Influence of Nitrogen Fertilizer Application on Biocontainer Decomposition in Landscape

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Introduction

With the public's growing environmental awareness, consumer interest has shifted toward sustainability in the landscape industry. Green industry stakeholders have identified the use of plantable biodegradable container alternatives as a way to improve sustainability in the current production system (Fulcher et al. 2015). Research to date has demonstrated successful use of plantable biocontainers to produce plants with similar or better performance to those grown in plastic containers in greenhouse and nursery production, however, very little is known about the biodegradation of plantable containers in landscape (Center for Applied Horticulture Research 2010). It is imperative that plantable containers break down as claimed because rate of biodegradation can affect plant health and performance in the landscape. Several factors influence rate of container biodegradation including container material, available nitrogen, moisture, temperature, pH, and microbes (Nambuthiri et al. 2015). Container types (i.e. cow manure and natural fiber) with high cellulose and nitrogen content usually exhibit faster degradation when compared to those with high lignin content (i.e. coconut coir). This research will be conducted 1) to determine the rate of biodegradation of three plantable biodegradable containers (Coir pot, Cowpot, Fertilpot) in Georgia soil at two different locations that exhibit different soil properties; 2) to assess how application of standard 10-10-10 fertilizer will effect decomposition of biocontainer materials.

Materials and Methods

Litter Bag Technique

Decomposition of three plantable four inch biocontainer materials: cow manure and natural fiber [Cowpot Square #4, Freund's Farm, East Canaan, CT], wood pulp fiber [Fertilpot FP 513, Fertil International, Boulogne-Billancourt, France], and coconut coir [Greenhouse Megastore Inc., Los Angeles, CA] were evaluated using the litter bag technique performed according to Swift and Anderson (1989) and Alvarez et al. (1992). This technique will be used to analyze and describe differences in decomposition rate among the two container materials. Mesh bags designed from mesh fiberglass screen [Phifer Incorporated, Tuscaloosa, AL] were with various biocontainers (cow manure and natural fiber, wood pulp fiber, and coconut coir) were buried 10.1 cm in depth to completely cover the biocontainer (Figure 1).

Figure 1. Cowpot, Fertilpot, and Coconut Coir pot containers placed in mesh bags designed from mesh fiberglass screen.

Experimental Design

Mesh litter bags for each container material (50 total), previously weighed in the laboratory, were placed in a randomized complete block design with five replications and ten sub-samples (Figure 2) in plots applied with 1 lb. 10-10-10 fertilizer/ per 100 sq. feet and no fertilizer application at two locations: the University of Georgia Bledsoe Farm (Pike Co., GA) (Figure 3) and University of Georgia Dempsey Farm (Spalding Co., GA) (Figure 4) on October 21-23, 2015. Sampling will occur every month for ten months until all sub-samples were collected.

Figure 2. Placement of mesh litter bags at the University of Georgia Bledsoe (Pike Co, GA) and Dempsey (Spalding Co., GA) Farms.

Figure 3. Plots with and without fertilizer application at the University of Georgia Bledsoe Farm (Pike Co., GA).

Figure 4. Plots with and without fertilizer application at the University of Georgia Dempsey Farm (Spalding Co., GA).

Data Collection

Mesh litter bags collected during respective sampling dates were washed with deionized water to remove dirt sediments and placed in labelled brown paper bags [Great Value, 29.2 cm x 11.4 cm] for drying (Figure 5). Samples were placed in a drying oven for forty-eight hours at 60°C and weighed after a constant weight was obtained (Figure 6). The final weight represents the mass remaining after decay and hence from this, the percent of initial mass remaining can be calculated.

Figure 5. Mesh litter bags after washing of dirt sediments occurred.

Figure 6. Biocontainer samples placed in drying oven for forty-eight hours at 60°C.

Results and Discussion

Data presented represents average dry weight of container materials over a two month period: November and December 2015. On average, the dry weight of coir (15.08), Cowpot (18.47), and Fertilpot (7.53) was higher in the plot applied with 10-10-10 fertilizer application at the University of Georgia Dempsey Farm over a two month period. Whereas, average dry weight of biocontainer materials were lower in the plot with no fertilizer application (Figure 7).

