

生物土壤结皮对准噶尔盆地5种荒漠植物幼苗生长与元素吸收的影响

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摘要 生物土壤结皮广泛分布于许多干旱和半干旱地区, 它影响土壤物理过程、水文、侵蚀和养分循环过程, 从而影响植物种子萌发与生长发育。该文以新疆准噶尔盆地腹地的古尔班通古特沙漠的生物土壤结皮为研究对象, 分析了生物土壤结皮对准噶尔盆地5种荒漠植物(白梭梭(*Haloxylon persicum*)、蛇麻黄(*Ephedra distachya*)、角果藜(*Ceratocarpus arenaarius*)、涩芥(*Malcolmia africana*)和狭果鹤虱(*Lappula semiglabra*))的生长及其对元素吸收的影响。结果表明: 1)相对于裸沙而言, 生物土壤结皮显著促进了荒漠植物的生长速率, 并增加了草本植物地上和地下的生物量, 但对灌木的生物量无显著影响; 2)生物土壤结皮使部分一年生草本植物的开花和结实期提前, 这可能有利于荒漠植物在有限的环境资源下快速完成生活史, 并繁衍后代; 3)生物土壤结皮能够影响荒漠植物对土壤中营养元素的吸收, 具体表现在生物土壤结皮显著促进了5种植物对N的吸收, 增加了荒漠植物在N贫乏的荒漠生态系统的适应能力, 而对P和K的吸收均没有影响。生物土壤结皮对荒漠植物对元素吸收的影响因种而异, 对不同的植物有不同的影响。荒漠植物对Mg、Mn和Cu的吸收受生物土壤结皮的影响最小。

关键词: 生物土壤结皮 生物量累积 荒漠植物 生长速率 元素吸收

Abstract: *Aims* Biological soil crusts improve soil formation, increase landscape stability and fertility, prevent soil erosion by water or wind, and affect surface hydrological and nutrient cycles. Furthermore, biological soil crusts affect the germination, growth and establishment of vascular plants. The interaction between crusts and vascular plants is controversial, and the importance of biological crusts has not been well analyzed in the Gurbantunggut Desert of western China. Our objective was to examine effects of biological crusts on growth and nutrient uptake in vascular plants of the Gurbantunggut Desert. *Methods* We conducted manipulation experiments to examine the effects of biological crusts on growth and nutrient uptake in five typical, widely distributed species (*Haloxylon persicum*, *Ephedra distachya*, *Ceratocarpus arenaarius*, *Malcolmia africana* and *Lappula semiglabra*). We used shoot growth rate and above- and belowground biomass accumulation as indicators of seedling growth and the content of ten elements (N, P, K, Na, Mg, Fe, Mn, Cu, Zn and Na) as indicators of the influence of biological crusts on element uptake in the plants. *Important findings* Biological soil crusts significantly accelerated the growth rate of seedlings in all five species, but increased biomass accumulation only in herbaceous species, not in shrub species. Crusts also promoted early flowering and fruiting in herbaceous species, which could be beneficial to rapid establishment of herb communities before environmental resources become more available in other seasons. Crusts also influenced nutrient uptake by plants, especially N; the influence on uptake of other nutrients was species-specific. Therefore, biological soil crusts may be important in maintaining desert plant diversity.

Keywords: biological soil crusts, biomass accumulation, desert plants, growth rate, element uptake

收稿日期: 2010-12-21; 出版日期: 2011-04-01

基金资助:

基于生物结皮的受损荒漠生态系统修复关键技术

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引用本文:

张元明, 聂华丽. 生物土壤结皮对准噶尔盆地5种荒漠植物幼苗生长与元素吸收的影响. 植物生态学报, 2011,35(4): 380-388.

ZHANG Yuan-Ming, NIE Hua-Li. Effects of biological soil crusts on seedling growth and element uptake in five desert plants in Junggar Basin, western China. Chinese Journal of Plant Ecology, 2011,35(4): 380-388.

链接本文:

<http://www.plant-ecology.com/CN/10.3724/SP.J.1258.2011.00380> 或 <http://www.plant-ecology.com/CN/Y2011/V35/I4/380>

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