DEPARTMENT OF FORESTRY CANADA

Timber Talks

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WHY DO FERTILIZERS INCREASE TREE GROWTH? No. 35

Soil applications of nitrogeneous fertilizers accelerate the growth rate of trees, but the response is variable. This is attributed to several factors, either singly or in combination, influencing the physiological processes within the tree. An understanding of the effect of added nutrients on these processes would aid in the selection of stands where treatment would be most rewarding. The accelerated growth of 20-year-old Douglas-fir due to fertilization was investigated to determine if the response could be attributed to increased leaf size and improved photosynthetic efficiency of leaves.

Branch- and leaf-growth measurements were made on main branches of fertilized and untreated trees. Leaf areas were calculated from measurements of leaf length and width. Photosynthesis was measured for different aged shoots at various light intensities at air temperature of 20°C and respiration from the rate of CO_2 evolution in the dark. Water stress of the trees was determined with a pressure bomb and chlorophyll concentration in an acetone extraction. Radial growth was measured from increment cores at breast height and basal area increments computed.

Growth increased considerably after fertilization and by the fourth growing season after treatment the basal area increment of the fertilized trees exceeded that of the untreated trees by 80 percent, height growth was 50 percent greater but specific gravity of the wood was 12 percent less. On the treated trees the surface area of individual leaves was 20 percent larger, more shoots developed and number of leaves per shoot increased by about 50 percent. Rates of photosynthesis and respiration were similar on fertilized and unfertilized trees, and decreased with increase in leaf age; rate of respiration was fairly constant for different age shoots on untreated trees, but on those that were fertilized it was highest in the young shoots. In the year of fertilization, total nitrogen content of the current year's foliage of treated trees was 2 to 3 times in excess of that in control trees and the chlorophyll content 40 percent greater.

Increased growth was related to increase in amount of foliage, but other factors may be important. In the year of fertilization, basal area increment increased by 65 percent and height growth by 30 percent, but in that year leaf surface area per current shoot increased by only 20 percent and the number of shoots developed in excess of the normal was minor. Although the photosynthetic efficiency of leaves was similar for treated and control trees at the time of the study (August-September), this property should be investigated at other times of the year. The possibility of a more favourable water status of the leaves from increased root growth due to improved nitrogen concentration also warrants further investigation.

REPORT: Nitrogen Effect on Rates of Photosynthesis and Growth of Leaves and Stems of Douglas-fir Trees. H. Brix and L. F. Ebell, Forest Research Laboratory, Victoria, B. C.