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Evaluation of Kenaf Growth Media as a Substitute for Pine Bark

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Introduction

The bark of kenaf (*Hibiscus cannabinus* L.), a tropical fiber crop, is used to manufacture fiber board, acoustical tile, and newsprint (8). The core of kenaf stems, a byproduct comprising 60-70% of the plant, can be used as animal bedding and an oil absorbent (2). Kenaf core may also become a satisfactory component of growth medium to produce plants in containers.

Complete replacement of vermiculite with kenaf fiber core in sphagnum peat-based media was not conducive to maximum growth of *Begonia x semperflorens, Impatiens Wallerana, Salvia splendens* and *Catharanthus roseus* in 4-inch pots (3).

Ground kenaf stem was successfully substituted for part of traditional medium components with three ornamental plants. Growth of *Brassaia actinophylla, Hibiscus rosasinensis,* and *Pittisporum tobira* in 70-80% kenaf by volume was similar to or greater than growth in two popular commercial mixes (6).

Ilex crenata 'Cherokee' exhibited excellent growth in container plant growth media with fiber core as the organic component. Plant growth in kenaf, especially in composted kenaf, compared favorably with that of plants grown in pine bark, the organic component most commonly used to grow woody landscape plants in containers (4).

The objective of this study was to evaluate the effects of composting kenaf core, kenaf core particle size, and kenaf core:pine bark ration on the growth of *Ilex crenata* 'Compacta' and *Rhododendron* 'Sunglow' to determine the reliability of kenaf fiber core as a growth media component to produce containerized woody landscape plants.

Materials and Methods

Kenaf core, 53.5 cubic meters (70 yd^3) consisting of random-sized particles approximately 1.3-3.2 centimeters (0.5-1.25 inches), were obtained December 17, 1992 and held outdoors under ambient conditions. On January 28, 1993, the kenaf was divided into two portions. One portion was composted with added nitrogen (C +N) and one portion was composted without added nitrogen (C -N). Ammonium nitrate was dissolved in water and applied through a siphon with a 1:12 ratio in three equal applications of 0.8 kg/m^3 (1.3 lb/yd^3)per application on Jan. 29, May 29, and Sept. 29, 1993.

Fresh kenaf core was obtained in two particle sizes in the spring of 1994. Particle sizes were 0.6-1.6 cm (0.25 to 0.63 in) and 0.3-0.6 cm (0.12 to 0.25 in) and are referred to as noncomposted coarse (NC C) and noncomposted fine (NC F), respectively (5). Fresh milled pine bark with 80% of the particles <0.6 cm (<0.25 in) was obtained in February 1993 and composted outdoors under ambient conditions for this study.

Media treatments of four sources of kenaf, C +N, C -N, NC C, and NC F were blended with pine bark and sand in four ratios (v/v/v)-1:3:1, 2:2:1, 3:1:1, and 4:0:1, respectively--in a factorial arrangement. A mixture of 0 kenaf:4 pine bark:sand (v/v/v) served as a control (Table 1).

In separate experiments, liners of *Ilex crenata* 'Compacta' and *Rhododendron* 'Sunglow' in 7.6-cm (3-in) diameter pots were planted in 2.8-liter (3-quart) containers on April 13, 1994. The containers were filled to the rim with growth media.

In preparation for use, kenaf NC C and NC F particle sizes were moistened for 3 days prior to blending. All growth media blends were amended with 0.6 kg (1 lb) of 0-20-0, 0.6 kg (1 lb) of Micromax, and 1.8 kg (3 lb) of dolomitic limestone/m^3. Controlled-release Osmocote 17-7-12 was incorporated in the growth media blends at rates of 7.2 kg (12 lb/yd^3) for *Ilex crenata* 'Compacta' and 4.8 kg (8 lb/yd^3) for *Rhododendron* 'Sunglow.'

