CONCLUSION

This was just a small sample of our horticultural adventures in Japan. The trip illustrates that the IPPS is truly an international society, with much to learn and share beyond our regional borders. We encourage the IPPS-SRNA membership to take advantage of IPPS regional meetings around the world to capture some of the great experiences available. All regional meeting activities and schedules are available on the IPPS website <www.ipps.org>. Taste what the rest of the IPPS world has to share!

Offshoot Production of Perennial Groundcovers in Porous Ceramic©

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INTRODUCTION

Many groundcover plants such as *Ophiopogon, Hosta, Hemerocallis,* and *Liriope* are marketed and sold as bare-root divisions. Dividing and barerooting these plants is a labor-intensive process, whether container grown or field grown. Profile™ (Profile products LLC, Buffalo Grove, Illinois) is a calcined clay product whose base minerals are illite clay and amorphous silica. The raw product is heated in a kiln at 1500 ºC+, which permanently changes the base minerals to a stable calcined clay (also called porous ceramic) particle. The resulting particles have approximately 74% pore space with half of the pores available for capillary (water holding), and the remaining half for noncapillary (air and drainage) pores. The final product also has a cation exchange capacity of 33 meq/100 g. These products have been used for many years as soil amendments in golf course greens to improve soil structure. There have been comprehensive reviews on these and other soil amendments in turfgrass (Daniel and Freeborg, 1979; Grunthal, 1996). Past research has indicated an increase in bermudagrass (*Cynodon dactylon*) tissue when soil was amended with ≥ 40% Profile™ (Wehtje et al., 2003). *Rhododendron* sp. has been shown to grow exceptionally well in media containing calcined clay at up to 50% by volume (Carlile and Bedford, 1988).

On 23 Feb. 2003, three bare-root single-bibb divisions of *Ophiopogon japonicus* and *O. japonicus* 'Nanus' were potted into 20-cm-wide (8-inch) by 13-cm ($5^{1}/_{8}$-inch) tall containers [C-350 (small mum pan), Nursery Supplies Inc., Chambersburg, Pennsylvania] using either 100% aged pinebark, 8 pinebark : 2 peatmoss (v/v), 100% perlite, 100% 24 × 48 Profile™ porous ceramic [(P1), Profile products LLC, Buffalo Grove, Illinois], or 100% 5 × 50 Profile™ porous ceramic (P2). Hardware cloth was placed in the bottom of each container to prevent loss of substrate through container holes.

Containers were place in a greenhouse and liquid fed each irrigation with 15N-2.1P-12.3K (15-5-15 Cal-Mag, The Scotts Co., Marysville, Ohio). On 18 June 2003, plants were moved to an outdoor shade structure covered with 40% shade cloth, top-dressed with 14 g of 18N-2.5P-9.8K (18-6-12 The Scotts Co., Marysville, Ohio) and overhead irrigated as needed. On 24 Sept. 2003, four workers were randomly

Table 1. Time required to bareroot container-grown *Ophipogon japonicus* (2003) and *Ophiopogon japonicus* 'Nanus' (2004).

	Time to bareroot (sec)[z]		Time to bareroot per bibb (sec)	
Substrate	2003	2004	2003	2004
1 - Pinebark	57.1	135.5	5.92	1.44
2 - 8 pinebark : 2 peat (v/v)	43.0	116.6	4.77	1.45
3 - Perlite	27.9	67.0	2.97	1.51
4 - Profile (24 × 48)	35.4	74.6	2.49	0.86
5 - Profile (5 × 50)	20.5	65.4	2.34	0.96
Contrasts[y]				
1 vs 2	*[x]	NS[w]	NS	
1 vs 3	*	***	**	NS
1 vs 4	NS	**	**	**
1 vs 5	**	***	**	*
2 vs 3	***	***	***	NS
2 vs 4	**	***	***	**
2 vs 5	***	***	***	*
3 vs 4	NS	NS	NS	**
3 vs 5	NS	NS	NS	*
4 vs 5	*	NS	NS	NS

[w] NS represents a nonsignificant treatment response.

[x] *, **, and *** represent significance where P ? 0.05, 0.01, and 0.001.

