Evaluation of O3 Effects on Cumulative Photosynthetic CO2 Uptake in Seedlings of Four Japanese Deciduous Broad-Leaved Forest Tree Species Based on Stomatal O3 Uptake

编号	010019403
推送时间	20190708
研究领域	森林生态
年份	2019
类型	期刊
语种	英语
标题	Evaluation of O3 Effects on Cumulative Photosynthetic CO2 Uptake in Seedlings of Four Japanese Deciduous Broad-Leaved Forest Tree Species Based on Stomatal O3 Uptake
来源期刊	Forests
期	第194期
发表时间	20190702
关键词	Japanese deciduous broad-leaved trees; net photosynthetic rate; net primary production; stomatal;
摘要	The current level of tropospheric ozone (O3) is expected to reduce the net primary production of forest trees. Here, we evaluated the negative effects of O3 on the photosynthetic CO2 uptake of Japanese forest trees species based on their cumulative stomatal O3 uptake, defined as the phytotoxic O3 dose (POD). Seedlings of four representative Japanese deciduous broad-leaved forest tree species (Fagus crenata, Quercus serrata, Quercus mongolica var. crispula and Betula platyphylla var. japonica) were exposed to different O3 concentrations in open-top chambers for two growing seasons. The photosynthesis–light response curves (A-light curves) and stomatal conductance were measured to estimate the leaf-level cumulative photosynthetic CO2 uptake (ΣPn_est) and POD, respectively. The whole-plant-level ΣPn_est were highly correlated with the whole-plant dry mass increments over the two growing seasons. Because whole-plant growth is largely determined by the amount of leaf area per plant and net photosynthetic rate per leaf area, this result suggests that leaf-level ΣPn_est, which was estimated from the monthly A-light curves and hourly PPFD, could reflect the cumulative photosynthetic CO2 uptake of the seedlings per unit leaf area. Although the O3-induced reductions in the leaf-level ΣPn_est were well explained by POD in all four tree species, species-specific responses of leaf-level ΣPn_est to POD were observed. In addition, the flux threshold appropriate for the linear regression of the responses of relative leaf-level ΣPn_est to POD was also species-specific. Therefore, species-specific responses of cumulative photosynthetic CO2 uptake to POD could be used to accurately evaluate O3 impact on the net primary production of deciduous broad-leaved trees.

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