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Plant Performance and Nutrient Losses during Containerized Landscape Shrub Production using Composted Dairy Manure Solids as a Peat Substitute in Substrate

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SUMMARY. **Concerns over the environmental impact and economics of harvesting sphagnum and reed-sedge peat have increased the desire to identify acceptable peat substitutes for use in container substrates. This preliminary study evaluated the use of composted dairy manure solids as a substitute for sphagnum or reed-sedge peat in container substrates for production of woody ornamental shrubs and assessed potential leaching of nutrients. Walter's viburnum (*Viburnum obovatum*), sandankwa viburnum (*Viburnum suspensum*), and japanese privet (*Ligustrum japonicum*) were grown in 3-gal plastic containers with seven substrates containing (by vol.) 60% pine bark, 10% sand, and 30% sphagnum peat (S), reed-sedge peat (R), and/or composted dairy manure solids (C). Substrate composition had no effect on plant quality ratings for any species, growth index (GI) of walter's viburnum, or shoot and root dry weight of walter's viburnum and japanese privet. However, the GI of japanese privet and sandankwa viburnum was the lowest when grown in substrates containing a high percentage of reed-sedge peat (0S:3R:0C). Substrate effects on average nitrate + nitrite nitrogen leachate losses were minimal over the 88-day leachate collection period. However, the substrate containing the highest proportions of composted dairy manure solids (0S:0R:3C) generally had the highest average ammonium nitrogen and dissolved reactive phosphorus losses compared with other substrates. All substrates tested as part of this study appeared to be commercially acceptable for production of container-grown woody ornamental shrub species based on growth and quality. However, average nutrient losses from containers differed depending on the peat or peat substitute used to formulate the substrates.**

Recent concerns over the environmental impact and costs of harvesting sphagnum and reed-sedge peat have generated interest in identifying alternative materials that can be used as a substitute for peat in container substrates. Researchers suggested that composted dairy cattle manure solids can be an acceptable substitute for peat in container substrate (Gorodecki and Hadar, 1990; Li et al., 2009; Wang et al., 2004) because the physical and chemical properties of this compost are adequate to support plant growth (Li et al., 2009). Nutrient leaching [particularly nitrogen (N) and phosphorus (P)] from container substrates containing composted materials has not been studied and is a concern.

A number of factors affect the extent of leaching from container substrate including the substrate components (Wilson et al., 2009), species grown in the substrate (Cole and Newell, 1996), frequency of watering or rainfall (Broschat, 1995), volume of water applied (Huett, 1997; Huett and Morris, 1999; Yelanich and Biernbaum, 1994), and/or the addition of inorganic fertilizers (Beeson, 1996). Leaching from container substrates containing composted materials (e.g., composted yard waste and composted recycled paper) is variable. However, researchers have reported that some substrate combinations leached equal or less N [as nitrate (NO_3)–N and ammonium (NH_4)–N) (Beeson, 1996; Cole and Newell, 1996) and P (Beeson, 1996) than a comparable peat-based substrate. leachedy, a substrate containing pine bark, peat, and sand at a ratio of 3:1:1 produced less leachate NH_4–N than a comparable substrate when peat was replaced with composted paper (Cole and Newell, 1996). However, few studies have evaluated the leaching potential of composted materials when used as a peat substitute in pine bark–based substrate formulations for the production of ornamental woody plants. The objectives of this study were to 1) evaluate the use of composted dairy manure solids as a substitute for sphagnum or reed-sedge peat in container substrate on the growth and quality of walter's viburnum, sandankwa viburnum, and japanese privet and 2) assess the potential for N and P leaching from substrates during production by examining the nutrient content in leachate from pots.

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.01	%	$g \cdot g^{-1}$	100
10	%	$g \cdot kg^{-1}$	0.1
29.5735	fl oz	mL	0.0338
0.3048	ft	m	3.2808
0.0283	ft^3	m^3	35.3147
3.7854	gal	L	0.2642
25.4	inch(es)	mm	0.0394
16.3871	$inch^3$	cm^3	0.0610
1	micron	µm	1
1	mmho/cm	$dS \cdot m^{-1}$	1
28.3495	oz	g	0.0353
28,350	oz	mg	3.5274×10^{-5}
6.8948	psi	kPa	0.1450
(°F – 32) ÷ 1.8	°F	°C	(1.8 × °C) + 32

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