[y] Contrasts performed using proc mixed in SAS with worker as the random variable and substrate as the fixed variable, *p*-values determined using the pdiff statement in SAS.

[z] Time (in seconds) required to remove plants from container and wash substrate from roots

assigned two replications of *O. japonicus* from each treatment and instructed to bareroot each container by washing the substrate from the root system using pressurized water. The time required to bareroot each container was recorded and this data was analyzed using PROC ANOVA, with workers as the random variable, and substrate as the fixed variable (SAS, v 8e, SAS Institute Inc., Cary, NC). Bibbs were subsequently divided and graded into #1, #2, and #3 grades based on density of foliage and roots. *Ophiopogon japonicus* 'Nanus' was overwintered under the shade structure and fertilized on 12 March 2004, with 18 g of 15N-1.7P-7.3K (15-4-9, Harrells, Sylacauga, Alabama), overhead irrigated as needed, and harvested as described above on 14 July 2004. The experimental design was a randomized complete block with eight, single-plant replicates with each taxon a separate experiment.

Table 2. Bareroot bibb production of container-grown *Ophipogon japonicus* (2003) and *O. japonicus* 'Nanus' (2004).

Substrate	Total bibbs	# 1 bibbs	# 2 bibbs	# 3 bibbs
	2003 *Ophiopogon japonicus*			
Pine bark	9.0 b[z]	2.0 b	3.8 ab	3.3 a
8 pinebark : 2 peat (v/v)	9.9 b	4.1 a	2.6 b	3.1 a
Perlite	9.8 b	3.5 ab	3.0 ab	3.3 a
Profile (24×48)	14.6 a	4.5 a	5.5 a	4.7 a
Profile (5×50)	9.8 b	2.8 ab	3.4 ab	3.6 a
	2004 *Ophiopogon japonicus* 'Nanus'			
Pine bark	82.6 ab	5.4 ab	11.6 b	65.6 ab
8 pinebark : 2 peat (v/v)	96.1 a	2.6 b	14.5 ab	79.0 a
Perlite	45.6 c	2.6 b	10.0 b	33.0 c
Profile (24×48)	88.6 ab	8.1 a	18.6 a	61.9 ab
Profile (5×50)	70.5 b	4.1 ab	12.5 b	53.9 bc

[z] Means with different letters within columns are significantly different, separated by the Bonferroni method ($\alpha = 0.05$).

RESULTS AND DISCUSSION

At approximately 210 days after initial potting, the *O. japonicus* were harvested as described above. By nursery standards these containers would not have been considered full at the time of harvest. It took approximately 61% more time to bare-root plants grown in pinebark compared to those grown in P1 (Table 1). Plants grown in P1 yielded 52% more bibbs on average than any other substrate (Table 2). On 12 March 2004, *O. japonicus* 'Nanus' was harvested. It took approximately 81% more time to harvest plants grown in pinebark than those grown in P1 (Table1). There was no difference in total bibb yield in plants grown in P1 compared to pinebark or pinebark : peat substrates (Table 2). Plants grown in P1 yielded 210% more #1 bibbs than pinebark and peat, and 60% more #2 bibbs than pinebark. The results of this study indicate that *O. japonicus* grown in P1 produce higher quality bibbs than those grown in more standard nursery substrates with a significant decrease in time to harvest for bare-root production.

Experiments are currently under way evaluating *Hosta, Hemerocallis,* and *Liriope.* Preliminary data indicate similar results as with the *Ophiopogon*.

LITERATURE CITED

Carlile, W.R. and **I. Bedford.** 1988. Plant growth in container media amended with calcined clay. Acta Hort. 221:117-132.

Daniel, W.H. and **R.P. Freeborg.** 1979. Rootzones and water, P. 137-199. In: Turf managers' handbook. Harvest Pub., Cleveland, Ohio.

Grunthal, P.E. 1996. Buried treasure: The "dirt" on inorganic soil amendments to enhance turfgrass. GreenMaster. June/July.

Wehtje, G.R., J.N. Shaw, R.W. Walker, and **W. Williams.** 2003. Bermudagrass growth in soil supplemented with inorganic amendments. HortScience 38:613-617.