

Photosynthetic Characteristics of Mixed Caragana microphylla and Planted Poplar in the Horqin Sandy Land and Their Response to Climate: Postprint

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Abstract

In-situ field measurements of photosynthetic characteristics were conducted on co-occurring Caragana microphylla and planted poplar (*Populus* spp.) using the LI-6400 photosynthesis system. Through comparative analysis of differences in photosynthetic characteristics between drought periods and post-rainfall conditions in these native and planted species, and their relationships with physiological and environmental factors, the adaptive traits and response mechanisms to drought and precipitation were revealed. The results showed: During the drought period, net photosynthetic rate (P_n), transpiration rate (Tr), and stomatal conductance (G_s) of both co-occurring plants decreased significantly, exhibiting an obvious “midday depression” phenomenon with advanced peak times; after rainfall, the “midday depression” phenomenon in Caragana microphylla disappeared; G_s and photosynthetically active radiation (PAR) were the main physiological and environmental factors affecting P_n in Caragana microphylla and planted poplar; during the drought period, photosynthetic characteristics of Caragana microphylla were primarily influenced by stomatal regulation, while after rainfall they were mainly affected by environmental factors (PAR); photosynthetic physiological characteristics of planted poplar remained relatively stable both during drought periods and after rainfall, and were primarily influenced by PAR; Caragana microphylla adapted to drought environment by maintaining lower stomatal opening, lower Tr , and higher water use efficiency (WUE), while planted poplar avoided drought stress through higher P_n , Tr , and lower WUE; after rainfall, photosynthetic characteristics of Caragana microphylla changed more significantly than those of planted poplar, showing a stronger response to precipitation. In the mixed community, adaptation mechanisms of Caragana microphylla and planted poplar to drought and rainfall were

distinctly different, with *Caragana microphylla* showing stronger adaptability to environmental changes.

Full Text

Photosynthetic Traits of *Caragana microphylla* and *Populus* spp. and Their Responses to Climate in the Horqin Sandy Land

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Abstract

In this paper, the photosynthetic traits of *Caragana microphylla* and *Populus* spp. were measured with LI-6400 in the field. The adaptability of these two species and their responses to drought and precipitation were investigated through comparative analysis of their photosynthetic traits and the relationships between physiological characteristics and environmental factors under drought conditions and after precipitation events. The results are as follows: (1) Under drought conditions, the net photosynthetic rate (Pn), transpiration rate (Tr), and stomatal conductance (Gs) of both co-occurring species decreased significantly, exhibiting pronounced “midday depression” with peak values occurring earlier. The midday depression in *C. microphylla* disappeared following precipitation. (2) Pn values in both *C. microphylla* and *Populus* spp. were primarily influenced by the physiological factor Gs and the environmental factor photosynthetically active radiation (PAR). The photosynthetic traits of *C. microphylla* were mainly affected by stomatal regulation (Gs) under drought, but shifted to environmental factors (PAR) after precipitation. In contrast, the photosynthetic traits of *Populus* spp. remained relatively stable under both drought and post-precipitation conditions, being predominantly influenced by environmental factors (PAR). (3) To adapt to drought, *C. microphylla* maintained low Tr and high water use efficiency (WUE), whereas *Populus* spp. adapted through high Pn and Tr with low WUE. After precipitation, the photosynthetic traits of *C. microphylla* showed more significant changes than those of *Populus* spp., indicating greater sensitivity to precipitation. In mixed communities of *C. microphylla* and *Populus* spp., the two species exhibited significantly different adaptability to precipitation, with *C. microphylla* demonstrating higher adaptability to environmental changes.

Keywords: photosynthetic trait; *Caragana microphylla*; *Populus* spp.; drought; precipitation; Horqin sandy land, Inner Mongolia

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