production (Argo and Biernbaum, 1997) including temperature, moisture, plant uptake, losses to leaching and volatilization, microbial activity, and the physical, biological, and chemical attributes of the media. We measured decreases in extractable phosphorus (P), ammonium-nitrogen (NH₄-N) and nitrate-nitrogen (NO₃-N) and increases in available calcium (Ca) in the growing media between the beginning and the end of our experiment (Fig. 1). These changes were not detectable during the course of the experiment. Others have found that the pH of coir media to decrease over time (Argo and Biernbaum, 1997) or increase over time (Meerow, 1994, 1995; Offord et al., 1998). These researchers measured pH of media in which coir was the sole or primary medium component and used different plants and fertilizer types. In our experiment, coir was only a small proportion of the total medium and probably contributed less to total medium pH.

Variation source                                df     \( P \)       \( \eta^2 \)  
Genus                      5     <0.0001          <0.0001          <0.0001

Table 1. Analysis of variance (ANOVA) results for dry weight of leaves, stems, and roots of plants grown for 16 weeks in three different formulations of media.

\( ^{a} \) Growing media containing (by volume) 80% composted Douglas fir bark and either 20% peat (Peat), 10% peat and 10% coir (Peat/Coir), or 20% coir (Coir) 16 weeks after transplanting. Bars on data points represent standard error of the mean pooled across treatments for Distance*Media LS Means (n = 55).
Vector Shift | Concentration | Content | Weight | Interpretation
--- | --- | --- | --- | ---
A | Decrease | Increase | Increase | Nutrient non-limiting. Differences in concentration or content due to increase in weight (e.g., dilution due to growth).
B | Unchanged | Increase | Increase | Nutrient uptake, availability, or translocation enhanced. Differences in concentration or content related proportionately to change in weight.
C | Increase | Increase | Increase | Nutrient uptake or availability enhanced. Differences in concentration or content have little influence on growth (e.g., luxury consumption, storage).
D | Increase | Increase | Unchanged | Elevated nutrient concentration causes decrease in growth (e.g., toxicity).
E | Increase | Decrease | Decrease | Nutrient limiting to growth due to lower availability (e.g., deficiency).
F | Decrease | Decrease | Decrease | Efficiency of nutrient use increased (e.g., more growth given less nutrient in plant).
G | Decrease | Decrease | Increase | Efficiency of nutrient use increased (e.g., more growth given less nutrient in plant).

Fig. 3. Graphical representation of interpretations comparing changes in dry weight and concentrations of nutrients between plants grown in different media types. The content isolines represent combinations of dry weight and concentration giving constant content per unit dry weight. The arrows indicate the direction in which each interpretation holds (adapted from Swift and Brockley, 1994).

The levels of extractable \( \text{NH}_4\text{-N} \) and \( \text{NO}_3\text{-N} \) measured in coir-amended media were similar to that reported elsewhere (Konduru et al., 1999; Stamps and Evans, 1997, 1999). The relative decrease in \( \text{NH}_4\text{-N} \) and \( \text{NO}_3\text{-N} \) were both significantly different for the different media types \((P < 0.0001)\). Decreases in \( \text{NH}_4\text{-N} \) \((P < 0.004)\) and \( \text{NO}_3\text{-N} \) \((P < 0.0001)\) were larger in the coir-amended medium than the peat-amended medium (Fig. 1c and d). Similar decreases in \( \text{NO}_3\text{-N} \) have been reported for a 50/50 bark to coir medium (Stamps and Evans, 1997). In our study, plants growing in coir-amended medium generally had higher N contents and concentrations than plants growing in the peat-amended medium (Fig. 4), suggesting that plants growing in the coir-amended medium had a higher N-uptake.

The relative increases in extractable Ca were significantly different for the different media types \((P < 0.0001)\). Increases in Ca were larger in the coir-amended medium than the peat-amended medium \((P < 0.0001)\) (Fig. 1b). In contrast, others (Stamps and Evans, 1997) have reported initial Ca concentrations were similar in a 50/50 bark to coir or 50/50 bark to peat medium, but over time, available Ca was higher in the 50/50 bark to peat medium when compared to the 50/50 bark to coir medium. In our study, plants growing in the coir-amended medium had higher concentrations and content of Ca than plants growing in the peat-amended medium suggesting that either more Ca was released from previously unavailable forms or less Ca was lost from the coir-amended medium than the peat amended medium. All plants within a cultivar received the same amount of water in our experiment and since differences in moisture holding capacity of the different media was <2%, it is unlikely that the differences in initial media moisture holding capacity could solely accounted grown. Differences in moisture holding capacity of the different media formulations we used was initially <2%. Although it is possible that the slightly higher water holding capacity in the coir-amended media may have had some influence on plant growth, it is unlikely that the differences in initial media moisture holding capacity could solely accounted grown differences between plants growing in the different media types.

