DICKEY: FERTILIZING BUXUS MACROPHYLLA JAPONICA

EFFECT OF TWO FERTILIZATION INTERVALS, AND FOUR NITROGEN LEVELS ON GROWTH AND CHEMICAL COMPOSITION OF BUXUS MACROPHYLLA JAPONICA REHD. & WILS.

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Abstract. A 2x4 factorial experiment was conducted to test effects of 2 fertilization intervals (FI)—twice monthly and monthly, and 4 N levels (NL)—500, 1000, 1500, 2000 lb./A/yr., on growth and chemical composition of Japanese box grown in 6-inch green plastic containers. Plant growth, as measured by visual grade and number of bud breaks, responded quadratically to NL. Quality and number of bud breaks increased as NL increased from 500 to 1000 lb./A/yr., but with no further response as NL were increased above this level. Response to NL was the same at both FI. Plants fertilized twice monthly were of higher quality, and with more bud breaks than those fertilized monthly.

Foliage N increased linearly as NL increased, but was not affected by FI. Foliage K decreased linearly as NL increased, and plants fertilized monthly had more foliage K than those fertilized twice monthly. There was a linear decrease in foliage Ca as NL increased, but FI did not effect foliage Ca. FI and NL had no effect on foliage content of P and Mg.

Cost of fertilization as affected by amount of fertilizer applied, especially N, and interval of application, are important factors affecting production costs of container grown woody ornamental plants. Previous research indicates importance of fertilization intervals (2, 6, 7, 8, 9, 10, 14), and N levels (1, 3, 4, 5, 7, 9, 10, 11, 12, 13) on growth, quality, and flowering of some container grown woody ornamental plants in Florida. This experiment was initiated to give further information on effects of these factors on growth and chemical composition of Buxus macrophylla japonica Rehd. & Wils., Japanese box.

Materials and Methods

This experiment, initiated November 3, 1971 and terminated October 31, 1972, tested effects of 2 fertilization intervals (FI), and 4 N levels (NL) in factorial combination on growth and chemical composition of Japanese box. The experiment was set up in randomized complete block design with 7 replications, and an experimental unit of 1 plant.

Uniform, single-stemmed cuttings of Japanese box were potted, 1 plant to a can, in 6-inch (160 in³) green plastic containers in a 1:1 by volume mixture of Canadian sphagnum peat and coarse builders sand, and placed under 50% saran shade. Superphosphate at rate of 5 lb./yd.³, dolomite at rate of 8 lb./yd.³, and “Perk” at rate of 4 lb./yd.³ had previously been incorporated into the medium.

The variables were: NL—500, 1000, 1500, and 2000 lb./A/yr.; and FI—twice monthly and monthly. Fertilizer was applied in solution to the soil surface and differential treatments begun January 15, 1972. N was supplied from NH₄NO₃, and K (not a variable) from KC1 was applied monthly to all plants at rate of 1000 lb./A/yr. of K.

Treatment effects were expressed as visual grade, and number of bud breaks (total number of branches per plant) from the single-stemmed cuttings. Visual grades ranged from 1 to 4 in which 1 indicated poor, 2 fair, 3 good, and 4 very good quality plants. Recently matured leaves near shoot terminals were taken October 31, 1972, and chemically analysed for N, P, K, Ca, and Mg by procedures previously outlined (11).

Data were analysed by the analysis of variance method. Treatment comparisons for growth measurements, and chemical composition were made by orthogonal single degree of freedom.

Results and Discussion

Growth Measurements

Visual grade and number of bud breaks. Results from these growth measurements were similar so they are considered together (Table 1). Plants fertilized twice monthly were of higher quality, and had more bud breaks than those fertilized monthly. There were significant linear and
quadratic responses to NL, since quality and number of bud breaks increased as NL increased from 500 to 1000 lb./A/yr., but with no further increases with the higher rates. The non significant FI x NL interaction, and its single degree of freedom components \((\text{FI}_L \times \text{NI}_L), \text{FI}_L \times \text{NL}_Q, \text{FI}_L \times \text{NL}_C\) indicate that response to NL was the same at both FI.

