DEPARTMENT OF FORESTRY · CANADA ·

Timber Talks

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LIGHT INTENSITY AND TEMPERATURE EFFECT ON GROWTH OF DOUGLAS FIR SEEDLINGS

No. 22

The major gain in dry matter of plants is obtained by the process of photosynthesis and the major loss is through the process of respiration. The total amount of photosynthates produced by a plant depends on the intensity of photosynthesis per unit of leaves and on the amount of leaves produced by the plant. By studying photosynthesis, respiration and aspects of leaf production in relation to environmental factors, the effect of environment on dry matter production of plants can be better understood.

Douglas-fir seedlings from a uniform seed source were grown under controlled environment in growth rooms. The seedlings were grown at nine different combinations of constant temperatures of 13, 18 and 24°C (55, 65, 75°F) and at light intensities of 450, 1,000 and 1,800 ft-C with a photoperiod of 16 hours. At ages 65 and 100 days after germination, the dry weight of leaves, roots, stems and branches was measured, the relationship between leaf area and leaf dry weight determined, and the dry matter production per unit leaf area calculated. Rates of net photosynthesis of seedlings in relation to light intensity and temperature, and rates of respiration of roots as influenced by temperature, were measured.

Increasing the light intensity increased dry matter production. This resulted from an increased rate of photosynthesis per unit of leaf area. The gain obtained in this manner was partly offset by decreased efficiency in the production of leaf area at high light intensities.

Increasing the temperature from 13 to 18°C resulted in five times the amount of dry matter produced, but further increase in temperature to 24°C had only a negligible effect. The greater production with temperature increase from 13 to 18°C was not due to an improved rate of photosynthesis per unit of leaf; at the low light intensity (450 ft-C) the rate of photosynthesis decreased. The improved dry matter production was due to the substantial improvement in the efficiency of production of leaf area. During the dormant stage of the plant when leaves are not produced, an increase in temperature from 13 to 18°C will not increase the production of dry matter but decrease it because of a higher rate of plant respiration.

REPORT: An Analysis of Dry Matter Production of Douglas Fir Seedlings in Relation to Temperature and Light Intensity. Holger Brix, Forest Research Laboratory, Victoria, B. C.