The effects of different media components on plant biomass may not adequately represent growth differences important to commercial producers. To better gauge differences in plant growth, form, and appearance between the different media we measured several morphological parameters. Some of the differences we found in plant form between plants grown in the coir-amended medium when compared to plants grown in the peat-amended medium have the potential to influence the quality or marketability of the plants. Morphological responses to the different media types in our study were similar between cultivars/species within a genus but we found significant differences between genera in response to the different media.

In general, the number of leaves and stems and total stem length of plants increased with increasing proportion of coir in the media (Table 1). Leaf dry weight in different media differed significantly between genera, with genera having the largest leaves (e.g., *Rhododendron* sp.) responding the most to increased proportions of coir in the media. Root dry weight was also affected by changes in media composition and differed significantly between genera. For all *K. latifolia* cultivars root dry weight increased with increasing proportion of coir in the media, while for all *Rhododendron* cultivars and *G. shallon*, root dry weight decreased. For all other genera, root dry weight was similar for plants grown in coir-amended or peat-amended media, however the combination of peat and coir amendment significantly increased root dry weight. Others have reported positive, negative, or no response in several plant growth parameters when comparing media amended with coir or peat (Evans and Stamps, 1996; Knight et al., 1998; Meerow, 1994, 1995; Offord et al., 1998; Stamps and Evans, 1997, 1999). Some differences in plant growth in response to coir have been attributed to increased water holding capacity of the fibers in comparison to peat. Others have found that although initial media moisture holding capacity of peat-amended media is similar to coir, over time, peat can have a higher moisture holding capacity and lower air-filled pore space (Meerow, 1995).

**Plant morphology and form.** The effects of different media components on plant biomass may not adequately represent growth differences important to commercial producers. To better gauge differences in plant growth, form, and appearance between the different media we measured several morphological parameters. Some of the differences we found in plant form between plants grown in the coir-amended medium when compared to plants grown in the peat-amended medium have the potential to influence the quality or marketability of the plants. Morphological responses to the different media types in our study were similar between cultivars/species within a genus but we found significant differences between genera in response to the different media.

In general, the number of leaves and stems and total stem length of plants increased with increasing proportion of coir in the media (Table 2), but the magnitude of the responses varied with genus. The number of leaves per plant on genera with the smallest leaves (e.g., *Arctostaphylos*, *Pieris*, and *Vaccinium*) was most responsive to increasing the proportion of coir in the media. For all genera except *Arctostaphylos*, the number of stems per plant and total stem length per plant increased with increasing proportion of coir in the media.

Media composition altered plant form and dry weight partitioning to the various plant parts.
Within a variable, genera with similar magnitude of response (\(P > 0.05\)) to different media formulations are followed by the same letter.

Table 2. Analysis of variance (ANOVA) results for aboveground morphological characteristics of plants grown for 16 weeks in three different formulations of media.

