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Effects of biological soil crusts on seedling growth and element uptake in five desert plants in Junggar Basin, western China

Y. Zhang
Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi, China (zhangym@ms.xjb.ac.cn)

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. 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.The results show that 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.

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