Processed Corncob as an Alternative to Perlite in The Production of Container Grown Perennials

Tyler Weldon, Glenn Fain, Jeff Sibley, and Charles Gilliam

Since the 1960's soilless substrates have been developed in the use of nursery 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 minded 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 airspace 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 airspace 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/yd^3 of 15-6-12 slow release fertilizer (Harrells, Lakeland, Fl), and 3 lbs/yd^3 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 counter part. 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

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Table 1. Physical Properties of Corncob Amended Substrates.^{z}

	Air^{y} space	Container^{x} capacity	Total^{w} porosity	Bulk^{v} density
	---------------- (% vol)		---------------	(g/cm^{3})
10% Corncob^{u}	24.7b^{t}	58.2a	82.8a	0.80b
20% Corncob	29.9ab	51.7c	81.7a	0.80b
30% Corncob	31.7a	52.3c	83.9a	0.82a
10% Perlite	24.3b	56.5ab	80.8a	0.78c
20% Perlite	28.3ab	55.2abc	83.4a	0.78c
30% Perlie	26.6ab	53.4bc	80.0a	0.78c

^{z}Analysis performed using the NCSU porometer.

^{y}Air space is volume of water drained fromt the sample ÷ volume of sample x 100.

^{x}Container Capacity (wet weight - oven dry weight) ÷ volume of the sample x 100.

^{w}Total porsity is container capacity + air space.

^{v}Bulk density after forced air drying at 105^{0} C (221.0^{o}F) for 48 h.

^{u}Base substrate = 80:20 Pinebark:Peat

^{t}Duncans Multiple Range Test ($P \leq 0.05$, n = 3).

Table 2. Effects of Corncob in nursery perennial production

	Lantana		**Salvia**		**Miscanthus**
	GI^{z}	SDW^{y}	GI	SDW	SDW
			35 DAP		
10% Corncob^{x}	35.2ab^{w}	16.1abc	37.3bc	16.7b	16.7b
20% Corncob	36.1ab	12.6bc	35.1bc	11.8c	11.8c
30% Corncob	33.9b	11.6c	30.7c	9.8c	9.8c
10% Perlite	41.8a	20.7a	44.7a	22.3a	22.3a
20% Perlite	39.0ab	18.0ab	44.3a	20.4ab	20.4ab
30% Perlite	37.8ab	17.2abc	40.0ab	16.9b	16.9b
			90 DAP		
10% Corncob	67.6a	59.7ab	42.9a	37.4a	37.4a
20% Corncob	59.7ab	54.3b	53.8a	39.6a	39.6a
30% Corncob	52.2b	59.0b	59.7a	39.7a	39.7a
10% Perlite	57.2ab	86.4a	51.9a	49.2a	49.2a
20% Perlite	55.2ab	54.3b	48.6a	51.4a	51.4a
30% Perlite	52.8b	54.9b	54.9a	57.2a	57.2a

^{z}Growth index [(height + width1 + width2)/3]

^{y}Shoot dry weight measured in grams.

^{w}Base substrate = 80:20 Pinebark:Peat

^{x}Duncans Multiple Range Test ($P \leq 0.05$, n = 4).