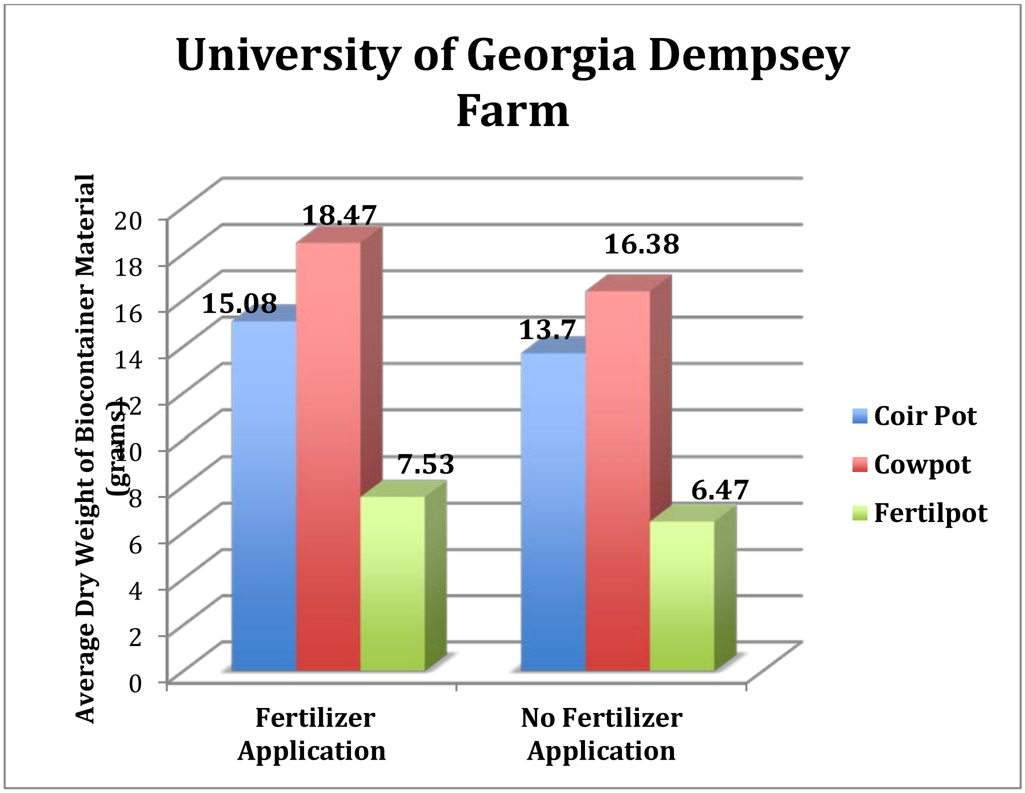

Figure 7. Average Dry Weight of Biocontainer Materials Exposed to 10-10-10 Fertilizer Application and No Fertilizer Application over a two-month period at the University of Georgia Dempsey Farm.

The average dry weight of the coir (14.95), Cowpot (17.57), Fertilpot (7.33) were lower in the plot applied with 10-10-10 fertilizer at the University of Georgia Bledsoe Farm over a two-month period. Biocontainer material dry weight for all container types were higher in the plot with no fertilizer application (Figure 8).

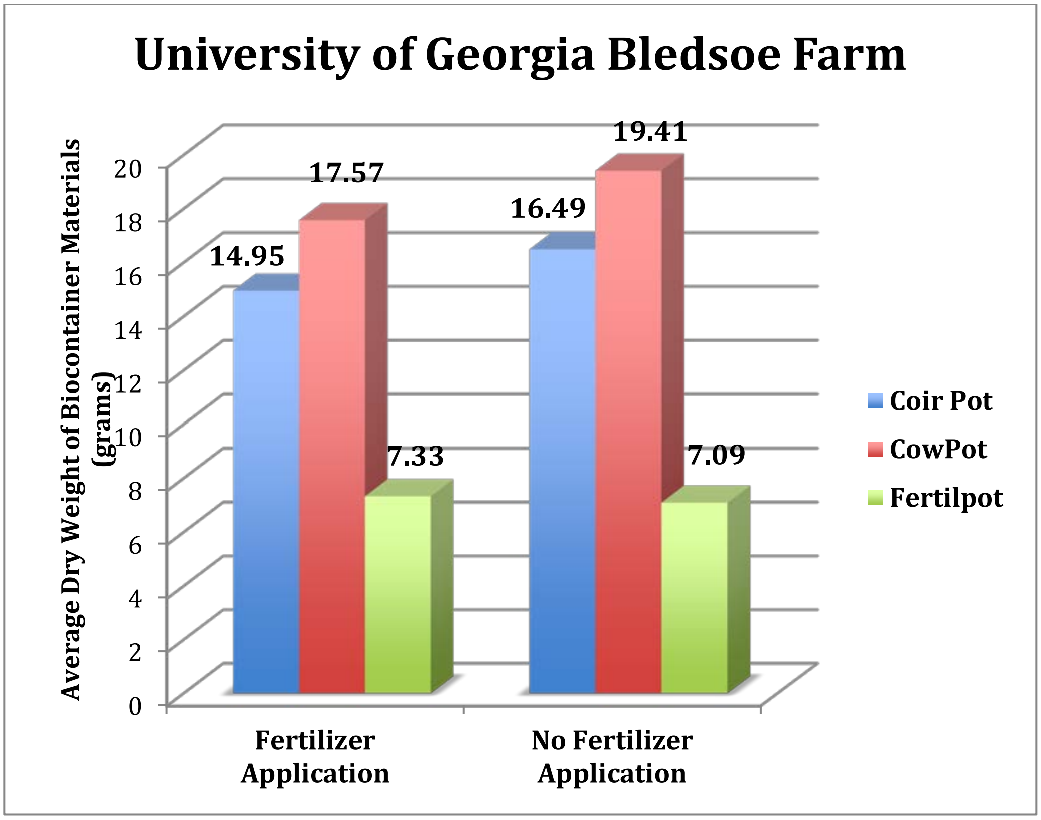

Figure 8. Average Dry Weight of Biocontainer Materials Exposed to 10-10-10 Fertilizer Application and No Fertilizer Application over a two-month period at the University of Georgia Bledsoe Farm.

From our results, we have confirmed additional sampling should be used to determine the effect of fertilizer on decomposition of biodegradable container materials and the rate of degradation over a six-month period, a typical growing and establishment period for annuals, biannuals, and perennials used in raised beds and landscape settings. This study will be extended from November 2015-May 2016.

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