Effect of Pine Bark Age, Starter Nitrogen, and Activated Charcoal on Growth of Plants in Containers[1]

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Abstract

Activated charcoal and soluble starter nitrogen were added to fresh and aged pine bark prior to use as a container growth medium. All test plants grew equally well in either fresh or aged pine, regardless of activated charcoal or soluble starter nitrogen application.

Index words: composting, phenolic compounds

Introduction

Workers in Australia (10, 11) reported that several species of plants were stunted when grown in a medium containing non-composted bark of *Pinus radiata.* Other researchers have suggested that phenolic compounds in pine bark may inhibit plant growth in media containing pine bark that has been neither aged nor composted (5, 6).

Self (7) reported that aging of pine bark is not necessary; however, he notes the desirability of composting to reduce the C-N ratio and possible nitrogen deficiencies later and remove potentially harmful compounds.

Composting or aging of pine bark to be used as a container medium is a common practice; however, composting is awkward and expensive (9). If starter nitrogen could be added to the mix to compensate for the nitrogen immobilization by microorganisms, considerable time and effort could be saved.

Activated charcoal has been used in many ways to absorb organic compounds, including pheonolics and herbicides (3, 4, 6). With this in mind, both fresh and one-year-old bark from short leaf pine, *Pinus echinata* and loblolly pine, *Pinus taeda* grown in western Arkansas were used to determine if adding activated charcoal would improve the growth of plants (Experiment 1) and if adding starter nitrogen to fresh pine bark would provide growth similar to aged pine bark (Experiment 2).

Materials and Methods

Experiment 1. Fresh pine bark and one-year-old pine bark were used with 0, 0.15, 0.3, 0.45, and 0.6 kg/m^3 (0, 0.25, 0.50, 0.75 and 1.0 lb. N/yd^3) of soluble nitrogen (Urea, 46-0-0) in a mix of bark, peat and sand, (3:1:1 by volume). All treatments received a moderate level of 17-7-12 Osmocote 8.3 kg/m^3 (14 lbs), and 0.9 kg (1.5 lbs) Mircomax micronutrients and 3.6 kg (6 lbs) dolomite per m^3 (yd^3). (Sierra Chemical Company suggests 12 lbs/cu yd as a medium rate and 16 lbs/cu yd as a high rate.) Test plants were river birch, *Betula nigra* and *Pyracantha* X 'Mojave' in 11.4 L (#3) and *Nandina domestica* and Japanese garden juniper, *Juniperus procumbens* in 3.8 L (#1) plastic containers. The nandina were grown under 30% shade and the others in full sun. All plants were watered using overhead sprinklers as required. The study was begun on April 15, 1982 and river birch, pyracantha and nandina evaluated on October 29, 1982, for top and root weight, stem caliper (except pyracantha) and number of branches (pyracantha only). Because no visually detectable differences were observed the junipers were not harvested for top or root weights. The study was conducted as a randomized complete block design with 6 replications/species and 10 treatments in a 2x5 factorial combination.

Experiment 2. Fresh and one-year-old pine bark were combined with 0, 0.3, 0.6, or 1.2 kg/m^3 (0, 0.5, 1 or 2 lbs/yd^3) of activated charcoal (Gro-Safe, ICI Inc., Wilmington, DE) in a bark, sand, peat (3:1:1 by volume) growth medium. All treatments contained 8.3 kg (14 lbs) 17-7-12 Osmocote, 0.9 kg (1.5 lbs) Micromax micronutrients and 3.6 kg (6 lbs) dolomite/m^3 (yd^3). Test plants were *Nandina domestica, Pyracantha* X 'Mojave,' *Juniperus chinensis* 'San Jose,' *Ilex crenata* 'Hetzi' and *Rhododendron* X 'Fashion,' Fashion azalea. The azalea, holly and nandina were grown under 30% shade while the pyracantha and juniper were in full sun. All liners were grown in 5 cm (2 in) containers in a peat:perlite (1:1 by volume) propagation medium amended with 3.6 kg (6 lbs) 18-6-12 Osmocote and 0.6 kg (1 lb) Micromax micronutrients/m^3 (yd^3). The study was begun on April 22, 1982 and was terminated on November 6, 1982. Plants were evaluated as described in Experiment 1. The study was conducted as a randomized block design with 6 replications/species and 8 treatments in a 2 x 4 factorial combination. Because of the uniformity of all treatments on a species only the nandina and Hetzi holly were terminated.

Results and Discussion

Experiment 1. In general, plants of all species grew similarly in old and new pine bark with or without starter nitrogen. This is consistent with the finding of Cobb and Keever (2) who observed equal or better growth with fresh bark as compared to aged bark. River birch and nandina receiving 0.3 kg (1/2 lb) of starter nitrogen had slightly larger top weights, however the

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differences, although significant statistically, were not visually detectable (Table 1). Plants of all species in all treatments were of salable quality after one growing season.

Pine bark used in this study was fresh, with visible wet cambium strips throughout, whereas the aged bark was one year old and contained no white wood or cambium. The 8.3 kg/m³ (14 lbs/yd³) rate of 17-7-12 Osmocote is not excessive, but apparently provided sufficient nitrogen for decomposition as well as plant growth. The liners used in this study were rooted in a 1:1 mix of peat: perlite with Osmocote 18N-2.6P-10K (18-6-12) and Micromax micronutrients added. Previous studies have shown that nutrients added during propagation have a substantial carryover effect on plant growth (1). If liners from a low fertility system had been used, the response to the starter nitrogen may have been greater. Likewise, if a lower level of Osmocote or other fertilizer had been used in the mix, benefit from the starter nitrogen may have been greater. If a starter nitrogen is to be used, 0.3 kg/m³ (1.0 lb/yd³) appears to be the optimum level.

