STAND TREATMENT AND SAMPLING TIME OF HARDWOOD FOLIAGE

II. MICRO-ELEMENT ANALYSIS*

by R. LEA, W. C. TIERSON, D. H. BICKELHAUPT and A. L. LEAF**

KEY WORDS

Acer saccharum  Betula alleghaniensis  Foliar analysis  Micro elements

ABSTRACT

A 70-year-old thinned northeastern Fagus-Betula-Acer stand in the Adirondack Mountains of New York was fertilized with varying combinations of N, P, K and lime. *Acer saccharum* Marsh. and *Betula alleghaniensis* Brit. foliage was collected periodically during the frost-free season and analyzed for foliage areas and weights, and levels of ash, Mn, Na, Fe, Zn, Al, Cu and Cd. Comparisons were made within species, and among treatments, expressed as concentration on dry weight and ash bases, and as contents on per leaf weight and area bases. Elemental composition trends over time were examined to determine treatment effects and optimum sampling period.

INTRODUCTION

In a previous paper* results of seasonal macro-elemental trends as affected by fertilizer application were presented for two north-eastern hardwood species. The present paper reports the micro-elemental trends of the same samples of *Acer saccharum* Marsh. and *Betula alleghaniensis* Brit. foliage as affected by fertilizer treatments. As in the previous study, comparisons were made within species, and among treatments, expressed as concentrations on dry weight and ash bases, and as contents on per leaf weight and area bases, to verify the affect of elemental expression on foliar diagnosis.

MATERIALS AND METHODS

As described in a previous paper*, a total of ten plots with an N, P, K application of 440 kg of N/ha as ammonium nitrate, 220 kg of P/ha as triple superphosphate and 220 kg of K/ha as potassium sulfate,

* Contribution of State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.
** The authors are Graduate Research Assistant, Director of Huntington Forest, Technical Research Assistant, and Professor of Forest Soil Science, respectively.
limed (9.0 metric tons/ha) and unlimed in duplicate, along with limed-only and unlimed controls in triplicate were selected for sampling *Acer saccharum* and *Betula alleghaniensis* foliage from a fertilized Fagus-Betula-Acer stand in the Adirondack Mountains of New York.

Foliage was sampled from the middle-third of the crown eight times spanning the growing season, and analyzed for leaf surface area, leaf weight (dried to constant weight at 65°C), Mn, Na, Fe, Al, Zn, Cu, and Co. The sampling dates were June 23, July 20, August 4 and 18, September 1, 14, and 25, and October 7, 1976. Whenever handling foliar material, plastic gloves were employed.

Leaf areas were determined by an electronic image analyzer for the June 23 through September 14 sampling dates, and the micro-elements were analyzed spectrophotometrically from ground samples, dry-ashed at 480°C for 24 hours and taken up in weak HCl solution with an atomic absorption spectrophotometer with the appropriate hollow cathode lamps.

The foliar data were summarized by computerized analysis of variance. Tukey's w test was employed for ranking treatment means at the 0.05 level of significance. Usually foliage of six individual trees, for each species, was used for determination of the means of each fertilizer treatment.

Table 1. Temporal variation of *Acer saccharum* foliage from the mid-crown position of 70-year-old trees, expressed as means and standard deviations, when no significant differences are attributed to the four treatments*

<table>
<thead>
<tr>
<th>Collection dates, 1976</th>
<th>Manganese</th>
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<tbody>
<tr>
<td></td>
<td>% dry weight</td>
<td>% ash</td>
<td>mg/leaf</td>
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<tr>
<td></td>
<td>x ± sd</td>
<td>x ± sd</td>
<td>x ± sd</td>
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<tr>
<td>June 23</td>
<td>0.082 ± 0.042</td>
<td>2.03 ± 1.00</td>
<td>0.27 ± 0.15</td>
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<tr>
<td>July 20</td>
<td>0.091 ± 0.041</td>
<td>1.78 ± 0.64</td>
<td>0.36 ± 0.25</td>
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<tr>
<td>Aug 4</td>
<td>0.119 ± 0.075</td>
<td>1.93 ± 0.95</td>
<td>0.55 ± 0.44</td>
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<tr>
<td>Aug 18</td>
<td>0.123 ± 0.062</td>
<td>1.91 ± 0.76</td>
<td>*</td>
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<tr>
<td>Sept 1</td>
<td>0.125 ± 0.069</td>
<td>1.87 ± 0.85</td>
<td>0.59 ± 0.40</td>
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<tr>
<td>Sept 14</td>
<td>0.131 ± 0.068</td>
<td>1.88 ± 0.74</td>
<td>0.53 ± 0.32</td>
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<tr>
<td>Sept 25</td>
<td>0.147 ± 0.143</td>
<td>2.11 ± 2.07</td>
<td>0.59 ± 0.56</td>
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<tr>
<td>Oct 7</td>
<td>0.213 ± 0.129</td>
<td>2.36 ± 1.05</td>
<td>0.84 ± 0.69</td>
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<thead>
<tr>
<th>Sodium</th>
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<td>ppm dry weight</td>
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<td>x ± sd</td>
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<tr>
<td>June 23</td>
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