FROM QUEST TO SYSTEM IN MEDIUM RESEARCH

BETSY SCARBOROUGH

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The nursery market is becoming increasingly competitive and the emphasis in production is to produce better quality plants. To improve quality the optimum growth conditions for each crop must be investigated. By manipulating microenvironments, those alterations resulting in positive growth responses can be selected and incorporated into the production system.

In our quest for improved quality one factor, medium, has received intensive study. Our standard production medium was a peat:sand mix, 3:2 (v/v) for ericaceous plants and 1:1 (v/v) for hollies, roses, junipers, euonymus, cotoneaster, and metasequoia. Our initial tests centered around the introduction of hardwood bark into the medium.

Through our experiments with hardwood bark as a medium component we hoped to answer several questions.

1. Were hardwood bark mixes superior to peat:sand?
2. What effect did particle size of the bark have on plant growth?
3. Was peat a necessary component in our hardwood bark mix?
4. Should bark be composted with urea or ammonium nitrate?
5. Did hardwood bark mixes contain more air space than peat:sand mixes?

The following five media were selected for study: 1) peat:sand (3:2 or 1:1); 2) coarse bark:peat:sand (2:1:1); 3) fine bark:sand (3:1); 4) coarse bark:sand (3:1) and 5) coarse bark:peat:sand (2:1:1) composted with urea.

Prior to mixing, each cubic yard of bark was composted with 9 lbs of ammonium nitrate with the exception of medium 5 which received 4.5 lbs of urea. In addition to the nitrogen source, 4 lbs of treble super-phosphate, 2 lbs of G.U.-49 (63% iron oxide) and 2 lbs of Aqua Gro were added per cubic yard of bark. After composting 6 weeks, the bark was mixed with the remaining medium admendments.

The coarse bark was hammermilled through a one-inch screen resulting in 31% of the particles greater than 1/4 inch and 12.7% less than 1/50 of an inch. The fine bark contained only 2.7% of the bark greater than 1/4 inch and 31.8% less than

1/50 of an inch.

The test plants, representing 5% of each cultivar grown at The Conard-Pyle Co. were transplanted into 2 or 3 gal containers on June 16, 1975. These plants received routine care, that is, weekly pesticide sprays and constant feeding at 150 ppm N of 15-20-24 fertilizer during the growing season. Final evaluation was taken August 12, 1976.

All 2-year container-grown plants in the coarse bark:peat:sand medium had better root and shoot growth than those grown in peat:sand or fine bark:sand (Tables 1 and 2). Lateral branching was also more developed on plants grown in the bark mixes versus the peat:sand. Only with the 1-year crops of euonymus, cotoneaster and metasequoia was growth in the peat:sand better or equal to the bark mixes.

Under our conditions the coarse bark produced better quality plants than the fine bark (Table 2). From additional tests using supplemental feeding with Osmocote 18-6-12, we were able to demonstrate that part of the reduced growth from the fine bark was due to nitrogen deficiency. Possibly more than 9 lbs of NH_4NO_3 was necessary in composting the fine bark because of the increased surface area.

The addition of peat to the bark:sand medium resulted in better growth (Table 2). One advantage of the peat as a component in the bark mix appeared to be an increase in water-holding capacity of the medium. Thus less frequent waterings were necessary.

Table 1. Size grade of *Ilex* 'Blue Angel', grown in experimental media.

Medium	Percent		
	Culls	10″-12″	12″-15″
Peat:Sand	97	3	0
Coarse-Bark:Peat:Sand	38	62	0
Fine-Bark:Sand	83	17	0
Coarse-Bark:Peat:Sand	26	72	2

Table 2. Size grade of *Rhododendron* 'Nova Zembla' grown in experimental media.

Medium	Percent			
	Culls	12″-15″	15″-18″	18″-21″
Peat:Sand	47	37	16	0
Coarse-Bark:Peat:Sand	9	27	41	23
Fine-Bark:Sand	35	65	0	0
Coarse-Bark:Sand	25	32	34	9
Coarse-Bark:Peat:Sand (urea as N source)	10	13	37	40

Depending upon the cultivar being grown, urea could be substituted for ammonium nitrate as the nitrogen source during composting. For the rhododendrons, 'Blue Angel' hollies, and junipers tested, better or equal growth was obtained in urea versus ammonium nitrate-treated bark. For pieris and Exbury azaleas ammonium nitrate was the superior nitrogen source (Table 3).

