Use of Switchgrass as a Nursery Container Substrate

Containerized nursery and greenhouse crops are grown almost exclusively in soilless substrates. Loblolly pine (*Pinus taeda* L.) bark is the primary component of nursery container substrates in the eastern United States. Shortages in pine bark availability have prompted investigation of alternative substrates. Switchgrass (*Panicum virgatum*) is a native grass grown in the upper Midwest states for its potential as a biofuel, and its high biomass yields offer potential as a pine bark replacement as the primary potting component in nursery containers. The objective of this research was to document the suitability of locally-grown switchgrass as the primary component in container nursery substrates with a short production-cycle woody crop.

Two experiments were conducted using 'Paprika' rose (*Rosa* L. 'ChewMayTime') potted in 15-cm tall and wide containers. In Expt. 1, substrates were composed of coarse-milled switchgrass (processed in a hammermill with 1.25- and 2.5-cm screens) amended with 0%, 30%, or 50% peatmoss and fertilized with 100, 250, or 400 mg·L^{-1} nitrogen (N) from ammonium nitrate. In Expt. 2, substrates were composed of coarse-milled (similar to Expt. 1) or fine-milled switchgrass (processed through a single 0.48-cm screen), amended with 0% or 30% peatmoss, and fertilized with the same N rates as in Expt. 1.

Fine switchgrass with or without peatmoss had closer to ideal physical properties (10-30% air space, 45-65% container capacity) than coarse switchgrass (Table 1). In general, switchgrass pH was high, with fine-milled switchgrass having higher pH than coarse-milled (Table 2). Foliar nutrient analysis detected deficiency in calcium and iron, but there was no detection in N immobilization by switchgrass. Root growth decreased linearly with increasing N rate, while shoot growth increased linearly or quadratically across with increasing N rate among all switchgrass grade and peat moss combinations (Table 2). Averaging across N rates, no substrate combination provided superior growth among those tested.

Overall, plant growth was vigorous in all treatments regardless of substrate type. In summary, switchgrass can be processed and modified such that it is suitable for production of short-term woody crops.

Table 2. Effect of coarse or fine switchgrass substrate amended with 0% or 30% peatmoss and fertilized with three nitrogen (N) rates on substrate pH and rose root and shoot growth grown in those substrates (n=6)

Switchgrass grade[y]	Peat (%)	N rate (mg·L^{-1})	Substate pH[z] 2 WAP	4 WAP	7 WAP	Root dry wt (g)	Shoot dry wt (g)
Coarse	0	100	6.64	6.86	6.69	2.7	5.0
		250	6.72	6.70	6.59	2.5	7.9
		400	6.50	6.81	5.98	2.0	9.0
			NS	NS	L***Q*	L***	L***Q*
	30	100	4.58	4.80	5.09	1.8	3.9
		250	4.75	5.44	5.21	1.5	7.4
		400	4.22	4.74	4.83	1.8	9.0
			Q**	Q***	Q*	NS	L***
Fine	0	100	6.89	6.95	6.83	1.9	3.2
		250	6.84	6.99	6.75	1.5	6.4
		400	6.81	6.91	6.47	1.3	9.1
			NS	NS	L**	L**	L***
	30	100	5.28	5.68	5.94	2.0	4.1
		250	5.49	5.90	5.63	1.4	8.3
		400	5.33	5.42	5.19	1.3	8.2
			Q*	Q***	L***	L***	L***Q***
LSD			0.26	0.16	0.24	0.4	1.3
Main effects					*Significance*		
Switchgrass			0.0001	0.0001	0.0001	0.0001	0.1299
Peat (P)			0.0001	0.0001	0.0001	0.0001	0.6463
S*P			0.0001	0.0001	0.006	0.0001	0.0593
N rate (N)			0.0027	0.0001	0.0001	0.0001	0.0001
S*N			0.0802	0.3863	0.2254	0.3456	0.5122
P*N			0.2212	0.0001	0.9509	0.1181	0.2938
S*P*N			0.3988	0.0012	0.0032	0.0744	0.0077

[z]Substrate pH was determined with the pourthrough method.
[y]Coarse switchgrass was processed through a hammermill with 1.25- and 2.54-cm screens, whereas fine switchgrass was processed through a hammermill with a single 0.48-cm screen.
L, Q, and NS represent linear, quadratic, or nonsignifican rate response with respect to N rate.
*, **, and *** represent significant effects with *P* values less than or equal to 0.05, 0.01, or 0.001, respectively.
LSD values are the least significant difference as determined by Fisher's least significant difference test.
WAP = weeks after planting.

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Table 1. Physical properties of switchgrass (SG) substrates amended with 0%, 30%, or 50% peatmoss.

Switchgrass grade	Peat (%)	Expt. 1 Air Space (%)	Container capacity (%)	Total porosity (%)	Bulk density (g·cm^{-3})	Expt. 2 Air space (%)	Container capacity (%)	Total porosity (%)	Bulk density (g·cm^{-3})
Coarse	0	53 a[y]	36 c	89 a	0.068 b	55 a	29 c	84 b	0.066 c
	30	41 b	45 b	87 b	0.071 a	47 b	42 b	90 a	0.073 b
	50	36 c	53 a	89 a	0.072 a				
Fine	0					37 c	53 a	90 a	0.092 a
	30					37 c	52 a	90 a	0.089 a
Main effects							*Significance*		
SG type						0.0001	0.0001	0.0015	0.0001
Peat rate						0.0692	0.0019	0.0055	0.0335
Interaction						0.0382	0.0009	0.0028	0.0008

[z]Switchgrass used was classified as either coarse (processed through 1.25- to 2.5-cm screens) or fine (processed through a 0.47-cm screen) (n = 6).
[y]Means with different letters, within a column, are significantly different according to Fisher's protected least significant difference test.

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