INTRODUCING A MULTI-CAVITY COLLECTION METHOD FOR EXTRACTING PLUG ROOT-ZONE SOLUTIONS

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Abstract. Monitoring soluble salts and pH of plug media has been a challenge for ornamental plant producers because of the limited volume of plug/cell media available for typical saturated media extract (SME) or 1:2 sampling, and the multi-cavity unit designs are not favorable for the standard water pour through method. Recently, a press extraction method (pressing the top of the plug to expel solution, PEM) was developed; however, the method is invasive because the necessary pressing can cause irreparable damage to the plants. In this study, a modified pour-through method, multi-cavity collection (MCC), was developed for root-zone solution extractions from plugs without plant damage. The MCC method requires the placement of a clean, accommodating, non-permeable tray beneath the multi-cavity unit. The root-zone solution is collected by slowly and evenly pouring water onto the surfaces of the individual/joined cavities. Soluble salts and pH of bulk solutions extracted from different plug media using the MCC, PEM, SME, and 1:2 methods were compared. Results showed that the soluble salts and pH readings of root-zone solutions extracted by the MCC method were proportional to those readings from solutions extracted by the other three methods. The availability of another extraction option further maximizes the speed and convenience of monitoring media soluble salts and pH without plant loss.

Currently, there are four methods being widely used by growers, extension agents, and analytical laboratories for extracting root-zone solutions from potting media for soluble salts, pH, and nutrient analyses: (1) 1:2 dilution, (2) 1:5 dilution by volume, (3) Pour-through (PT), and (4) Saturated media extract (SME). The first two require that one part air-dried medium be mixed with two or five parts of distilled or deionized (DI) water; the mix is stirred and allowed to equilibrate for 90 min, then filtered using filter paper or several folds of cheese cloth (Lang, 1996). The PT method needs an adequate amount of distilled or DI water to be slowly poured over the surface of near-saturated container-medium so that about 50 ml of bulk solution can be collected in a beaker as leachate from drainage holes (Yeager et al., 1983). The SME method requires about 500 ml of medium sampled from potting media mixed with distilled or DI water until just saturated (medium surface glistens); after equilibrating for 1.5 h, solutions are extracted using a vacuum filter (Lucas et al., 1972).

Methods of monitoring soluble salts, pH, and nutrient concentrations of plug media, however, have not been well developed, because of the limited volume of plug/cell media not suitable for typical SME, 1:2, or 1:5 sampling, and the multi-cavity unit designs are not favorable for the standard PT method. Recently, a press extraction method (pressing the top of the plug to expel solution, PEM) was developed (Scoffins et al., 2000); however, the method is invasive, because the necessary pressing can cause irreparable damage to the plants, and, also, medium or lime particles may be forced into solution which may interfere with soluble salts readings.

The objectives of this study were to (1) develop a multi-cavity collection (MCC) method for extracting root-zone solution from plug media, (2) compare soluble salts and pH readings of root-zone solutions extracted from different media using the MCC, PEM, SME, or 1:2 methods, and (3) develop equations for converting SS readings from one method to another.

Literature Cited

peat + 10% bark + 80% yard trimmings with biosolids, and (5) yard trimmings. The last three media contained composts and were designated as CM1, CM2, and CM3, respectively.

Umbrella tree (*Schefflera actinophylla*) seeds were sown into cells with five seeds per cell. After seed germination, a Peter's water-soluble fertilizer 24.0N-3.5P-13.3K (24-8-16) (1 g dissolved in 2 L of DI water) was applied at 50 ml per cell weekly. Plants were grown in a shaded glasshouse with a maximum light intensity of 200 μmol m⁻² s⁻¹ (1250 foot candles) and a temperature range from 20 to 32°C (68 to 90°F). The experiment was arranged in a completely randomized design with six replications.

