INTERNAL UPTAKE AND ASSIMILATION OF GASEOUS NITRIC ACID BY WESTERN FOREST TREE SPECIES

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A nitric acid gas analysis system was designed, tested, and calibrated to measure nitric acid deposition to forest tree species. Two modified Monitor Labs 8440 NO, NO_x, NO_2 analyzers were used in parallel to measure the nitric acid deposited onto leaf surfaces of ponderosa pine (*Pinus ponderosa*) and California black oak (*Quercus kelloggii*) seedlings. Measurements were made during 24 hr exposures in which plants were kept in dark, temperature controlled growth chambers. The broadleaf oaks had much higher rates of deposition than pines on a leaf area basis: 4.7 nmoles HNO_3 m^{-2} s^{-1} for oaks, and 0.6 nmoles HNO_3 m^{-2} s^{-1} for pines. There was good agreement in HNO_3 deposition calculated from the nitric acid gas analysis system and that measured by nitrate analysis of leaf washings.

Alternate light with dark period experiments (48 hr fumigation) showed that nitric acid deposition was about 2X greater than fumigation under darkness calculated by gas analysis and ^{15}N labeling methods. Nitrate reductase activity was used as an indicator of internal uptake and assimilation of HNO_3 into the leaf foliage. The enzyme activity increased in the alternate light/dark fumigated plants 10X greater than the unfumigated control. Preliminary experiments on the epicuticular waxes showed increases in the proportion of free fatty acids and alkyl esters, while estolide fractions decreased. These results indicate that nitric acid vapor may decrease the cuticular resistence to the nitric acid uptake into the leaf.

This HNO_3 analysis system is a significant advancement into nitric acid research and has the potential to measure the physiological response of plants to nitric acid exposures.

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