

BIOMONITORING OZONE WITH WHITE CLOVER CLONES

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Objectives

Development of methods to use an ozone-sensitive clone of white clover as a biomonitor for ambient ozone exposure. Conducting initial research to develop culture methods and techniques for scoring and evaluating injury.

Methods

Two clones of white (Ladino) clover, originally isolated at North Carolina State University for their tolerance and sensitivity to ozone, were grown in pots of greenhouse soil under standard greenhouse cultural conditions. During the summer months multiple pots of each clone were placed outside at the Proctor Maple Research Center (PMRC) or used in ozone fumigation experiments at UVM. Experimental exposures consisted of 3 daily 6 hr exposures of both clones to 100-150 ppb ozone; there were no control (non-ozone) treatments. Measures of response (foliar chlorosis, necrosis and chlorophyll concentration and shoot and root biomass) were evaluated 10 days after treatments.

Significant Findings

No significant differences were measured for the plants grown at PMRC. During the period of exposure (August-September, 1991) maximum ozone concentrations did not exceed 75 ppb, with an average daily maximum around 50 ppb.

Exposure to experimental ozone treatments caused significant differences in chlorophyll, chlorosis and necrosis. Chlorophyll-a was reduced 20% in the sensitive plants compared to the resistant ones. Necrosis and chlorosis were approximately 50% and 15% respectively greater in the sensitive plants compared to the resistant ones. Root biomass was much greater (240%) in the sensitive clones, but this was probably an inherent property of the plants rather than a result of exposure to ozone, since the time between ozone exposure and measurement was so brief (< 10 days).

These results indicate that these plants do respond differently to acute (>100 ppb) ozone exposure, but not to chronic low level exposure. It must be stressed that this was a short-term (<8 weeks) pilot investigation. Additional work is needed to characterize and calibrate responses of these plants over longer time periods.

Future Plans:

Further work is needed to identify long-term responses of these plants to chronic and acute ozone exposures. In 1992 multiple pots of sensitive and resistant clover will be placed in the field in mid-May at PMRC, Underhill State Park, and, in conjunction with the Vermont Dept. of Agriculture, 4 sites around Vermont (southern, central, northwest, northeast). In addition, experimental exposures to varying ozone levels will be conducted during the summer at UVM. Clover condition data will be assessed regularly and correlated with local or regional measures of climate and ozone concentration.

Funding Sources:

This work was supported by the UVM School of Natural Resources and the US Forest Service Northeastern Forest Experiment Station.