Discussion. Poole and Dickey (14), and Dickey et al (8) worked with container grown Rhododendron indicum 'Formosa' ('Formosa' azalea) and Viburnum suspensum (viburnum) found no difference between viburnum plants fertilized at 2 and 8 week intervals. However, 'Formosa' azalea plants fertilized every 2 weeks were larger than those fertilized every 8 weeks at the medium and high NL, but this difference could not be detected visually. In another experiment Dickey et al (9) grew 'Formosa' azalea and viburnum in containers and found no difference in growth and quality between plants fertilized every 2 and 4 weeks. They (10) found no difference in size and quality of container grown 'Formosa' azalea between FI of 1, 4, and 8 weeks. Dickey and Poole (7) and Dickey (2) found no difference in size and quality of 'Formosa' azalea and Pittosporum tobira, between plants fertilized with \(\text{NH}_4\text{NO}_3\) and KCl monthly or bimonthly, and plants given split applications (April 5 and July 1) of urea-formaldehyde and coated N were larger and of better quality than those receiving these materials all at start of experiment.

A linear response to increasing NL with rates, in some experiments, up to 900 lb./A/yr. was reported by Poole and Dickey (14), Dickey and several coworkers (5, 6, 8, 11) for container grown 'Formosa' azalea and viburnum. Dickey (3, 4) also found that container grown Ilex opaca cv 'East Palatka' ('East Palatka' holly) responded linearly to NL increments up to 1200 lb./A/yr. Joiner et al (13), and Joiner and Dickey (12) reported increased growth and flowering of container grown Bougainvillea glabra 'Sander' from NL up to 600 lb./A/yr. Conover and Joiner (1) found that Lantana spp. 'Cream Carpet' responded linearly as NL were increased from 250, to 750, to 1250 lb./A/yr., but Ligustrum japonicum responded quadratically as there was no further increase in size and quality when NL were increased from 750 to 1250 lb./A/yr.

Data from previous experiments (1, 8, 14), and results with Japanese box show that all species used in these experiments did not respond alike to FI and NL treatments, which suggests that a similar occurrence can be expected with other container grown woody ornamentals.

**Chemical Composition**

Chemical composition data showing simple af-

### Table 1. Effect of N level, and fertilization interval on visual grade, and number of bud breaks of Japanese box.

<table>
<thead>
<tr>
<th>N level lb./A/yr</th>
<th>Visual grade</th>
<th>Bud breaks</th>
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<tbody>
<tr>
<td></td>
<td>Fert. Interval</td>
<td>NL</td>
</tr>
<tr>
<td></td>
<td>Twice mo.</td>
<td>Monthly</td>
</tr>
<tr>
<td>500</td>
<td>2.1</td>
<td>1.6</td>
</tr>
<tr>
<td>1000</td>
<td>3.4</td>
<td>2.9</td>
</tr>
<tr>
<td>1500</td>
<td>3.6</td>
<td>2.6</td>
</tr>
<tr>
<td>2000</td>
<td>2.9</td>
<td>2.4</td>
</tr>
<tr>
<td>FI means</td>
<td>3.0</td>
<td>2.4</td>
</tr>
</tbody>
</table>

**Significant effects**

<table>
<thead>
<tr>
<th>Fert. Interval</th>
<th>Visual grade</th>
<th>Bud breaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twice mo. vs monthly</td>
<td><strong>Z</strong></td>
<td>*z</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>N level</th>
<th>Visual grade</th>
<th>Bud breaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Quadratic</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Cubic</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

**x**Visual grade: No. 1 - poor; No. 2 - fair; No. 3 - good; No. 4 - very good quality plants.

**y**Average number of bud breaks per plant.

**z**Difference significant at: *5% level; **1% level; NS - non significant.
Effects of FI and NL on percent dry weight of N, P, K, Ca, and Mg in Japanese box foliage are given in Table 2. Generally, the foliage of Japanese box was considerably higher in N, P, K and Ca, but not Mg, than was found in foliage of 'Formosa' azalea, viburnum, and 'East Palatka' holly in previous experiments (3, 5, 6, 7, 8, 9, 10, 11).

Nitrogen. Foliage N increased linearly as NL increased, but this increase was not reflected in increased quality and bud break above the 1000 lb./A/yr. rate. FI did not affect foliage N. N content of Japanese box foliage at the 500 and 1000 lb./A/yr. rates was considerably higher than in foliage of 'Formosa' azalea and viburnum receiving 900 lb./A/yr. of N (5, 6, 7), and of 'East Palatka' holly given 1200 lb./A/yr. of N (10) in previous experiments. This suggests that under similar growing conditions (container grown) species differ in their ability to absorb and utilize N.

Potassium. Foliage K decreased linearly as NL increased, and plants fertilized monthly had more foliage K than those fertilized twice monthly.

Calcium. Foliage Ca decreased linearly as NL increased, but the differences though significant, were small and probably of no biological importance. FI had no effect on foliage K.

Phosphorus and magnesium. FI and NL had no effect on the foliage content of these elements.

## Literature Cited