Use of Ground Miscanthus Straw in Container Nursery Substrates

Pine bark (PB) is the primary component of substrates in outdoor container production. Pine bark availability has decreased due to its use as a fuel source for paper and lumber mills, while cost has increased. Finding an alternative to PB for use in container nursery production is important for stability in the industry. The objective of this research was to determine if ground miscanthus (*Miscanthus* x *giganteus*) straw (MS) could be used to replace all or part of the PB fraction in container substrates.

Pine bark and MS were used to create five substrate blends. All substrates contained 15% sphagnum peatmoss and 5% municipal solid waste compost, with the remaining 80% consisting of one of the following PB:MS ratios: 0:80, 20:60, 40:40, 60:20, and 80:0. Luna Red hibiscus (*Hibiscus moscheutos*) were grown in each substrate and evaluated for eight weeks in a greenhouse. Substrate physical properties, including air space (AS), container capacity (CC), total porosity (TP), and bulk density (D_b) were measured prior to transplanting. Substrate pH and foliar SPAD were measured at 1, 2, 4, 6, and 8 weeks after transplant (WAT). Foliar nutrient analysis and root ratings (based on a 0-10 scale, with 0= no roots and 10= complete root coverage at the substrate-container interface) were analyzed at the end of the experiment. The experiment was repeated twice.

Air space and CC increased linearly with increasing levels of PB, and substrates with 40% or more MS had higher than ideal AS (40%) (Table 1). All substrates, except those with 80% MS in Experiment 1 had sufficient CC. Bulk density increased linearly with increasing levels of PB. Substrate pH increased over time for all treatments, and decreased linearly with increasing PB fraction at 1, 4, and 8 WAT (Table 2). However, the overall change was not horticulturally significant. Shoot dry weight and root ratings increased with increasing PB percentage in both experiments; however, those plants grown in 20 to 80% PB generally had similar values. Foliar SPAD was not affected by PB:MS ratio (data not shown). Foliar nitrogen did not respond to PB:MS ratio in either experiment. All other nutrients responded linearly or quadratically to PB:MS ratio, although absolute differences in treatments were relatively minor and caused no observable symptoms of nutrient deficiency or toxicity.

Based on these results, MS was a suitable substrate for production of hibiscus over 8 weeks, given the substrate contained at least 20% PB.

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Pine bark	Miscanthus straw	Experiment 1[z] AS	CC	TP	D_b	Experiment 2 AS	CC	TP	D_b
		(%)			(g·cm^{-3})	(%)			(g·cm^{-3})
0	80	46	44	90	0.09	39	48	88	0.09
20	60	37	53	90	0.10	33	52	85	0.10
40	40	38	48	86	0.14	31	57	88	0.13
60	20	30	53	84	0.17	26	56	82	0.16
80	0	26	55	81	0.19	24	57	81	0.18
LSD[y]		6	6	3	0.01	7	8	5	0.00
Trend[x]		L***	L***	L***	L***	L***	L**	L***	L***Q*

[z]AS, CC, TP, and D_b refer to air space, container capacity, total porosity, and bulk density, respectively.
[y]LSD refers to Fisher's least significant difference value where $\alpha = 0.05$.
[x]Trend refers to the linear (L) or quadratic (Q) rate response to changing pine bark and miscanthus straw ratios.
*, **, *** denote significant regression response where $P < 0.05$, 0.01, and 0.001, respectively.

Table 1. Physical properties of substrates comprised of 15% sphagnum peat moss, 5% municipal solid waste compost, and the remaining 80% comprised of varying ratios of pine bark and miscanthus straw.

Experiment	Pine bark	Miscanthus straw	1 WAT[w]	4 WAT	8 WAT	Shoot dry weight (g)	Root rating
1	0	80	5.6	6.2	6.2	8.6	4.7
	20	60	5.3	5.9	6.0	11.2	5.9
	40	40	5.1	5.7	5.8	11.7	6.3
	60	20	5.3	5.9	5.7	12.7	6.1
	80	0	5.1	5.6	5.4	12.0	6.6
	Trend[y]		L***Q***	L***Q*	L***	L***Q*	L***
	LSD[x]		0.1	0.2	0.3	2.0	0.8
2	0	80	6.1	6.7	6.6	15.1	5.3
	20	60	5.8	6.5	6.4	17.3	6.0
	40	40	5.5	6.1	5.5	16.9	6.3
	60	20	5.3	5.9	5.8	18.5	6.4
	80	0	5.3	6.1	5.9	20.4	6.4
	Trend		L***Q***	L***Q***	L***Q***	L***	L**
	LSD		0.1	0.1	0.2	2.1	0.7

[w]WAT refers to weeks after transplanting.
[y]Trend refers to the linear (L) or quadratic (Q) rate response to changing pine bark and miscanthus straw ratios.
[x]LSD refers to Fisher's least significant difference value where $\alpha = 0.05$.
*, **, *** denote significant regression response where $P < 0.05$, 0.01, and 0.001, respectively.

Table 2. Substrate pH of containers filled with substrates comprised of 15% sphagnum peat moss, 5% municipal solid waste compost, and the remaining 80% one of four combinations of pine bark and miscanthus straw (MS).

Altland, J.E., Locke, J.C. 2011. Use of ground miscanthus straw in container nursery substrates. Journal of Environmental Horticulture. 29:114-118.