Research Structure Based on the Characteristics of Salinized Plants in Different Soils in Northeast China

Gao Zhanwu[1], Tong Ruqiang[2], Fan Chunyan[3], Cui Yanhui[1], Wang Lihong[1*]

[1]The Institute of Tourism and Geography of Baicheng Normal Universit, Baicheng, 137000, China.

[2]Jilin Province Soil and Water Conservation Bureau, Changchun, China

[3]Helong Town Senior High School, Nongan County, Jilin Province, China.

*Corresponding Author

Keywords: North-east area, Soil, Salt and alkali resistance, Plant tissue structure

Abstract: The degree of salinization in the northeastern China is a serious threat to the status of the granary, but changing the disadvantages of the distribution and genesis of saline-alkali land in the Northeast China will be beneficial, and to adopt the simplest method to achieve the best results. Based on the analysis of the characteristics, this paper put forward the planting structure of saline-alkali plants, and believes that, planting plants with strong salt and alkali resistance, as well as planting trees, alkaloids Planting rice and improving saline-alkali land are effective method of biological improvement.

1. Introduction

Northeast China is one of the regions with the highest degree of salinization, according to the survey statistics, the area of saline-alkali land in the whole area is 3.84 million hm2, of which the area of cultivated land saline-alkali is about 1.28 million hm2, accounting for about the total cultivated land in the northeast, and the area is 6.8%, as shown in Table 1. The area of saline-alkali cultivated land is so large when accounting for such a high proportion of the total area of cultivated land, which has a major containment impact on China's agricultural production, especially the development of agricultural grain bases in Northeast China. Therefore, it is of strategic practical significance to study the structure of salinity-resistant plants in saline-alkali cultivated land in northeastern China.

Table 1 : Statistical Table of Saline and Alkali Land Area Survey in Northeast China

distribution area saline-alkali land (10,000 hm2)	Area of cultivated land in saline-alkali land (10,000 hm2)	cultivated land treated with saline-alkali land (10,000 hm2)
Northeast China	384.25	127.623	57.07
Heilongjiang Province	146.87	56.223	21.56
Jilin Province	141	27.44	1.99
Liaoning Province	90.87	38.66	29.29
Inner Mongolia Dongsi Meng	6.85	5.33	4.26

2. Characteristics and Distribution of Saline-Alkali Land in Northeast China

2.1 Characteristics of Saline-Alkali Land in Northeast China

Compared with other large saline-alkali land in China, the northeast saline-alkali land has its own characteristics: First, the degree of grassland salinization is dynamically increasing, among them, the saline-alkali area of the Songnen Plain has about 2.4 million hm2, accounting for more than 2/3 of the plain grassland area; because the grassland in western Jilin has become nearly half of the alkali-spotted bare land; and the salinization of the entire Northeast Leymus chinensis steppe which is increasing at a rate of 1.5/%-2% per year and has reached more than 60% of the Northeast Leymus Grassland. The second is based on the type of soda salinity, becasue the groundwater depth

  DOI: 10.25236/acete.2019.045

in the northeastern region is generally 1.5-3m, and the salinity is high. So the salt composition of the soil is mainly carbonate, which has strong alkaline reaction and is more harmful to crops. Third, is due to the influence of the Siberian cold current, the soil maintains the frozen soil layer for half a year, and the depth is between 1.2 and 1.5 m. Therefore, the concealed salt accumulation in winter is high [1].

2.2 Distribution of Saline-Alkali Land in Northeast China

It is mainly distributed in four major areas: one is the western Songnen Plain; the other is the West Liaohe Plain; the third is the western part of the western Liaoning, the northern part of the Liaohe Plain, and the middle reaches of the Liaohe River; and the fourth is the coastal area in the southern part of the Liaohe Plain [2]. See Table 2 for details.

Table 2 : List Of Concentrated Distribution Areas of Saline-Alkali Land in Northeast China

City(Province)	Saline-alkali area	Saline-alkali land	Degree of salinization		Remarks
($10,000hm^2$)	Total area(%)	Severe(%)	Moderate(%)	Mild(%)	
Anda City	15.74	44	58.3	13.8	27.9 severe salt spot rate >50%;
Daqing City	28.9	59.44	34.5	33.3	32.2 Moderate salt is between 30-50%;
Daan City	30.57	62.4	73.8	6.1	20.1 Mild salt spot rate is
Quzhou County	6.75	27.2	79.8	-	20.2
Wuyuan County	10.98	26.9	57.2	3.2	39.6
Dumont County	11.94	19.5	7.3	92.7	-
Longjiang County	6.55	10.4	3.7	91.1	5.2
Qian'an County	18.05	39.8	42.6	34.5	22.9
Changling County	16.81	29.3	26.1	37.3	36.6
Nong'an County	9.99	34.5	7.1	19.9	73
Fuyu County	12.86	22.3	32.2	9.3	58.5
Qianguo County	19.67	30.7	30.7	19.8	49.5
Tongyu County	36.75	43.6	22.0	27.5	50.5
Zhenzi County	18.86	35.2	51.7	31.5	26.8

3. Formation of Saline-Alkali Land in Northeast China

The cause of saline-alkali land in Northeast China has two aspects: one is the natural factor and the other is the human factor.