Root-zone solutions of the media were sampled using the PEM, SME, 1:2, and MCC methods 6, 9, and 12 weeks after seeding. The MCC includes four steps: (1) 1 h after applying fertilizer or liquid feed, select plug trays of interest; (2) place a clean, accommodating, non-permeable plate beneath the multi-cavity unit, (3) root-zone solution (about 50 ml) is collected by slowly and evenly pouring distilled or DI water onto the surfaces of the individual/joined cavities; (4) leachate is poured into a suitable container for analyses of pH, EC, or nutrients.

Soluble salts and pH of collected solutions were measured using a Fisher Accumet Selective Ion Analyzer, Model 750 (Fisher Scientific, Pittsburgh, Pa.). Means of each treatment and standard errors were calculated using means procedures of SAS (SAS Institute, 1992). Correlation coefficients of SS among the four extraction methods, regardless of media types and date of sampling, were calculated. Equations for converting SS readings obtained from one extraction method to another were developed using regression procedures of SAS.

**Results and Discussion**

**Plug SS and pH readings utilizing the four extraction methods.** Soluble salts readings of root-zone solutions extracted using MCC did not significantly differ from those extracted using PEM but did vary substantially from those extracted using either the SME or 1:2 methods. The reading similarity between MCC and PEM could be due to the fact that both methods hardly dilute root-zone solutions since MCC only partially replaces existing medium solution, and PEM does not dilute extract at all. We attribute the significant differences between MCC and SME or 1:2 to the degree of dilution. Root-zone solutions are greatly diluted by both the SME and 1:2 methods. Root-zone solutions extracted by SME were diluted less than those extracted by the 1:2 method; therefore, SS readings of the 1:2 method-derived solutions were the lowest among the four methods. Although SS readings of the same medium differed according to extraction methods, the differences were well paralleled between the methods (Fig. 1). This suggests that the four methods can be compared. The pH readings of the same medium were not significantly affected by extraction methods (Fig. 2). These results lend support to the findings documented by Huang et al. (2000) that only SS readings, not pH, vary according solution extraction methods.

**The relationship among the four methods.** Simple correlation coefficients (r) for SS of root-zone solutions extracted by the MCC, PEM, SME, and 1:2 methods were highly significant, ranging from 0.70 to 0.92. Thus, data from different sampling dates were grouped by individual methods, and regression analyses were performed to provide formulas for converting SS readings from one method to another (Table 1). When referencing and/or comparing SS levels, final readings may not be reported using results from identical extraction procedures. The developed formulas can help to convert one reading to another.

**The MCC extraction method.** The MCC method is modified from the standard PT method. The differences between MCC and PT lie in the facts that (1) the former is developed for plug media, while the latter has been used for potting media, (2) leachate collection using MCC requires a plate that can accommodate the plug tray, but leachate collection by PT needs beakers or other similar containers that hold pots.

The MCC method, like PEM, does not require medium removal from plugs or waiting around typically needed for
AWN REMOVAL OF NATIVE SCRUB GRASSES

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Abstract. In the Florida Panhandle, the native scrub grasses that are the most important in autotrophic succession are: Wiregrass (Aristida stricta Michx), Little Bluestem [Schizachyrium scoparium (Michx) Nash], and Lopsided Indian Grass [Sorghastrum secundum (Ell.) Nash]. These grasses produce significant awns and this study evaluated treatment with sulfuric acid, flash burning, and mechanical methods for removal of awns. Awn removal with subsequent seed survival was more difficult than envisioned. Sulfuric acid was not able to degrade awns to the point that they separated from the seed. Awns proved to be extremely flammable and this combined with the elongate nature of the seeds proved to be disastrous to seed health after burning. Mechanical removal showed promise as some awns were easily detached from seeds while with others the seeds protruded through the nylon mesh with the awns being retained on the inside.

