Effects of long-term sand mixing ameliorating measures on soil salinity characteristics of saline-alkali land in northern Shaanxi

Lirong He 1,2,3,4, *, Yuhu Luo 1,2,3,4

1 Shaanxi Provincial Land Engineering Construction Group Co., Ltd, China
2 Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd, China
3 Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Natural Resources, China
4 Shaanxi Provincial Land Consolidation Engineering Technology Research Center, China

*Corresponding author e-mail: 2015051029@nwafu.edu.cn

Abstract. To explore different mix sand measures of saline-alkali land improvement effect for a long time, this study in northern shaanxi dingbian county saline-alkali soil as the research object, combined with field experiment and indoor test methods in the wild, analysis and improvement of saline-alkali soil salt and 1 ~ 6 years change characteristics of organic matter, reveal different mix sand thickness of heavy saline-alkali soil salt content and organic matter distribution. The results showed that the overall soil salt content in saline-alkali land did not change regularly with the change of sediment mixing amount or improvement years. There is no significant difference between different thickness (proportion) sand mixing measures on saline-alkali land improvement benefits. As time goes by, the soil salt content in the whole soil layer of saline-alkali land is not significantly changed by sand mixing treatment, but the soil salt content in arable layer is decreasing year by year, and the improvement benefit is significant in the short term. In conclusion, the long-term sand mixing improvement measures are beneficial to the improvement of the cultivated layer of saline-alkali land, thus reducing the salt damage suffered by crops in the process of growth and development, etc., the effects of sand mixing treatment on soil microorganisms and enzyme activities remain to be further explored.

Keywords: Sand mixing improvement; Saline-alkali land; Characteristics of salt.

1. Introduction
With the high-quality development of the global economy, the demand for land use area has increased. Due to improper use of land, soil environment and soil structure are damaged, thus facing the problem of soil salinization [1]. According to the data of the United Nations Science, Education and FAO, salinized land in the world is about 954.38 million hectares, of which 9,913 hectares are in China [2].
Due to salinization stress, these lands have been left barren and unused for a long time, which not only wastes land resources, but also affects ecological landscape. Therefore, it is urgent to take effective measures to improve the saline-alkali wasteland so that it can be effectively used.

The salinized soil contains more salt and alkali components, and the soil structure is poor, which inhibits the normal growth of plants, or even fails to survive. The arid and semi-arid areas in China are the areas with severe water shortage, soil erosion and soil salinization. Long-term and large amount of chemical fertilizer application causes soil hardening [3,4], resulting in the poor quality of cultivated land, low production quality, poor water holding capacity, poor soil fertility and other undesirable characteristics. At the same time, a large amount of fertilizer seepage, leaching, cause groundwater pollution, seriously affect the crop surface water environment, and even toxic effect on crop growth. Salinization restricts the productivity and sustainable development of local green agriculture. Therefore, the problem of soil salinization has become a major obstacle in the process of efficient utilization of land resources and improvement of ecological environment. At present, the treatment of saline-alkali land conforms to the strategic policy of ecological security in China, and is a necessary process to improve and develop ecological agriculture. For a long time, how to reduce the degree of soil salinization, improve soil fertility, using effective improvement measures to create the suitable soil ecological environment is the focus of many experts and scholars, and put forward the improved measures [5-9], since the 20th century, many experts and scholars at home and abroad for saline soil improvement measures and mechanism research has made significant results, some measures have been in practice played a good effect and promoted [10,11]. In recent years, among the physical improvement measures, the technology of deep loosening of powder ridges, as a new technology, has played a good role in the improvement of saline-alkali land, and achieved the improvement of saline-alkali land by physically improving the soil physical and chemical structure and soil ecological environment [12]. It is of great significance to the improvement of saline-alkali land and the sustainable development of green agriculture. Drip irrigation under plastic film has the advantages of low cost, water saving and fertilizer saving because of its close distance drip irrigation, which enables the root zone of crops to obtain the required water, and keeps the soil in a suitable state of water and heat all the time [13].

