Postprint of Experimental Study on the Desalination Effects of Four Herb and Shrub Species in the Xining Basin

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Abstract

Taking the self-built experimental area in the Changlinggou watershed of the Xining Basin as the study area, two shrub species, Caragana korshinskii Kom. and Zygophyllum xanthoxylon (Bunge) Maxim., and two herbaceous species, Agropyron trachycaulum cv. Slender and Medicago sativa Linn., suitable for growth under local climatic conditions were selected as test species. In the experimental area, monoculture and mixed planting methods were adopted for the four plant species to investigate the content and variation characteristics of eight soluble salt ions, including K+, Ca2+, Na+, Mg2+, SO4^2-, Cl-, HCO3-, and CO3^2-, in the soil vertically below the slope surface under the two planting conditions, and to evaluate the capacity of the two herbaceous and two shrub species to reduce soil salinity in the slope. The results showed that monoculture planting of Agropyron trachycaulum cv. Slender, Medicago sativa, Caragana korshinskii, and Zygophyllum xanthoxylon had significant reducing effects on SO4^2-, Ca2+, and Na+ in the slope soil; Herbaceous-shrub combination I (Caragana korshinskii + Medicago sativa + Agropyron trachycaulum cv. Slender) and herbaceous-shrub combination II (Zygophyllum xanthoxylon + Medicago sativa + Agropyron trachycaulum cv. Slender) exhibited significant reducing effects on SO42, Ca2+, Mg2+, K+, and Na+ in the slope soil; The salt-reducing effect of Medicago sativa was relatively the most significant, followed by Caragana korshinskii and Agropyron trachycaulum cv. Slender, while that of Zygophyllum xanthoxylon was less significant than the former; The salt-reducing effect of herbaceous-shrub combination II was relatively more significant than that of herbaceous-shrub combination I.

Full Text

Title and Authors

Soil Salt Reduction Effect of Four Herbaceous and Shrubby Species in the Xining Basin, Qinghai Province

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Abstract

In this study, two shrubby species *Caragana korshinskii* Kom. and *Zygophyllum xanthoxylon* (Bunge) Maxim. and two herbaceous species *Agropyron trachycaulum* and *Medicago sativa* L., adapted to the natural conditions in the Xining Basin, were screened out to experimentally plant in the Changling Gully in the basin. In the research area, the four species were planted by means of single planting and assembled planting. The contents and variations of eight soluble salts including K , Ca^2 , Na , Mg^2 , SO^2 , Cl , HCO , and CO^2 in different soil layers and plant systems and roots under the two different planting conditions were discussed. The capabilities of two herbaceous and two shrubby species in reducing total salt content in slope soil were evaluated. The test results revealed that, under single planting of these four species, their effect in reducing the contents of SO^2 , Ca^2 , and Na was significant, and that of herbaceous and shrubby assemblage I (*C. korshinskii* + *M. sativa* + *A. trachycaulum*) and assemblage II (*Z. xanthoxylon* + *M. sativa* + *A. trachycaulum*) in reducing the contents of SO^2 , Ca^2 , Mg^2 , K , and Na in slope soil was significant. The salt reduction effect of *M. sativa* was relatively more significant, and then that of *C. korshinskii* and *A. trachycaulum*, but that of *Z. xanthoxylon* was not significant. The salt reduction effect of the herbaceous and shrubby assemblage II was significantly higher than that of the herbaceous and shrubby assemblage I.

Keywords: soil salt reduction; soluble salt ion; total salt content; single planting; herbaceous and shrubby assemblage; Xining Basin

5 Conclusions

(1) Under single planting of the four species, the variations of SO^2 , Ca^2 , Na , and K showed consistent patterns. Similarly, under both assemblage I (*Caragana korshinskii* + *Medicago sativa* + *Agropyron trachycaulum*) and

assemblage II (*Zygophyllum xanthoxylon* + *M. sativa* + *A. trachycaulum*), the variations of SO^{2}, Ca^{2}, and Mg^{2} exhibited consistent trends.

(2) The four species under single planting—*C. korshinskii*, *Z. xanthoxylon*, *M. sativa*, and *A. trachycaulum*—demonstrated significant effects in reducing total salt content in slope soil. Among them, *M. sativa* showed the most significant salt reduction effect, followed by *C. korshinskii* and *A. trachycaulum*, while *Z. xanthoxylon* exhibited no significant effect. Furthermore, the salt reduction effect of herbaceous and shrubby assemblage II was significantly greater than that of assemblage I.

(3) Both herbaceous and shrubby assemblage I and assemblage II showed significant capabilities in reducing the salt content of slope soil, with the effect being more pronounced for assemblage II.

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Note: Figure translations are in progress. See original paper for figures.