Effect of Nitrogen on Blueberry and Juniper Grown in a Fish Waste Compost:Fir Bark Medium

Rita L. Hummel, Shiou Kuo, Diane W. Privett, and E.J. Jellum
Washington State University Puyallup Research and Extension Center, 7612 Pioneer Way, Puyallup, Washington 98371

***Juniperus horizontalis* 'Bar Harbor' and *Vaccinium corymbosum* 'Bluecrop' rooted liners were transplanted from 2-1/4-in.to 1-gallon containers in a 1 ground bottomfish waste hemlock/fir sawdust compost : 3 Douglas-fir bark (v/v) growing medium. Nitrogen was applied as a liquid once every 2 weeks at the following concentrations: 0, 150, 300, 450, and 600 ppm, N as NH_4NO_3. Results indicated that the addition of 450 ppm N once every 2 weeks was sufficient to produce the best overall growth and quality of blueberry and juniper plants.**

INTRODUCTION

In a single Washington coastal county, Pacific County, more than 30 million pounds of seafood waste was generated during a 3-year period (Bonacker et al., 1989). Environmental regulations have restricted the options for disposal of these wastes and necessitated a search for alternatives to traditional disposal methods. Recycling the seafood waste by composting is a viable means of disposal and produces a value-added, marketable product for the seafood processing industry.

Studies have shown that high-quality composts can be produced using seafood wastes (Frederick et al., 1992; Jellum and Kuo, 1992; Johnson et al., 1992; Mathur et al., 1988;). Jellum and Kuo (1992) composted ground bottomfish waste and shrimpshell sludge with red alder or a mixture of western hemlock and Douglas-fir sawdusts to produce four composts. They compared their composts to commercially available sewage sludge and cow manure composts for the production of greenhouse-grown corn and an orchardgrass/perennial ryegrass mixture. With the exception of the red alder-shrimpshell sludge compost, they found the fishwaste composts to be equal or superior in promoting dry matter production.

The ground bottomfish waste with hemlock/fir sawdust compost had a C to N ratio of 27, and a total N content of 1.3% of which 30% was inorganic (Jellum and Kuo, 1992). This compost was selected for additional tests of its potential as a growing medium and N source for the production of container-grown nursery stock. The objective of the present research was to determine the growth and quality response of blueberry and juniper plants to a Douglas-fir bark container medium amended with the ground bottomfish waste hemlock/fir sawdust compost and fertilized at five different nitrogen rates.

MATERIALS AND METHODS

In early June 1992 2-1/4-in. (5.7 cm) rooted liners of *Juniperus horizontalis* 'Bar Harbor' and *Vaccinium corymbosum* 'Bluecrop' were obtained from Briggs Nursery (Olympia, WA) and transplanted into 1-gal (3.8 liter) containers filled with a 1 ground bottomfish waste hemlock/fir sawdust compost : 3 Douglas-fir bark (v/v) growing medium. The pH values of the fir bark (B) and bottomfish waste hemlock/fir sawdust compost (FWC) were initially 4.3 and 7.8, respectively. Before the components of the growing medium were mixed, the pH of the FWC was adjusted to reflect the pH of B by adding 30 ml of one normal H_2SO_4 per pound of FWC. The medium for both species was amended with Micromax micronutrient mix at the rate of 1.75 lb/yd^3 (1038 g/m^3). The juniper medium had an additional amendment of 8 lb/yd^3 dolomite.

Nitrogen fertilizer solutions were applied to the containers every 14 days at concentrations of 0, 150, 300, 450, and 600 ppm N as NH_4NO_3, which corresponded to 0, 80, 160, 240, and 320 mg N/container, respectively. A single phosphorus and potassium solution was applied to all containers concomitant with the N application.

There were eight replications of each nitrogen treatment. Plants were arranged in a randomized complete block design on an outdoor gravel nursery bed. Overhead sprinkler irrigation was applied as needed (usually daily) at a rate of about 1/2 in. (1.3 cm).

At the end of the growing season, in late October 1992 the performance of the plants was evaluated by measuring shoot height, width, and fresh and dry weights. From the height and width data, a shoot growth index (SGI) was calculated [SGI=(height +width)/2]. Plants were grouped by species according to their quality, a rating of their potential marketability to consumers. The groups were then assigned numbers from 1 (indicating dead) to 5 (indicating well-branched, deep-green, and of superior quality). On this scale, a plant had to have a rating of 3 to be considered marketable. A separate analysis of variance was performed for each species and the orthogonal polynomial trend comparisons procedure (Gómez and Gómez, 1984) was used to evaluate the effect of nitrogen rate on plant growth and quality.

RESULTS AND DISCUSSION

Results of this experiment indicated N rate had significant linear and quadratic effects on shoot dry weight, SGI, and quality of blueberry and juniper grown in a 1 FWC : 3 B (v/v) medium (Tables 1 and 2). Shoot fresh weight data is not presented because of similarity to dry weight measurements. Shoot dry weight and SGI of both species increased with increasing nitrogen up to 450 ppm N. When 600 ppm N was applied dry weight and SGI of blueberry and juniper decreased slightly. Blueberry quality increased with increasing N fertility while juniper quality was not influenced by increased N fertility above the 300 ppm N rate (Tables 1 and 2).

