NUTRIENT CONTENT OF THROUGHFALL AND STEMFLOW IN FERTILIZED AND IRRIGATED PINUS RESINOSA AIT. STANDS*

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SUMMARY

The P, K, Ca, and Mg contents of throughfall and stemflow from K-fertilized and/or irrigated plots from adjacent sites differing in productivity in 39-year-old Pinus resinosa plantations were determined. The amounts of these elements leached from the tree canopies (throughfall plus stemflow) during April through October varied significantly according to site and treatment. These amounts ranged in kg per ha from -0.03 to 0.23 for P, 2.05 to 8.78 for K, 1.55 to 3.63 for Ca, and 0.02 to 0.44 for Mg. Leaching of P, K, and Ca from the trees was usually greater on the more productive site than on the poorer one. In general, the fertilization treatment was correlated with increasing amounts of P, K, and Ca leached, whereas the irrigation treatment was correlated with decreasing amounts of P, K, and Ca leached. For Mg, leaching was consistently greater on the poorer site than on the more productive one; further, it was greatest on the control plots and least on plots both fertilized and irrigated.

Gross precipitation of 61.26 cm contained P, K, Ca, and Mg in amounts of 0.33, 0.84, 2.96, and 0.83 kg per ha, respectively. Volumes of both throughfall and stemflow were significantly affected by site conditions. Although throughfall was not affected by treatment, stemflow varied significantly according to plot treatment and was also highly and positively correlated with tree diameter. Stemflow accounted for about 2 per cent of the total water volume collected beneath the canopies, and contained, on a relative basis, considerably less P, an equivalent amount of K, twice as much Mg, and four times as much Ca as throughfall.

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INTRODUCTION

It has long been recognized that nutrient elements can be leached from intact plant leaves. Because of the implications of this leaching in the cycling of nutrient elements in forest stands, foliar leaching has attracted considerable attention. Several reviews on this phenomenon have been presented in recent years. Studies of foliar leaching in forest stands have been carried out for a variety of species and forest types. These studies, however, were mainly concerned with characterizing the nutrient flow from plant to soil through this pathway in single, undisturbed forest ecosystems. It is known that the quantitative and qualitative aspects of foliar leaching are influenced by both environmental and physiological factors, and, these are subject to cultural manipulation. This paper reports on the variations in P, K, Ca, and Mg leached from red pine plantations as a result of differences in site conditions and differences created by fertilization and/or irrigation treatments.

MATERIALS AND METHODS

The nutrient composition of gross precipitation and of throughfall and stem-flow from 39-year-old, 2 × 2 m spaced plantations of Pinus resinosa on sites known to be deficient in K were compared. The plantations are growing on a deep, level outwash of sandy soil (Hinckley series) on the Charles Lathrop Pack Forest in the Upper Hudson River Valley of the southeastern Adirondack Mountain region of New York State. The experimental site and equipment, part of the long-term K fertilization trials at Pack Forest, have been previously described in detail. The more productive and less productive areas, hereafter referred to as 'good' and 'poor', are on opposite sides of an old fence line. The fertilization and/or irrigation treatments were applied to 0.08-ha plots on both the good and poor sites, and measurements were made on two 0.02-ha subplots within each treatment plot as schematically shown in Fig. 1. The plot treatments consisted of: 1) irrigation with 5 cm of water twice a month from June 1 through September 1, a total of 35 cm per annum, in each of the 2 years before initiation of this study and continuing during the season of this study, 2) a single application of 448 kg per ha of elemental K as KC1, applied broadcast in the spring, 2 years before this study was initiated, 3) a combination of irrigation and fertilization, and 4) no treatment (controls).