Table 3. Size grade of *Juniperus horizontalis* 'Wiltoni', *Pieris japonica* 'Compacta', *Ilex* 'Blue Angel' and *Thododendron* 'Roseum Pink'(?) grown in bark:peat:sand composted with urea or ammonium nitrate.

Variety	Nitrogen Source	Percent					
		Culls	10-12"	12-15"	15-18"	18-21"	21-24"
J. horizontalis 'Wiltoni'	NH_4NO_3	8	32	32	28		
	Urea	11	33	42	14		
P. japonica 'Compacta'	NH_4NO_3	3	41	53			
	Urea	17	55	28			
I. 'Blue Angel'	NH_4NO_3	38	62	0			
	Urea	26	72	2			
R. 'Roseum Pink'(?)	NH_4NO_3	0	0	13	35	39	13
	Urea	0	0	10	22	52	16

The available air space in freshly-prepared peat:sand (3:2) was only 12.7% whereas the air space in freshly prepared coarse-bark:peat:sand was 36%. After 15 months, the air space was reduced to 9.5% in the peat:sand medium while the air space in the bark medium was 19%. Even freshly prepared, the peat:sand medium contained less air space than the amount considered adequate for good plant growth, which is 15-25% (1).

Through observations, several other advantages of the bark:peat:sand medium were noted. The bark mixes, due to composting, had fewer weeds initially than the peat:sand medium. This meant 1 to 2 fewer hand weedings the first summer and less competition to impede plant growth. Secondly the bark mixes appeared to suppress certain plant pathogens that were active in the peat:sand medium. Reports indicate that composting pasteurizes the medium and antagonistic microorganisms and chemicals in composted bark contribute to control of plant pathogens (2). Nutrient and water retention of the bark mixes increased with aging and were higher than the peat:sand. Although the water retention was better in the bark, the drainage in the bark was also superior to the peat:sand medium thus lowering the susceptibility to infestation by root rot fungi. Finally the difference in weight per 3 gal container, peat:sand weighing 32 pounds at field capacity and bark:peat:sand weighing 22.5 pounds, resulted in increased productivity in handling the containers.

In summary, not only was the quality of the plants grown in bark:peat:sand improved but also the production efficiency in growing these plants increased. The plants grown in coarse-bark:peat:sand had larger root systems, were generally one size grade larger and were fuller plants due to increased lateral branching. The peat not only improved the growth when mixed with the coarse bark but reduced labor costs by reducing the number of waterings needed. The coarse bark, which is more readily available to us, produced better plants than the finely hammermilled bark. Although further testing is warranted, either urea or ammonium nitrate could be used as the nitrogen source which allows us to be flexible with the fertilizer market.

As for production advantages, less frequent waterings were necessary with the bark mixes, fewer weedings were needed the first summer and fewer pesticide drenches were required. Finally, worker productivity was increased during canning, spacing and shipping due to decreased weight of the media. These results have been incorporated into our production system and we are now completing our first growing season with plants in a bark:peat:sand medium.

LITERATURE CITED

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HOW TO GROW MINIATURE ROSES

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The story of present day miniature roses in the United States has been created mostly by two men: the late John de Vink of Boskoop, Holland, and the late Robert Pyle of The Conard-Pyle Co., West Grove, Pennsylvania. When Mr. Pyle was in Europe in 1933 he visited Mr. de Vink in Holland and found him experimenting with the breeding of miniature roses for his own amusement. Mr. Pyle was charmed with the idea of having "Fairy Roses", as he thought of them, and was sure they would be popular if he could produce them on a commercial scale. This would also permit Mr. de Vink to afford to keep amusing himself by developing more, and better, cultivars.

The miniature rose is a newcomer to the West. Miniature roses were known in England early in the 19th century. It is believed that the plants were a form of *Rosa chinensis* 'Minima'