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Root Spatial Expansion Ability of *Leymus chinensis* in Response to Clipping and Salt Stress

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Abstract

Root system expansion is a complex and important process for rhizomatous plant clonal growth and spatial resource exploration, which is mainly controlled by morphological integration. However, experimental evidences are still lacking to understand mechanisms for root spatial expansion ability (RSEA) of clonal plants under stresses. A 3×3 factorial greenhouse experiment was conducted with a simulated grazing gradient (0 %, 35 % and 75 % of shoot removal) under three levels of saline-alkali intensity (0, 100 and 200 mM) to determine the effects of clipping and salt-alkaline stress on belowground morphological integration of *Leymus chinensis*, a high palatable, dominant grass of the northern chinese steppe ecosystems.

Our results showed that plant biomass and relative growth rate were significantly decreased along the gradient of saline-alkali intensity, but clipping significantly facilitated plant compensatory growth. The interactions between salt-alkaline and clipping on clonal growth and RSEA were siginificant. Slight saline-alkali stress has positive impact on compensatory growth of *L. chinensis* at low clipping intensity pressure, resulting in high level of RSEA. But high salt–alkali significantly inhibited clonal growth by the limitation of bud outgrowth and rhizome expansion, regardless of clipping intensity. Furthermore, when the ranges of the fine root/shoot ratio are from 0.5 to 0.6, shoot compensatory growth of *Leymus chinensis* is mainly due to the stimulation of leaf bud growth; but when this ratio is higher than 0.6, *L. chinensis* invests more photosynthesate into rhizomes and clonal expansion, and shoot compensatory growth originates from the development of rhizome buds into daugther ramets.

We conclude that the rhizome grass *Leymus chinensis* shows a selective biomass allocation strategy under different environmental stress intensities. These plasticities translating into clonal integration are potentially important mechanisms in response to overgrazing and salt stress and may help to optimise grassland management towards improved forage regrowth.

Keywords: Clipping intensity, clonal integration, root/shoot ratio, salinity-alkalinity stress, songnen grassland

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