Native environments are of extreme ecological importance, however, the influence of economic development on these native areas has created the need for restoration (Cunningham and Saigo, 1996). One kind of native environment is characterized by native scrub grasses that once were a dominant factor in the recycling of nutrients in areas of secondary autotrophic succession (Engle et al., 1991). In the Florida Panhandle, the native scrub grasses that are the most important are Wiregrass or Pineland Three-Awn (Aristida stricta Michx), Little Bluestem [Schizachyrium scoparium (Michx) Nash], and Lopsided Indian Grass [Sorghastrum secundum (Ell.) Nash] (Kindell et al., 1996; McCaleb et al., 1963; Means, 1997). All of these grasses are bunch type grasses that produce abundant seed with significant awns (Hitchcock, 1950). Awns are elongated appendages that serve to aid in the dispersal of the mature floret or as a protective appendage during seed development and maturation (Fahn and Werker, 1972; Stefferud, 1961). In the case of A. stricta, S. scoparium, and S. secundum, the awns are a substantial part of the mature floret (Hitchcock, 1950). Awns are elongate appendages that serve to aid in the dispersal of the mature floret or as a protective appendage during seed development and maturation (Fahn and Werker, 1972; Stefferud, 1961). In the case of A. stricta, S. scoparium, and S. secundum, the awns are a substantial part of the mature floret (Hitchcock, 1950; Kucera, 1961). These awns create problems for human intervention in the repopulation of these grasses, because the awns increase the volume of the floret and decrease the ability of these seeds to pass through mechanized methods of seed dispersal (Fahn and Werker, 1972; Wilson, 1992).

Table 1. Formulas for converting soluble salts readings from one extraction method to another.*

<table>
<thead>
<tr>
<th>Reading Method</th>
<th>Multiplier</th>
<th>Additive</th>
<th>Conversion Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCC</td>
<td>0.92</td>
<td>0.07</td>
<td>PEM</td>
</tr>
<tr>
<td>MCC</td>
<td>0.94</td>
<td>0.12</td>
<td>SME</td>
</tr>
<tr>
<td>MCC</td>
<td>0.87</td>
<td>0.03</td>
<td>1:2</td>
</tr>
<tr>
<td>PEM</td>
<td>0.96</td>
<td>0.07</td>
<td>MCC</td>
</tr>
<tr>
<td>PEM</td>
<td>0.56</td>
<td>0.09</td>
<td>SME</td>
</tr>
<tr>
<td>PEM</td>
<td>0.49</td>
<td>0.04</td>
<td>1:2</td>
</tr>
<tr>
<td>SME</td>
<td>1.36</td>
<td>0.10</td>
<td>MCC</td>
</tr>
<tr>
<td>SME</td>
<td>1.45</td>
<td>0.02</td>
<td>SME</td>
</tr>
<tr>
<td>SME</td>
<td>0.85</td>
<td>0.10</td>
<td>1:2</td>
</tr>
<tr>
<td>1:2</td>
<td>1.25</td>
<td>0.39</td>
<td>MCC</td>
</tr>
<tr>
<td>1:2</td>
<td>1.45</td>
<td>0.28</td>
<td>PEM</td>
</tr>
<tr>
<td>1:2</td>
<td>0.97</td>
<td>0.19</td>
<td>SME</td>
</tr>
</tbody>
</table>

*These formulas were developed for converting soluble salts readings of plug media only, not suitable for potting media conversion.

Example:

Suppose a SS reading of 1.0 dS/m is obtained using the MCC method. To convert this reading to the equivalent PEM, SME and 1:2 reading, use the table as follows:

1.0 x 0.92 + 0.07 = 0.96 dS/m (PEM)
1.0 x 0.94 + 0.12 = 0.63 dS/m (SME)
1.0 x 0.87 + 0.03 = 0.96 dS/m (PEM)

Therefore, if the PEM, SME, and 1:2 method are used to extract root-zone solution of this plug medium, the SS reading should be 0.96, 0.63, and 0.42 dS/m respectively.

Literature Cited


