Types, harms and improvement of saline soil in Songnen Plain

Zhengjun Wang, Jingjing Zhuang, Anping Zhao, Xinxin Li
Heilongjiang University, School of Hydraulic and Electric Power, Heilongjiang, China

Abstract. Saline soil is an extremely difficult and modified soil, widely distributed around the world. According to UN-UNESCO and FAO, the world's saline soil area is about $9.54 \times 10^8$ hm$^2$, and there is a growing trend, every year in $1.0 \times 10^6-1.5 \times 10^6$ hm$^2$ speed growth, the effective utilization of land resources to the world is the most serious threat. The total area of saline-alkali land in China is about $9.91 \times 10^7$ hm$^2$, including the Songnen Plain, which is called one of the three major saline soil concentrations in the world. The Songnen plain is an important grain producing area in China, and the saline soil occupies most of the Songnen plain, so it is of great significance to study the saline soil and improvement in Songnen plain.

1. Geographical Distribution of Songnen Plain
Songnen Plain is located in the Northeast Plain, located in the northeast of the east of Greater Khingan Range, the eastern mountain west longitude 118-122 degrees, 48 degrees north latitude, north from Xingan small ridge transection, bordering south and Liaoh plain. The Songnen Plain saline soil area involves 14 cities and counties in Heilongjiang Province, 7 counties and 14 cities and counties in Inner Mongolia Jilin Province, a total of 35 cities and counties in Zhaozhou, Heilongjiang. Anderson, Zhaoyuan, Mingshui, Lanxi, Daqing, Qiqihar, Qing Gang, Longjiang, Tailai, Gannan, Dumont, Fuyu and Lindian; Jilin Province, Baicheng, Songyuan, Tiaoan, Daan, Tongyu, Changling, Zhen GUI, Qianan, Nongan, Dehui, Shuangniao, Shuangliao, Lishu, HuaiDe, Tongliao, Kulun, Naiman, Wengniute, Kezuozhongqi, kezuohouqi and Kailu of Zhemeng district in inner Mongolia.

2. Land Condition of Saline Soil In Songnen Plain
Distribution of saline soil in Songnen Plain saline soil is very wide, a total area of about $342 \times 10^4$ hm$^2$, accounting for 19.4% of the plain area; the soda salinization area is $230.5 \times 10^4$ hm$^2$, saline soil in the region accounted for more than 70% of the total area, is the largest distribution area of soda salinization of soil in China, and it is also the three largest soda saline soil areas in the world one of the saline soil in this area. The salt of the area is basically inland soda salt, and the salt consists mainly of soda ($\text{Na}_2\text{CO}_3$) and the NaHCO$_3$, which contains a small amount of sulfate and chloride. Since the soil is associated with the process of alkalization in the process of baking soda, the baking soda has a...
different degree of salinization and alkalization. Due to human activity is frequent, long-term unreasonable development, result in the ecological environment is very fragile, salinization of soil area expands unceasingly, the soil quality degradation increasingly intensified. The researches show that in 1950s the plain area of $241.5 \times 10^4$ hm$^2$, salinization area expanded to $301.2 \times 10^4$hm$^2$ in the 80s. By 90s, the salinization area has reached $342 \times 10^4$hm$^2$, and the trend of increasing year by year.[1]

3. The Harm of Saline Soil

Soil salinization is a worldwide agricultural ecological environment problems. The physical and chemical properties of saline soil can significantly inhibit the poor crop growth, and even lead to the death of crops, seriously affecting crop yield. Soil salinization, resulting in ecological imbalance, changing natural environment, land desertification and land resources loss in large area worse, the conditions of agricultural production and rural economic poverty, seriously hinder the income of the farmers in the west of Jilin Province, the agriculture and the rural economy sustained and healthy development.

The harm of saline soil to crops and plants is shown in the following aspects: (Figure1,2) Reduce water availability. Solution's osmotic potential is affected by concentration. If the salt ion concentration in the solution increases, osmotic pressure will rise and the effectiveness of the moisture will reduce. The root system absorbs moisture difficulty and causes water shortage. To destroy the structure of the membrane. The high concentration of salt damages the cell membrane, causes the loss of nutrients in the cells, and causes the plant nutrient deficiency. Destroying soil structure prevents root growth. High sodium salt soil, high dispersion degree of soil grain, easily clog the soil pore, affect the root system breathing, nutrient absorbing ability decrease, cause nutrient deficiency.

4. The Properties of Saline Soil In Songnen Plain

Saline soil in Songnen Plain are mainly saline soil, meadow soil, and alkaline earth. Three types of meadow soil types including carbonate, containing soda or soda saline meadow soil; saline soil mainly contains soda and soda saline; alkaline earth contains soda or soda saline alkaline earth.(Table 1)
| Soil class          | Subclasses                              | Soil species                              |
|---------------------|-----------------------------------------|-------------------------------------------|
| Saline soil         | Meadow Salt soil                        | Sulfate oxide Meadow Salt soil            |
|                     | Alkaline Meadow Salt Soil               | Soda Alkaline Meadow Salt soil            |
|                     | Swamp Meadow Salt soil                  | Soda mixed saline alkaline meadow salt soil|
| Meadow soil         | Alkaline Meadow Soil                    | Alkaline Meadow Soil                      |
|                     | Swamp Meadow Salt soil                  | Saline soil of soda Meadow translated from Marsh|
| Alkaline soil       | Meadow Alkaline                         | Orange Peel Meadow Alkaline               |
|                     | Shallow Columnal meadow Alkaline        | Shallow Columnal meadow Alkaline          |
|                     | Median Columnal meadow alkaline         | Median Columnal meadow alkaline           |
|                     | Deep Columnal Meadow Alkaline           | Deep Columnal Meadow Alkaline             |

