Since the 1960’s soilless substrates have been developed in the use of
culture crop production. The main components of most nursery and greenhouse
soilless substrates include pinebark, peatmoss, and perlite (1). Recent
developments have caused concerns with the availability of pine bark and
peatmoss because of other industrial uses and environmental concerns. Perlite,
an igneous glassy rock, that is milled and heated to 1600°C to remove all water
and expand the rock (6). Amending perlite into the substrate with pine bark and
peatmoss is beneficial because its ability to add air space to the substrate without
effecting growth.

The production of perlite produces a very fine particle dust that is
considered to be a lung and eye irritant (4). This problem that is associated with
perlite has lead nursery and universities to look for alternatives that will be able to
provide the same amount of air space to the soil but will less impact on
environmental and health concerns. Current alternatives to perlite include rice
hulls, pumice, and expanded polystyrene. A possible new alternative that has the
ability to provide the same amount of air space as perlite but with less
environment and health impact is processed corncob.

Corncob is a waste byproduct of the feed and seed industry that requires
less energy to produce than perlite. Corncob is widely available which could
result in lower transportation cost. The purpose of this study was to see the
effects of container grown perennials when mixed with Corncob and compare
that to the industry standard perlite.

An experiment was installed (May 13, 2011) at the Paterson Research
and Teaching Facility at Auburn University. The base substrate used was a 80:20
pinebark:peat (PBP) mixed with either processed corncob(C) (The Andersons
Inc. Maumee, OH) or perlite (PL). Treatments were 90:10 PBP:C (v:v) 80:20
PBP:C (v:v) 70:30 PBP:C (v:v) 90:10 PBP:PL (v:v) 80:20 PBP:PL (v:v) 70:30
PBP:PL (v:v). Substrates were amended with 15.5 lbs/yd³ of 15-6-12 slow
release fertilizer (Harrells, Lakeland, FL), and 3 lbs/yd³ of dolomitic lime. After
mixing 1.96 L containers (Dillen Products. Middlefield, OH) were filled and one 2”
liner of Lantana camara, Salvia guaranitica or Miscanthus sinensis were planted
in each container. Containers were placed on a nursery pad under overhead
irrigation.

Total porosity (TP), container capacity (CC), air space (AS) and bulk
density (BD) were determined using the NCSU Porometer method (5). Before
planting, initial pH and EC of treatments were determined (Accumet Excel XL50;
Fisher Scientific, Pittsburgh, PA) using the pour-through method (8).
Subsequently pH and EC were taken at 30, 60, and 90 days after potting (DAP).
At 35 and 90 DAP all plants were measured for growth index (GI) [(height +
width + perpendicular width)/three (cm)], and shoot-dry weights (SDW) (Shoots
were removed at the substrate surface and oven dried at 70°C for 72 h and
weighed). Containers were arranged in a randomized complete block with 12
single plant replicate. Each plant species was treated as a separate experiment. Data was subjected to analysis of variance using the general linear models and Duncans Multiple Range Test.

**Results**

Physical properties analysis (Table 1) showed that that CC and AS of corncob-amended substrates were found to be equal to their perlite amended counterpart. Results from the bulk densities showed that substrates containing corncob were found to be higher than all substrates containing perlite with 30% corncob being higher than all other. One explanation for the higher BD of the corncob substrates is because of the weight of the cob compared to perlite.

Results for pH showed that at 0 DAP (Data Not Shown) pH for corncob substrates were lower than those of the perlite mixes, with 20 and 30% perlite having the highest pH readings. Results at 30 and 60 DAP for lantana and miscanthus showed that pH of substrates with corncob were higher than perlite substrates while at 90 DAP no major differences were found across all treatments. Electrical conductivity readings at 0 DAP showed that corncob substrates were equal to their perlite counterpart. At 30 DAP EC’s for substrates containing corncob were less than substrates containing perlite. At termination no differences were found across all treatments for both miscanthus and lantana.

Growth index for Salvia at 35 DAP (Table 2) showed a reduction in growth with an increase in percentage of corncob. In addition, at 35 DAP substrates containing perlite had greater GI than those containing corncob. Results at 90 DAP differed from 35 days with all corncob-amended substrates being equal to its perlite counterpart. Lantana GI differed from salvia with no difference being found in corncob and its perlite counterpart at 35 and 90 DAP. Shoot-dry weights of salvia were similar to results found in GI with a reduction in growth at 35 DAP, and by 90 days no differences were found in corncob and its perlite counterpart. Miscanthus results differed slightly with corncob substrates at 10 and 30% being less in weights to its counterpart, while at 90 days all were equal except for 30% corncob, which was again found to be less to 30% perlite.

