

研究论文

# 黄土高原常用造林树种水分利用特征

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**摘要** 在适宜土壤水分、中度干旱和严重干旱3种土壤水分条件下研究了黄土高原干旱、半干旱地区常用的人工造林树种84k杨树 (*Populus spp.*)、刺槐(*Robinia pseudoacacia*)、沙棘(*Hippophae rhamnoides*)和油松(*Pinus tabulaeformis*)苗木生长及水分利用特征。结果显示, 干旱胁迫使各树种成活率、生长速率、光合速率均显著下降; 84k杨树和刺槐单叶水分利用率(WUE)在适宜水分下最高, 沙棘的在中度干旱下最高; 在中度干旱下, 4个树种的总水分利用率最高, 而严重干旱下最低。无论干旱与否, 4个树种中沙棘生长速率最高。在中度干旱条件下, 4个树种均可良好生长, 而严重干旱下生长均受到显著抑制, 其中84k杨树受影响最大; 4个树种中沙棘和油松的耐旱性较强, 同时油松在各种土壤水分下其生长速度和干物质生产均显著低于其它3个树种; 刺槐和84k杨树的耗水量、生物量及水分利用率在3种土壤水分下均显著高于沙棘和油松, 84k杨树和刺槐均属于高耗水树种; 研究结果表明, 84k杨树和刺槐不适宜大面积栽植在黄土高原缺水地区, 仅适合栽植在阴坡、沟道等适宜水分条件下。沙棘和油松则适宜栽植在土壤水分较低的地区, 如阳坡、峁顶等立地条件上

关键词 [土壤干旱](#); [树种](#); [生长](#); [水分利用](#)

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## Water use efficiency characteristics of four tree species under different soil water conditions in the Loess Plateau

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**Abstract** Poplar (*Populus spp.*), seabuckthorn (*Hippophae rhamnoides*), locust (*Robinia pseudoacacia*) and Chinese pine (*Pinus tabulaeformis*) are the important tree species in most areas of the Loess Plateau, which is subjected to water stress. To evaluate water use efficiency characteristics of the four tree species, the experiments were designed by monitoring changes of the physiological traits at three soil water conditions, such as favorable soil water condition, medium drought and serious drought, which hold about 70%~80%, 50%~60% and 30%~40% of field water capacity, respectively. The results showed the physiological processes that determine the yield potential, such as survival, growth and photosynthesis rates of the four tree species, were inhibited at drought stress. Among the four cultivars, both the poplar and the locust showed the highest single leaf water use efficiency at favorable soil water condition, while the seabuckthron displayed this trait at medium drought condition. The highest total water use efficiencies occurred under medium drought, and the lowest under serious drought conditions in the four cultivars. Regardless of soil water conditions, seabuckthron showed the highest growth rate among the four tree species. Under medium drought conditions, the four tree species grew well, while they were all inhibited under serious drought, especially for poplar. Both seabuckthron and Chinese pine showed higher drought-tolerance than the other two tree species. However, the growth rate and the dry biomass accumulation of Chinese pine were remarkably lower than that of the other three tree plants. Since both poplar and locust are more water consumption species, the higher water consumption, biomass accumulation, water use efficiency were displayed in both species in comparison to seabuckthron and Chinese pine under the three soil water conditions. Taken together, seabuckthron

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n and Chinese pine are recommended to planting in the water-shorting area of the Loess Plateau, due to the superior adaptation of both species to water deficient. In contrast, both poplar and locust are not suitable for extensively planting.

**Key words** soil drought species growth water use efficiency

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