The cost of adding 3.6 kg/m³ (6 lbs/yd³) of 18-6-12 in the propagation medium used in 5 cm (2 in) pots is about $0.01 cent. In addition, if Osmocote 17-7-12 is $1.32 /kg (0.60 cents/lb), the additional 1.2 kg (2 lbs), 7.15 vs. 933 kg (12 vs. 14 lbs) would be more economical than the labor and complication of adding starter nitrogen separately. Likewise the likelihood of fertilizer burn of young liners from Osmocote is very low compared to soluble nitrogen.

Experiment 2. All plants were of similar size and quality at the end of the growing season regardless of charcoal level and aged or fresh pine bark. Activated charcoal had no effect on the growth of nandina or Hetzi holly (Table 2).

If toxins are present in pine bark as suggested by Yazaki and Nichols (11), these test species are apparently tolerant or leaching occurred very quickly. It seems doubtful that normal watering at planting would be sufficient to leach toxic compounds before they could affect the test plants.

Significance to the Nursery Industry

These data suggest that there is no need to compost pine bark or add activated charcoal before use in a container growth medium for woody ornamentals. This means greater flexibility in obtaining, storing and using pine bark in the container nursery. If weak or poor fertilizer liners are used, starter nitrogen may be beneficial.

Table 1. Effects of starter nitrogen on growth of plants in containers.

	Nitrogen Rate, kg/m³ (lb/yd³)					
	0	0.15 (0.25)	0.3 (0.50)	0.45 (0.75)	0.6 (1.0)	
River Birch						
Height (cm)	130	133	134	133	124	NS[y]
Stem Caliper (cm)	1.8	1.9	2.0	2.0	1.9	NS
Top wt (g)	315 a	318 a	331 b	330 b	317 a[z]	
Root wt (g)	213	232	221	256	248	NS
Pyracantha						
Branch no.	62	72	77	65	68	NS
Top wt (g)	256	232	296	265	283	NS
Root wt (g)	129	111	148	132	118	NS
Nandina						
Height (cm)	39	41	47	42	44	NS
Stem caliper (cm)	0.7	0.6	0.8	0.8	0.8	NS
Top wt (g)	91 ab	86 a	104 c	101 bc	96 abc	
Root wt (g)	148	157	159	161	151	NS

[z]Mean in a row followed by the same letter or letters are not significant at the 5% level using Duncan's Multiple Range Test.
[y]Not significant

Table 2. Effects of activated charcoal on growth of plants in containers.

	Activated Charcoal, kg/m³ (lbs/yd³)				
	0	0.3 (0.50)	0.6 (1.0)	1.2 (2.0)	
Nandina					
Height (cm)	44	47	43	44	NS[z]
Top wt (g)	92	89	99	101	NS
Root wt (g)	143	133	151	147	NS
Hetzi Holly					
Branch no.	72	66	68	71	NS
Visual grade	8.0	8.3	8.2	7.9	NS
Top wt (g)	43	41	40	44	NS
Root wt (g)	51	53	54	55	NS

[z]not significant

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Effect of Growth Regulator and Nitrogen on Height and Branching of *Skimmia reevesiana*[1]

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Abstract

Application of gibberellins A_{4+7} (GA_{4+7}) or 6-benzylamino purine (BA) stimulated a second growth flush on plants of *Skimmia reevesiana* Fort. that had completed normal spring growth. Plants treated with GA_{4+7} were up to 130% taller than untreated plants at the end of the first season, and up to 50% taller after a growth flush the following spring without re-treatment. The number of shoots was increased more than 100% by BA at 4000 ppm, without affecting height. Promalin (BA + GA_{4+7}) at 2000 ppm of each active ingredient increased height 50% the year of treatment, and the number of shoots more than 160%. There was not a significant difference in height after the next spring flush. Increasing the amount of nitrogen (N) supplied to the plants increased the number of shoots the second season and decreased plant height. Application of GA_{4+7} tended to counteract these effects of N.

Index words: 6-benzylamino purine, gibberellins

Introduction

Many kinds of plants respond to treatment with gibberellins by increased growth and shoot elongation. Applegate (1) reported up to 150% increase in height of 11 kinds of woody ornamentals sprayed with Gibrel.

More recently McCarthy (6) reported up to 100% longer shoots on dwarf forms of six species of woody landscape plants sprayed with gibberellic acid (GA_3) in a study to determine whether this treatment could be used to hasten production of dwarf forms in the nursery. Increased shoot length usually was accompanied by a reduction in number of shoots.

Plants of *Skimmia* species normally make one vegetative growth flush each season followed by a flowering flush. This makes them slow growing, requiring two or more seasons for the nurseryman to produce a saleable plant. Whalley and Loach (8) found that application of gibberellic acid (GA_3) to plants of *Skimmia japonica* induced an extra flush of vegetative growth in that species.

Increased branching from increased levels of N fertilization has been reported in various plants, including rhododendrons (*Rhododendron* X) (3, 7), tea (*Camellia sinensis*) (5), *Pyracantha coccinea* (4), and Japanese holly (*Ilex crenata*) (2, 4).

Experiments were started in 1979 to determine effects of gibberellins and BA on growth and branching of a self-fertile clone of *Skimmia reevesiana* Fort. Interaction of the response to these growth regulators with effects of nutritional levels were included in 1981.

Materials and Methods

The plants in these experiments were one year old, having made one flush of growth in the spring following the year in which they were rooted directly in 3.8 L (#1)

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