In Conclusion growth of lantana, salvia and miscanthus in corncob amended substrates were found to be of equal growth compared to its perlite counterpart at 90 DAP. Results from previous work have found mixed results in growth of greenhouse annuals in corncob amended substrates. Results from this study continue to show that corncob might be a viable alternative to perlite. Environmental and health concerns associated with perlite may be alleviated with the use of corncob. Advantages of corncob are its potential to be more regionally available and more carbon neutral compared to perlite. Based on these results and previous research additional studies need to be conducted to further investigate corncob as a perlite replacement in greenhouse and nursery production.
Literature Cited


**Table 1. Physical Properties of Corncob Amended Substrates.**

<table>
<thead>
<tr>
<th></th>
<th>Air (Vol%)</th>
<th>Container Capacity (Vol%)</th>
<th>Total Porosity</th>
<th>Bulk Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% Corncob</td>
<td>24.7b</td>
<td>58.2a</td>
<td>82.8a</td>
<td>0.80b</td>
</tr>
<tr>
<td>20% Corncob</td>
<td>29.9ab</td>
<td>51.7c</td>
<td>81.7a</td>
<td>0.80b</td>
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<tr>
<td>30% Corncob</td>
<td>31.7a</td>
<td>52.3c</td>
<td>83.9a</td>
<td>0.82a</td>
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<tr>
<td>10% Perlite</td>
<td>24.3b</td>
<td>56.5ab</td>
<td>80.8a</td>
<td>0.78c</td>
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<tr>
<td>20% Perlite</td>
<td>28.3ab</td>
<td>55.2abc</td>
<td>83.4a</td>
<td>0.78c</td>
</tr>
<tr>
<td>30% Perlite</td>
<td>26.6ab</td>
<td>53.4bc</td>
<td>80.0a</td>
<td>0.78c</td>
</tr>
</tbody>
</table>

*aAnalysis performed using the NCSU porometer.*

*bAir space is volume of water drained from the sample ÷ volume of sample x 100.*

*cContainer Capacity (wet weight - oven dry weight) ÷ volume of the sample x 100.*

*dTotal porosity is container capacity + air space.*

*eBulk density after forced air drying at 105°C (221.0°F) for 48 h.*

*fBase substrate = 80:20 Pinebark:Peat*

*gDuncans Multiple Range Test (P ≤ 0.05, n = 3).*

**Table 2. Effects of Corncob in nursery perennial production**

<table>
<thead>
<tr>
<th>Lantana</th>
<th>Salvia</th>
<th>Miscanthus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GI</td>
<td>SDW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>35 DAP</strong></td>
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<td></td>
</tr>
<tr>
<td>10% Corncob</td>
<td>35.2ab</td>
<td>16.1abc</td>
</tr>
<tr>
<td>20% Corncob</td>
<td>36.1ab</td>
<td>12.6bc</td>
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<tr>
<td>30% Corncob</td>
<td>33.9b</td>
<td>11.6c</td>
</tr>
<tr>
<td>10% Perlite</td>
<td>41.8a</td>
<td>20.7a</td>
</tr>
<tr>
<td>20% Perlite</td>
<td>39.0ab</td>
<td>18.0ab</td>
</tr>
<tr>
<td>30% Perlite</td>
<td>37.8ab</td>
<td>17.2abc</td>
</tr>
<tr>
<td><strong>90 DAP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% Corncob</td>
<td>67.6a</td>
<td>59.7ab</td>
</tr>
<tr>
<td>20% Corncob</td>
<td>59.7ab</td>
<td>54.3b</td>
</tr>
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<td>30% Corncob</td>
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<td>59.0b</td>
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<td>57.2ab</td>
<td>86.4a</td>
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<td>55.2ab</td>
<td>54.3b</td>
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<tr>
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<td>52.8b</td>
<td>54.9b</td>
</tr>
</tbody>
</table>

*Growth index [(height + width1 + width2)/3]*

*Shoot dry weight measured in grams.*

*Base substrate = 80:20 Pinebark:Peat*

*Duncans Multiple Range Test (P ≤ 0.05, n = 4).*