Plant height and width, shoot fresh weight, and root ratings were taken at termination on February 21, 1995 for 'Compacta' and on February 22, 1995 for 'Sunglow.' Plant height was measured from the rim of the container. Plant height was measured in two directions perpendicular to each other and averaged. Shoots were severed at the surface of the growth medium to obtain fresh weight.

Visual root ratings ranged from 10 (excellent) to 0 (very poor). Growth media depth, the degree of growth medium sinkage caused by settling and decomposition, was obtained by measuring from the top rim of the container to the media surface in two places opposite one another and averaged.

Growth medium leachate pH and electrical conductivity were taken on May 19, July 11, and Nov. 17, 1994, and on Jan. 18, 1995 from four replications using the Virginia Tech Extraction Method (7).

Data were analyzed using an analysis of variance for an augmented factorial arrangement of treatments in a Randomize Complete Block Design. Means were separated using Fisher's protected least significant difference. Calculations were performed using Statistical Analysis System (SAS).

Results and Discussion

Shoot height of *Ilex crenata* 'Compacta' was similar regardless of media treatment (Table 1). Shoot width and fresh weight of 'Compacta' were similar in kenaf media of C +N and C -N. Plants in these media were greater in shoot width and fresh weight than those in kenaf media NC C and NC F. Fine and coarse noncomposted media were also similar in shoot width and fresh weight. Although slight differences were obtained as an interaction, root ratings of 'Compacta' were excellent for all treatments. Shoot width and fresh weight were similar regardless of ratio of kenaf in the media.

Composting was beneficial with 'Compacta' resulting in greater width, fresh weight, and root ratings. In addition, composted kenaf at 20% or more in the media resulted in higher shoot fresh weight compared to the control.

Shoot height of 'Sunglow' was similar for plants grown in composted kenaf media. These plants were taller than those grown in noncomposted kenaf media (Table 2). Shoot width and fresh weight of 'Sunglow' decreased slightly with C -N media compared to C +N. Least shoot height, width, and fresh weight were measured on plants grown in media containing NC C or NC F materials compared to composted materials. Shoot height, width, and fresh weight were similar for plants grown in kenaf media with coarse and fine particle sizes.

Root ratings of 'Sunglow' were lower when grown in NC C kenaf media and in media of 80% kenaf. A linear decrease in shoot height and a quadratic decrease in shoot width and fresh weight were observed on 'Sunglow' as the percent kenaf in the media increased. Use of composted kenaf media resulted in greater height, width, and fresh weight of 'Sunglow' shoots compared to noncomposted kenaf media. Shoot height, width, and fresh weight of 'Sunglow' grown in composted kenaf were similar to the control with the exception that an increase in fresh weight was obtained with plants grown in C + N. Kenaf NC C and NC F particle sizes resulted in substantially lower shoot height, width, and fresh weight of 'Sunglow' compared to the control.

Media containing 80% kenaf vs the control resulted in a decrease in plant height, width, fresh weight, and root ratings of 'Sunglow.' Plant height was also less in media containing 20, 40, or 60% kenaf and plant width was also less in 60% kenaf.

A kenaf source x ratio interaction was obtained with depth of media in which 'Compacta' were grown. The media depth of 60% kenaf NC F increased to levels obtained with 80% kenaf (Table 1). An interaction was also obtained with 'Sunglow,' where the depth of media containing 80% NC C kenaf was not as great as that obtained with the three remaining media (Table 2). Except for 'Compacta' grown with 20% kenaf, the depth of all media with both cultivars, regardless of percentage of kenaf, was greater than the control (Table 1 and Table 2). Growth medium depth increased linearly and quadratically for both cultivars as the percentage of kenaf in the media increased and was substantial with media containing 60 and 80% kenaf.

Significant differences in the electrical conductivity of media treatments were measured (data not shown). However, the electrical conductivity of all media treatments was low and ranged from 0.3 mmhos/cm to 0.1 mmhos/cm in May and 0.2 mmhos/cm to 0.1 mmhos/cm in July. Thereafter, electrical conductivity of leachates was less than 0.10 mmhos/cm for all media treatments.

