DEPARTMENT OF FORESTRY · CANADA ·

Timber Talks

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RESPIRATION IN DOUGLAS FIR SEEDLINGS

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In the process of respiration, carbohydrates and other organic materials derived from photosynthesis are oxidized and released as carbon dioxide (CO_2) and water, resulting in a loss in the weight of dry matter within a plant. The difference between the gain from photosynthesis and the loss from respiration mainly determines dry matter production of plants. Light influences the rate of respiration but the effect varies amongst plants. In some there is oxidation of a considerable amount of the products of photosynthesis in the light and in others only a negligible quantity. As part of a study on dry matter production of Douglas fir in relation to environment the following experiment was performed.

In the laboratory, the rate of CO_2 exchange between Douglas fir seedlings that were encased in a sealed chamber and atmospheric concentrations of CO_2 that ranged from 600 ppm to CO_2 compensation point were measured at three temperatures (6, 20, 28°C) and six light intensities (200, 400, 600, 1000, 2500 and 3300 ft-c). The data were extrapolated to zero atmospheric CO_2 concentration to find the CO_2 released in respiration.

At temperatures 20° and 28°C, the rate at which carbon dioxide was released to the atmosphere decreased when light intensity was increased from darkness to 200 ft-c. Further increase in light intensity increased the rate of carbon dioxide evolution and at intensities above 1000 ft-c, it exceeded the rate of evolution in the dark for all the temperatures investigated.

The rate of photorespiration, determined in this study from data extrapolated to zero atmospheric CO_2 concentration, differs from the rate when measured in CO_2 - free air. This suggests that photosynthesis influences respiration, as in the latter method photosynthesis is restricted to the small amount of CO_2 released by respiration and in the former it follows a more normal pattern. Further evidence of such an influence is that the increase in CO_2 evolution with increase in light intensity as shown in this investigation parallels a relationship from a concurrent study where the rate of photosynthesis was saturated at 2000 ft-c with a temperature of 20°C.

REPORT: The Influence of Light Intensity at Different Temperatures on the Rate of Respiration of Douglas Fir Seedlings. H. Brix, Forest Research Laboratory, Victoria. B. C.