4.1 Saline soil

Saline soils are often found on alluvial deposits and lacustrine deposits on low river and lake floodplains. Farmers call it "bright base", a small or porphyric distribution. The underground water buried depth of 1-1.5 meters, high degree of mineralization. Soil generally contains a large amount of salt. The section is not obvious, and the lower part often shows poor drainage. In addition to the marshy meadow, the surface of the earth is usually completely bare or the most salt-tolerant plant, and the surface has the accumulation of salt. The total amount of anions on the surface of the soil is often more than 10 to 20 mg / 100 grams. These saline soils, such as water and salt are not used for improvement, cannot be used as a land for agriculture and forestry or as part of grazing land and mowing pasture.[2]

4.2 Meadow soil

Meadow soil is developed in low-lying, groundwater or submerged soil, and soil of meadow plants. Its main feature is the high content of organic matter and humus layer thickness, soil aggregate structure better and more sufficient water. The formation of the waterloggedgenic meadow soil and humus accumulation process. Meadow soil humus humus layer, transition layer and the incubation layer.

4.3 Alkaline soil

The main distribution of meadow alkali soil in Songnen Plain. Meadow alkaline soils often appear in high river lake plain and the high floodplain. The underground water buried depth is about 0.20-0.25, lower degree of mineralization. The amount of salt in the soil is not high, and the total amount of the anion is 10 mg / 100g, which is mainly of carbonate and carbonic acid, and has very little chloride and sulphate. The sodium in the cation is the advantage of the yan, and the calcium and magnesium are very few. This kind of soil usually has a columnar and blocky B and leached layer A. The salt content and alkalinity are often highest in B, and there is a significant increase in mucograin.

5. The Formation of Saline Soil

Soil salinization is the natural factors and human disturbance factors. Salt accumulation process of natural soil, known as the primary farmland soil salinization. Due to anthropogenic factors caused by salt accumulation, the non saline soil into saline alkali soil, or light salt alkalization into strong saline soil.
soil and solonchak a process called secondary soil salinization.[4-5]

5.1 Natural factors

Songnen Plain is located in the continental monsoon climate zone of the north temperate zone, which is affected by the cold air of Mongolia and the monsoon of the ocean. Winter is cold with snow. The spring and autumn have more monsoon. During the whole year, the frostless period is shorter and the temperature of the same season. During the growth of crops, the difference between temperature and temperature is over 10 degrees Celsius, which is conducive to the growth of crops and grasses. Due to the common effects of continental and monsoon, the land in Daqing area has produced two special seasons, namely, "desalination" and "return to salt" season. It is a semi-arid area, with low rainfall and large amount of evaporation, which can easily accumulate in the surface of the soil. In particular, the spring surface water evaporates strongly, and the salt in the groundwater rises in the surface of the soil as the fine water rises to create a season of "return to salt". At present, some land in Songnen plain has become barren because of salinization. Land salinization poses a threat to people's life, production and the development of labor, agriculture, forestry and animal husbandry, which seriously restricts the sustainable development of local ecology. Therefore, the improvement of saline-alkali soil, restoration and restoration of ecological environment is imminent.

5.2 Human factors

The northeast originally had a lot of red land, fertile soil, but people's excessive reclamation cultivation, do not give the land resumption period to achieve suitable planting conditions. Over time, once the red land into saline soil, so that the loss of desalination layer, forming a large sheet of light, and there was no grass. And because of the "Northeast Sambo" existence, locals and people from all over the country to dig and hunt animals and plants, so that the original ecological environment has been seriously destroyed, leaving the surface of countless potholes. When it comes to heavy rain, the difference in the capacity of the soil is highlighted, and runoff pools the lowlands, swamping the grass and causing water. Wait until a large amount of soluble salt dries up and remains on the surface. In particular, dark alkali lattice because of water immersion, dense sheep grass thinning, evaporation is strong, the final step makes the soil slowly salinization and salinization formation.

6. Saline Soil Improvement Measures

6.1 Water improvement

The water conservancy project improvement measures of saline soil are based on the principle of "salt with water, salt with water", and salt and salt are drained by water. The usual methods include water washing, flooding and salt water irrigation. Water diversion were widely used around the world by flushing the salinity in the soil with the slope into the low-lying land or underground drainage tubes to reach the function of resoling the salt. Countries with rich water sources such as the United States and Canada are widely using the method. In the poor country of the unconditioned water and salt water, the salt and alkali are used to fill the salt and the alkali, and the effect is good. Research shows that the surface of the soil is covered by river silt during the rainy season. 5-7cm clay which can effectively prevent soil salinization after the drying of the sun and when the clay thickness reaches 28-36cm, the soil will not be salinized for more than 10 years. Reasonable use of salt water can also be used to desalinate the salinity of salt water.[3]
6.2 Biological improvement

Biological improvement of saline soil is mainly to borrow some strong salt resistance of trees or grass in saline-alkali land planted with avoid salt, salt secrete salt and hidden in the body and other biological characteristics to achieve the purpose of improving saline soils. Friends ji Grass, reed roots can be under the salt layer below and avoid salt to grow. Strange willow has special gland tissue will absorb the salt from the body and secrete it. Populus euphratica, salt alkali peng can convert the absorbed salts into the body of sodium bicarbonate.

7. Conclusion

The salinized soil in the songnen plain is widely distributed, and the area of secondary salinization and saline-alkali soil of the cultivated land are both increasing. With the continuous development of northeast China's revitalization strategy, the influence of saline soil on economic construction and human construction has become more and more important, which has become an uneschewed engineering project.

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