<table>
<thead>
<tr>
<th>Genus/species</th>
<th>Media (^1)</th>
<th>No. of leaves per plant (#/plant)</th>
<th>No. of stems per plant (#/plant)</th>
<th>Stem length per plant (cm/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kalina japonica</td>
<td>Peat</td>
<td>23.8</td>
<td>a 2.8</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>Peat/Coir</td>
<td>36.4</td>
<td>a 2.9</td>
<td>22.3</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>57.0</td>
<td>4.3</td>
<td>37.4</td>
</tr>
<tr>
<td>Rhododendron spp.</td>
<td>Peat</td>
<td>36.2</td>
<td>a 2.8</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td>Peat/Coir</td>
<td>47.7</td>
<td>a 3.2</td>
<td>30.5</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>53.6</td>
<td>3.5</td>
<td>33.8</td>
</tr>
<tr>
<td>Arctostaphylos uva-ursi</td>
<td>Peat</td>
<td>131.8</td>
<td>b 18.7</td>
<td>140.4</td>
</tr>
<tr>
<td></td>
<td>Peat/Coir</td>
<td>154.2</td>
<td>b 12.2</td>
<td>136.2</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>280.6</td>
<td>10.4</td>
<td>118.8</td>
</tr>
<tr>
<td>Gaultheria shallon</td>
<td>Peat</td>
<td>65.6</td>
<td>10.2</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Peat/Coir</td>
<td>87.4</td>
<td>a 16.4</td>
<td>144.9</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>93.7</td>
<td>17.5</td>
<td>153.7</td>
</tr>
<tr>
<td>Pieris japonica</td>
<td>Peat</td>
<td>119.6</td>
<td>7.4</td>
<td>45.7</td>
</tr>
<tr>
<td></td>
<td>Peat/Coir</td>
<td>270.7</td>
<td>b 8.2</td>
<td>80.4</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>219.6</td>
<td>9.8</td>
<td>106.9</td>
</tr>
<tr>
<td>Vaccinium vitis-idaea</td>
<td>Peat</td>
<td>93.6</td>
<td>11.4</td>
<td>38.3</td>
</tr>
<tr>
<td></td>
<td>Peat/Coir</td>
<td>258.8</td>
<td>b 15.8</td>
<td>167.6</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>296.4</td>
<td>24.2</td>
<td>143.4</td>
</tr>
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</table>

\(^1\)Growing media containing (by volume) 80% composted Douglas fir bark and either 20% peat (Peat), 10% peat and 10% coir dust (Peat/Coir), or 20% coir dust (Coir).

Table 3. Analysis of variance (ANOVA) results for plant form characteristics of plants grown for 16 weeks in three different formulations of media.

<table>
<thead>
<tr>
<th>Genus/species</th>
<th>Media (^1)</th>
<th>Leaves per length of stem (#/cm)</th>
<th>Leaves per length of stem (#/cm)</th>
<th>Length per stem (cm/stem)</th>
<th>Root/above-ground ratio (g/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kalina japonica</td>
<td>Peat</td>
<td>2.5</td>
<td>a 10.8</td>
<td>4.35</td>
<td>0.075</td>
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<tr>
<td></td>
<td>Peat/Coir</td>
<td>1.9</td>
<td>c 14.7</td>
<td>9.07</td>
<td>0.057</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>1.7</td>
<td>a 18.3</td>
<td>10.74</td>
<td>0.039</td>
</tr>
<tr>
<td>Rhododendron spp.</td>
<td>Peat</td>
<td>3.1</td>
<td>a 16.7</td>
<td>6.15</td>
<td>0.107</td>
</tr>
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<td></td>
<td>Peat/Coir</td>
<td>3.0</td>
<td>a 18.6</td>
<td>8.68</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>2.8</td>
<td>a 26.4</td>
<td>11.13</td>
<td>0.034</td>
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<tr>
<td>Arctostaphylos uva-ursi</td>
<td>Peat</td>
<td>0.8</td>
<td>a 5.5</td>
<td>8.73</td>
<td>0.068</td>
</tr>
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<td></td>
<td>Peat/Coir</td>
<td>0.6</td>
<td>a 5.6</td>
<td>8.85</td>
<td>0.062</td>
</tr>
<tr>
<td></td>
<td>Coir</td>
<td>0.6</td>
<td>a 7.6</td>
<td>8.98</td>
<td>0.029</td>
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<tr>
<td>Gaultheria shallon</td>
<td>Peat</td>
<td>2.6</td>
<td>a 16.5</td>
<td>6.70</td>
<td>0.038</td>
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<td></td>
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<td>a 25.6</td>
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<td>0.036</td>
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<tr>
<td></td>
<td>Coir</td>
<td>2.1</td>
<td>a 27.7</td>
<td>11.97</td>
<td>0.016</td>
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<tr>
<td>Vaccinium vitis-idaea</td>
<td>Peat</td>
<td>2.9</td>
<td>a 7.6</td>
<td>2.75</td>
<td>0.142</td>
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<td></td>
<td>Peat/Coir</td>
<td>2.3</td>
<td>a 14.2</td>
<td>6.77</td>
<td>0.113</td>
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<tr>
<td></td>
<td>Coir</td>
<td>2.1</td>
<td>a 17.9</td>
<td>7.75</td>
<td>0.091</td>
</tr>
</tbody>
</table>

\(^1\)Growing media containing (by volume) 80% composted Douglas fir bark and either 20% peat (Peat), 10% peat and 10% coir dust (Peat/Coir), or 20% coir dust (Coir).