The pH of growth media leachates with a 2:2:1 ratio containing 40% kenaf was slightly lower with the C -N media than with the NC C and NC F media in May (Table 3). In May, the pH of media leachates with a 4:0:1 ratio containing 80% kenaf was lower with the C +N media compared to C -N, NC C, and NC F media (Table 3). Composting kenaf tended to reduce leachate pH in May. Thereafter, media leachate pH among treatments in July and November 1994 and in January 1995 were similar, ranging from 4.8 to 5.5, an acceptable range for container grown plants of *Ilex* and *Rhododendron* (7).

Variation was observed in the physical properties, pH, and electrical conductivity of the media components used in this study (Table 4). Kenaf components were lighter than pine bark. Pore space and air space were greater with kenaf NC C compared to pine bark, and kenaf C +N, C -N, and NC F. Water holding capacity for pine bark and kenaf NC C were similar and less than kenaf C +N, C -N, and NC F.

Composting kenaf without N resulted in the highest pH, whereas composting with N lowered pH. The addition of nitrogen during composting substantially raised electrical conductivity (Table 4).

Acceptable growth with kenaf media varied with the source of kenaf and cultivar. In media composed of at least 60% kenaf, growth of 'Compacta' holly and 'Sunglow' azalea in composted kenaf was equal to or greater than in pine bark. And in noncomposted kenaf, growth was equal to pine bark with 'Compacta' holly and poor with 'Sunglow' azalea.

Shrinkage of kenaf by settling and decomposition during composting was substantial. The height of the piles at the beginning of composting was approximately 1.7 m (5.7 ft) and only 0.8 m (2.5 ft) 16 months later when this study was initiated. At termination of this study in February 1995, 10 months later, substantial shrinkage of growth media in containers with large amounts of noncomposted and composted kenaf was also observed. In containers 15.2 cm (6 in) high, media shrinkage, as indicated by the distance from the container rim to the media surface, was only 1.3 cm (0.5 in) with pine bark and up to 5.1 cm (2.0 in) with media containing kenaf.

Shrinkage of poor stability of growth media components is undesirable in that growth can be restricted and the consumer receives a less desirable plant because of a smaller root ball. Also, the addition of more media before marketing is an additional expense and may be harmful to the plant (1).

The use of kenaf as a component of growth media to produce container-plant crops that require at least one growing season appears to be limited because the poor stability of this material.

Literature Cited

1. Dickey, R.D., E.W. EcElwee, C.A. Conover, and J.N. Joiner, 1978. Container growing of woody ornamental nursery plants in Florida. Ag Exp. Sta., University of Florida. p. 24.

2. Fuller, M.J. and J.C. Doler. 1993. An economic analysis of kenaf separation, Proc. 1993 Int. Kenaf Conf., pp. 97-101.

3. Howell, J., S. Dueitt, S.E. Newman. 1993. Kenaf fiber core as a vermiculite substitute in peat-based media for growing greenhouse bedding plants. Proc. SNA Res. Conf. 38th Annual Report pp. 59-62.

4. Laiche, A.J., and S.E. Newman. 1994. Kenaf fiber core as a component of growth media for containerized woody landscape plants. MAFES Res. Rept. 19(8) 4p.

5. Personal Communication, 1993. John Black, MCES, Dept. of Ag. Econ., Mississippi State University.

6. Wang, Y.T. 1994. Using ground kenaf stem core as a major component of container media. J. Amer. Soc. Hort. Sci. 119(5):931-935.

7. Wright, R.D. 1987. The Virginia Tech liquid fertilizer system for container grown plants. Virginia Tech College of Ag. & Life Sciences. Info. Series 86-5, 22p.

8. Zhang, Jun, R.A. Jobes, and M.R. Dicks. 1993. Commercial kenaf production. Where are the markets? Proc. 1993 Int. Kenaf Conf., pp. 145-149.