3.1 In terms of the natural factors.

There are four main points: First, hydrogeological factors. Since most of the area is a semi-enclosed water storage basin, based on the slownes of groundwater flow, coupled with the high groundwater salinity, and shallow groundwater which also has weak surface runoff that is mainly regulated by bursting, and is objectively the land of the area. The formation of salinization provides the material basis and development space [3]; the second is the climatic factor. The precipitation in summer in the Northeast China also large, accounting for about 80% of the annual precipitation. In spring, it is less rainy and windy and prone to spring drought. Therefore, in spring, soluble salts in soil and groundwater evaporate with rising water, which accumulates on the surface after concentration; the third is the topographical factor. The micro-topography in the northeastern region is complex, mostly in the undulating terrain of each other. The terrain is wide, and the slope is small with many rivers. In addition, rainfall in the area is concentrated in the summer, and cannot be discharged to the area in time, it can only be adjusted by the evaporation, becasue the salt in the water is accumulated; the fourth is the effect of melting, the annual freezing period in the northeast region is as long as half a year, and the thickness of the frozen layer is also large. So during the freezing process of the soil, the non-frozen soil brine will transfer to the frozen layer, causing the brine to accumulate in the frozen layer, and when the spring arrives, the salt water will evaporate on the surface with the rise in temperature [4].

3.2 In terms of human factors.

There are also four points: first, poor drainage; second, poor management of farmland irrigation, secondary salinization; third, improper technical measures, rough management, increasing the degree of salinization of cultivated land; fourth, hacking and deforestation Excessive colonization has destroyed both the ecology and the salinization of the land.

4. Discussion on Planting Structure of Salt-Tolerant Plants in Northeast China

The scientific selection of the planting structure of crops can reduce the evaporation of saline-alkali water in the soil, which can prevent the return of salt and reduces the degree of salinization in the soil, and also redistribute the existing saline-alkali in the soil, as well as reducing the surface of the salt content can achieve the purpose of crop tolerance and rational use of salinization [5].

4.1 Planting Plants That Are Resistant to Salt and Alkali.

First, to plant food crops and cash crops. Mainly soybean, cotton, corn, barley, sorghum, sunflower, sugar beet, kenaf, Sudan grass and so on, because the cultivation of these food crops and cash crops can not only improve the utilization of salinized arable land, but also expand the cultivated area of cultivated land and increase the yield of crops. Second, planting salt-tolerant pastures. The preferred method is Leymus chinensis, followed by mantle, alkalima, Suaeda, and chloris, which is of great significance to improve the saline-alkali grassland by planting these plants into mixed communities.

4.2 Afforestation, biological alkaloids.

Afforestation can regulate the movement of saline-alkali in the soil, and one of them is the evaporation of soil into water surface or plant transpiration, second, the roots and leaves of trees can also reduce the groundwater level, inhibit soil evaporation, and control the accumulation of salt on the surface. It is necessary to plant more salt-tolerant trees and shrubs, such as salt-tolerant tree species such as weird willow, sand jujube, and ash tree, to improve the saline-alkali soil.

4.3 Planting rice and improving saline-alkali cultivated land.

Under the condition of irrigation and water source system, planting rice is an effective way to control salt and alkali, in order to achieve and improve on both soil, increase production and income, becasue the basic principle of this technology is that by planting rice, the salt and alkali components in the soil are partially discharged into the rivers outside the field along with the drainage, and the other part penetrates into the bottom layer of the soil. Therefore, this kind of rice is washed with salt, and the effect of the method is still quite significant, but the premise is relatively complete irrigation and drainage system must be established.

5. Summary

The existence of saline-alkali land in the northeastern region is objective, and it is beneficial to change the land of the distribution and causes of the saline-alkali land in the Northeast China, as it is an effective method to use in the biological planting to control the saline-alkali land and improve on the soil. So based on the analysis of the characteristics, this paper studies the planting structure of salt-tolerant plants in Northeast China, and the research results has shown the practical development which is the guiding significance of the agricultural production of saline-alkali land in the Northeast China.

Acknowledgement

Key Project of Jilin Provincial Department of Education: Effects of Saline-Alkali Threats on Reproductive Tradeoffs and Strategies of “Bisexual” of Leymus Chinensis(Jilin Education &

Science 201641); Key Project of Baicheng City: Study on the Ecological Adaptation Mechanism of Jerusalem Artichoke to Nitrogen Deposition and Saline-Alkali Threats Based on Metabolomics (201920)

References

[1] Yiming. Research on Improvement Technology of Northeast Soda Saline-alkali Land [J]. Agriculture & Technology, 2019, 39(1): 21-24.

[2] Zhou Jiwei, Gao Shumei. Analysis on the Greening Technology and Application of Soda Saline-alkali Land in Northeast China[J]. China Science and Technology Expo, 2011(23): 240-241.

[3] Song Decheng, Hong Ying, Yu Dayong. Analysis of the development and utilization of saline-alkali land in the Songnen Plain[J]. Journal of Northeast Water Resources and Hydropower, 2014, 32(9): 21-22.

[4] Yu Xingyang. Soil characteristics and biological evaluation of saline-alkali land in Songnen Plain [D]. Northeast Forestry University, 2010.

[5] Anonymous. Improvement and utilization of saline-alkali land in the Songnen Plain: theory and technology [M]. 2013.