\(^2\)Within a variable, genera with similar magnitude of response (\(P > 0.05\)) to different media formulations are followed by the same letter.
Fig. 4. Comparison of relative nutrient composition and above ground dry weight of (A, D) Kalmia, (B, E) Rhododendron, and (C, F) Arctostaphylos, Gaultheria, Pieris, and Vaccinium cultivars grown in composted Douglas fir bark amended with peat (normalized to 100 and shown as a single reference point) and coir dust (normalized as a percent of response compared to peat). The content isolines represent combinations of dry weight and concentration giving constant contents per unit dry weight. Acronyms above data points represent different cultivars/species (see Materials and methods for descriptions).
Fig. 5. Comparison of relative amino acid and protein composition of (A, D) leaves, (B, E) stems, and (C, F) roots of different cultivars of ericaceous plants grown in composted Douglas fir bark amended with peat (normalized to 100 and shown as a single reference point) and coir dust (normalized as a percent of response compared to peat). The content isolines represent combinations of dry weight and concentration giving constant contents per unit dry weight. Acronyms above data points represent different cultivars. (see Materials and Methods for descriptions).
Rhododendron spp., cultivars and V. vitis-idaea (VV). Manganese (Mn) uptake or availability was enhanced by coir amended media for KP, PJ, G. shallon (GS), Rhododendron sp., ‘Crette’ (RC) and ‘Trinidad’ (RT). Zinc uptake or availability was enhanced by coir-amended media for six of the 11 cultivars. Differences in nutrient availability to plants growing in the different media types may be a result of differences chemical properties (Bugbee, 1999; Kuo et al., 1997; Marconi and Nelson, 1984; Pill et al., 1995), physical (Evans et al., 1996; Handreck, 1993a; Kithome et al., 1999a, 1999b) of microbial activity (Linderman and Marlow, USDA, Corvallis, Ore., personal communication) between peat and coir. For instance, in our study, coir-amended media initially had significantly higher concentrations of available N that could be responsible for N content and concentrations in plants growing in coir-amended media.

If the concentration of protein or amino acids declined while the total content of protein or amino acids increased with increasing plant weight then the uptake of the nutrient is considered the same or the availability is equal in the different media types. Under these conditions differences in concentration and content between plants grown in coir- or peat-amended media were a result of increased plant weight. We found that uptake or availability of magnesium (Mg), iron (Fe), and boron (B) was similar in plants grown in peat- or coir-amended media for all cultivars (Fig. 4). Differences in the concentration of these nutrients in plants from the different media types were a result of the different plant growth rates and amino acids increased with increasing plant weight. For example, production of leaf protein was similar for K. latifolia cultivars, RC, and RT when grown in peat- or coir-amended media.

When comparing plants grown in coir-amended media to plants grown in peat-amended media, if the concentration and total content of protein or amino acids increased without appreciable increases in plant weight, then the production or accumulation of protein or amino acids is considered the same in the different media types. This means that differences in concentration and content between plants grown in coir- or peat-amended media are a result of increased plant weight. For example, production of leaf protein was similar for A. uva-ursi cultivated in RC, RT, and when grown in peat- or coir-amended media.

If the concentration and total content of protein or amino acids increased with increased plant growth rate, then the production or accumulation of protein or amino acids is considered the same in the different media types. This increase, however, does not directly contribute to increased growth (e.g., storage). For example, A. uva-ursi produced more leaf and stem proteins when grown in coir-amended media than in peat-amended media. When the concentration and total content of protein or amino acids declined while plant weight decreased, then the production or accumulation of protein or amino acids may be related to decreased growth or metabolic activity. For example, the production of proteins and amino acids in roots was lower in coir-amended media than in peat-amended media for GS and RC.

Conclusions

For the cultivars we tested, we found that coir is a suitable media amendment for growing ericaceous plants. Amendment of growing media for ericaceous plants with coir increased the growth and nutrient uptake of several cultivars. We also observed that coir amendment may positively influence several other aspects of plant production practices (e.g., fertilizer use), plant form, plant quality, and marketability.

Literature Cited

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