At present, there are many researches on saline-alkali soil improvement methods, which are mainly divided into physical, chemical and biological aspects. Physical measures mainly through the change of soil physical property, create a good and stable soil structure, enhance salt leaching down with water, and inhibit soil evaporation leads to lower salt upward migration, thus achieve the purpose of improvement of saline-alkali land [3], which mix sand improvement refers to the shaka in saline soil, the formation of aggregate by positive reinforcement effect, the structure change of soil, increase soil porosity raised and breathable performance is strong, with salt water movement and change [13], can effectively reduce the salt content in the soil, can quickly see improvement effect. At the same time, it also has some shortcomings. For example, in the implementation and application of the project, some people think that the timeliness of the sand mixing improvement measures is limited, and the long-term improvement may also cause the decline of land quality. Therefore, it is very important to monitor the long-term improvement effect of sand mixing on saline-alkali land continuously. In this study, heavy saline-alkali soil in Dingbian County, Northern Shaanxi Province was selected as the object, and sand mixing was used as a means to carry out follow-up monitoring on the saline-alkali land improved by sand mixing for as long as 6 years. By comparing the soil salt content characteristics of saline-alkali land under different years of improvement, the sustainability of sand mixing improvement was comprehensively evaluated.

2. Materials and methods

2.1. Experimental design

In shaanxi to build land engineering institute of technology built fuping experimental base for sizes 2 m * 2 m * 1 m (length x width x deep) test area, a total of seven, the inside and bottom are made from cement anti-seepage treatment, community within 0 ~ 1 m deep filling yulin dingbian county town king
beach village of beam acquisition of saline soil, the surface within 0 ~ 30 cm respectively according to mix the sand thickness of 0 cm, 7 cm, 11 cm, 15 cm laid, blending fully with saline soil and sand. The trial crop is ryegrass. The planting management is consistent with the local field, and no sand or saline soil is added during the planting management process.

2.2. Detection index and method
The soil samples in the 0~100cm depth of each test plot were collected with a soil drill in October every year. After being mixed and air-dried, the total salt content of the soil was measured by residue drying method, and the organic matter content of the soil was measured by potassium dichromate volume method. Analyze data and chart with SPSS 2.0.

3. Results and Analysis

3.1. Variation characteristics of soil salinity in different soil layers
In 2015 (the third year of improvement), the soil salt content in saline-alkali land increased with the increase of soil thickness, and the soil salt content in the 60-100cm layer was significantly higher than that in the 0-60cm layer (Figure 1). The surface soil salt content was lower, and the effect of soil improvement in the arable layer was obvious, and the crop growth was in good condition. 2018 improved (6 years) saline-alkali soil salt content is blank treatment had no significant difference (figure 2), experimental field long-term closed environment conditions, soil salt ion can only trace absorption by planting crops in the process of growth and development, mix sand processing is reached in the short term on the soil physical structure block of salt in surface gathering, dilute the effect of surface soil salt, but [0 ~ 100 cm soil soluble had no significant change, as the transpiration of salt deposition, rainfall desalting move up and down, continue to affect crop germination and normal growth.

| Tab. 1 The experiment design |
|-------------------------------|
| Treatment | Planting       | Thickness of covering sand |
| S1        | Perennial ryegrass | 7 cm                     |
| S2        | Perennial ryegrass | 11 cm                    |
| S3        | Perennial ryegrass | 15 cm                    |
| Ck        | Perennial ryegrass | 0 cm                     |

3.2. Variation characteristics of soil salinity in arable layer
After the sand mixing treatment was adopted, the soil total salt content in the 0-40 cm layer of the experimental field showed a decreasing trend year by year (Figure 3 and Figure 4). However, according to the soil salinization classification indexes in China, the cultivated soil is still heavily salinized soil, which is still unfavorable to the normal growth of most crops compared with the non-salinized soil. Therefore, continuous attention should be paid in the future.
4. Conclusion

In this study, by comparing the total salt content of saline-alkali soil after 1 to 6 years of improvement, the long-term improvement effect of different thickness sand mixing measures on saline-alkali soil was analyzed. The results show that there is no significant difference between different thickness (proportion) sand mixing measures on saline-alkali land improvement benefits. Over time, mix sand treatment on the saline-alkali soil (0 ~ 100 cm) soil salt content has no obvious change, but the magnetism of soil salt content showed a trend of decreasing year by year, and a significant improvement in the short term benefits, as long-term field trials in a closed environment, soil salt ion can only trace absorption by planting crops in the process of growth and development, mix sand processing is reached in the short term on the soil physical structure block of salt in surface gathering, dilute the effect of surface soil salinity, this and Lv Fengshan [14, 15], the results were similar to but no significant change in the field soil soluble. This also indicates that the long-term sand mix improvement measures are beneficial to the improvement of the cultivated layer of saline-alkali land, thus reducing the salt damage suffered by crops in the process of growth and development. Mix sand improvement measures can not only change soil physical and chemical properties, on the activity of soil microbial community and soil enzyme activity may also be affected, in the later experiments can join different improvement measures on saline-alkali soil microbes, microbes and enzyme activity of research, to provide a coherent experiment powerful system scientific theory basis.
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