Blueberry and juniper plants in the 0 ppm N treatment grew very little and were not of marketable quality (Tables 1 and 2). Although the FWC had a total N content of about 1.3% of which 30% was inorganic (Jellum and Kuo, 1992), analysis of leachate collected from plantless containers by the pour-through method (Wright, 1987; Yeager et al., 1983) indicated that this nitrogen fraction was rapidly leached from the medium by the frequent application of overhead sprinkler irrigation water (data unpublished). In this experiment, when no additional N was added, the 1 FWC : 3 B medium did not produce blueberry or juniper plants of acceptable quality to the consumer.

Table 1. Effect of nitrogen rate on shoot dry weight, shoot growth index (SGI) and quality of *Vaccinium corymbosum* 'Blue Crop' grown in 1 fish-waste compost : 3 fir bark (v/v) medium.

Nitrogen rate	Dry weight (g)	SGI[1]	Quality[2]
0 ppm	4.21	28.1	2.0
150 ppm	26.53	46.6	3.4
300 ppm	36.61	57.2	3.9
450 ppm	43.52	59.2	4.4
600 ppm	41.20	58.1	4.6
Significance[3]			
Linear	***	***	**
Quadratic	***	***	***

[1] SGI = (height + width)/2.
[2] Quality was rated on a 1 (dead plant) to 5 (superior plant) scale.
[3] NS, *, **, *** = nonsignificant and significant at $P \leq 0.05$, 0.01, or 0.001 level, respectively.

Table 2. Effect of nitrogen rate on shoot dry weight, shoot growth index (SGI) and quality of *Juniperus horizontalis* 'Bar Harbor' grown in 1 fish-waste compost : 3 fir bark (v/v) medium.

Nitrogen rate	Dry weight (g)	SGI[1]	Quality[2]
0 ppm	5.51	18.7	2.0
150 ppm	13.26	33.2	3.1
300 ppm	17.76	32.1	3.5
450 ppm	18.77	33.9	3.5
600 ppm	17.22	30.0	3.5
Significance[3]			
Linear	***	***	***
Quadratic	***	***	***

[1] SGI = (height + width)/2.
[2] Quality was rated on a 1 (dead plant) to 5 (superior plant) scale.
[3] NS, *, **, *** = nonsignificant and significant at $P \leq 0.05$, 0.01, or 0.001 level, respectively.

The 1 FWC : 3 B (v/v) medium used in this experiment was a satisfactory growing medium for the production of container-grown blueberry and juniper plants. Although the nitrogen present in the fishwaste compost alone did not produce marketable plants, adding a 450 ppm N solution to the medium once every 2 weeks was, in general, sufficient to produce the best growth and quality of blueberry and juniper plants.

LITERATURE CITED

Bonacker, L.A., J. June, and **A.D. O'Rourke.** 1989. Adding value to seafood products and processing wastes: Insights and recommendations for Pacific County, Washington. n.p.:Pacific County Economic Development Council.

Frederick, L., A.H. Miller, R. Harris, M. Milner, S. Kehrmeyer, and **L. Peterson.** 1992. Preparation and use of compost from fisheries by-products. Proc. 1991 Fisheries By-Products Composting Conference. University of Wisconsin Sea Grant Institute Technical Report No. WISCU-W-91-001. pp. 13-20.

Gómez, K.A. and **A.A. Gómez.** 1984. Statistical Procedures for Agricultural Research. 2nd ed. John Wiley & Sons, New York.

Jellum, E.J. and **S. Kuo.** 1992. Production and testing of composts containing fisheries by-products and sawdust. Proc. 1991 Fisheries By-Products Composting Conference. University of Wisconsin Sea Grant Institute Technical Report No. WISCU-W-91-001, pp. 147-161.

Johnson, K.W., T.J. Malterer, and **T.E. Levar.** 1992. The evaluation of peat-based fisheries by-products composts for use as horticultural container substrates. Proc. 1991 Fisheries By-Products Composting Conference. University of Wisconsin Sea Grant Institute Technical Report No. WISCU-W-91-001, pp. 87-104.

Mathur, S.P., J.P. Daigle, J.L. Brooks, M. Levesque, and **A. Arsenault.** 1988. Composting seafood wastes. BioCycle. 29:44-49.

Wright, R.D. 1987. The Virginia Tech liquid fertilizer system for container-grown plants. VPI&SU College of Agriculture and Life Sciences Information Series 86-5, 20 pp.

Yeager, T.H., R.D. Wright, and **S.S. Donohue.** 1983. Comparisons of pour-through and saturated pine bark extract N, P, K, and pH levels. J. Amer. Soc. Hort. Sci. 108:112-114.