

# Study on the effect of soil amendment on saline-alkali soil

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## Abstract

**Soil salinization has an important effect on food security and ecological security of cultivated land. This paper has carried on the comprehensive comparison and analysis, the influence of the comprehensive analysis of the calcium material, acidic material, as well as the effect of organic modifier three kinds of modifier, which provided reference for the improvement of saline-alkali soil.**

## Keywords

**Soil; ameliorant; saline-alkali soil; effect of modified.**

## 1. Introduction

Saline-alkali soil refers to soil containing soluble salts with high concentration, which directly inhibit or harm plant growth. Saline-alkali soils are mainly distributed in the lowlands of the Northwest, North and Northeast plains, the lower edges of the lakeside or piedmont alluvial fans, and the coastal zone. According to the statistics of the Food and Agriculture Organization of the United Nations, the saline-alkali land area of China has 99.13 million hectares, among which the Yellow River Delta is bordering on the Bohai Sea and has 442,900 hectares<sup>[1]</sup>. Soil salinization can damage soil, reduce its productivity and hinder normal agricultural production, thus affecting crop yields. Therefore, in order to increase the yield, it is necessary to improve the saline-alkali land in order to increase the crop yield.

## 2. Saline-alkali soil improvement technology

Existing saline-alkali soil improvement technologies mainly include chemical improvement, physical improvement, water conservancy improvement and biological improvement<sup>[2-3]</sup>. Among them, chemical improvement is mainly to add chemical substances to the soil, apply gypsum, black alum and other amendments, reduce soil pH, improve soil physical and chemical properties. Physical improvement is to improve soil composition and structure by deep ploughing, leveling land, adding soil, covering grass, turning silt, covering sand, adding organic fertilizer, enhance soil permeability, and accelerate salt leaching. Water conservancy improvement is based on the law of "water and salt migration", to establish a perfect drainage and irrigation system, through underground infiltration pipes to discharge salt, combined with ditches, deep Wells drainage, continuous leaching and removal of salt in the soil, to prevent salt re-salting. Biological improvement refers to planting and turning green manure herbage, returning straw to the field, applying bacterial fertilizer, planting salt-tolerant plants, planting afforestation, etc., to improve soil fertility, improve soil structure, improve farmland microclimate, reduce surface water evaporation, and inhibit salt return. Comparison of the existing studies have found that biological improvement measures for cost is low, the advantages of environmentally friendly is considered to be the most effective modification, and improvement of vegetation improvement measures in improving the local productivity level at the same time, also can promote the virtuous cycle of vegetation, soil, the benign development of the ecological environment also play a crucial role in<sup>[4]</sup>. The purpose of this paper is to discuss

the effect of soil amendments on saline-alkali soil and to provide reference for the improvement of saline-alkali soil.

### 3. Effects of different amendments on saline-alkali soil

Saline-alkali soil amendments mainly contain calcium, acid and organic amendments. Calcium containing substances, such as gypsum, phosphogypsum, lime, etc., mainly by  $\text{Ca}^{2+}$  to replace  $\text{Na}^+$  as the mechanism of improvement; Acidic substances, such as sulfuric acid and its acidic salts, phosphoric acid and its acidic salts, mainly neutralizing alkali as the mechanism of improvement; Organic amendments, such as traditional humus (peat, weathered coal, green fertilizer, organic materials), industrial synthetic amendments (such as Shidijia, soil alkali modification agent CLS, Hekang, polymaleic anhydride and polyacrylic acid, etc.), industrial and agricultural waste, etc.

#### 3.1. Calcium containing substances

Calcium containing substances, namely direct calcium acting agents, are mainly used to replace  $\text{Na}^+$  in the soil adsorption complex by  $\text{Ca}^{2+}$ , so that harmful substances such as  $\text{Na}_2\text{CO}_3$  and calcium bicarbonate in the alkalized soil become harmless salts.

Tian Jiaming<sup>[5]</sup> et al. Study of exogenous calcium on saline soil in saline soil and the growth development and photosynthetic characteristics found that the influence of the saline soil after application of exogenous calcium not only delayed the peanut pods period of leaf aging, and before the pods period reduced leaf SPAD values drop, increase net photosynthetic rate, thus increasing the peanut is probably the matter accumulation of aerial part. Yin Xiaolin et al<sup>[6]</sup>. found in their study on the influence of calcium-containing waste on the growth of *Peduncilla* ash in coastal saline-alkali soil that calcium-containing waste could significantly increase Pn, Gs, Tr and WUE of white wax, maintain high chlorophyll content, reduce the adverse effect of soil salt stress on plants, and maintain the normal physiological function of plants in saline-alkali soil.

#### 3.2. Acidic substances

Acidic substances can provide hydrogen protons or can accept an electron pair of substances, according to material characteristics into organic acids, inorganic acids, according to the number of protons can be divided into monic acid, dionic acid...Polyacid, according to the strength of the material acid base strong acid and weak acid.

Wei Zhaohui<sup>[7]</sup> studied the effect of acid substances on the improvement of saline-alkali soil in DengMaying Lake, and found that among phosphogypsum (TP), sulfur (TS), Hekang (TH) and humic acid organic fertilizer (TF), among humic acid organic fertilizer had the best comprehensive improvement effect on saline-alkali soil. Zhou Yang<sup>[8]</sup> studied the effect of desulphurized gypsum and humic acid on the improvement of saline-alkali soil, and concluded that the salt composition of soil changed significantly after adding humic acid to the soil:  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{CO}_3^{2-}$  and  $\text{HCO}_3^-$  decreased significantly. The total salt content, total nitrogen, available phosphorus, available potassium, organic matter,  $\text{Ca}^{2+}$  and  $\text{SO}_4^{2-}$  increased significantly.

#### 3.3. Organic matter

Organic matter generally refers to the matter derived from life in the soil, which has the role of minerals and humification. Organic matter includes soil microorganisms, soil animals and their exudates as well as plant residues and plant exudates in soil.

Wang Guankai<sup>[9]</sup> the different organic fertilizer on the littoral clay saline soil organic matter, salt and the influence of wheat yield were found in humic acid conditioner and common organic fertilizer can improve the Binhai glue salt organic matter content, improve soil fertility, but also can obviously reduce the soil salt content, suppress soil accumulation of salt in the surface soil,

to reduce the surface soil salinity effect is remarkable. Wang Han<sup>[10]</sup> studied the improvement effect of different organic materials on coastal saline-alkali soil and believed that organic fertilizer, biological organic fertilizer, organic inorganic compound fertilizer and fermented bacterial bran could effectively improve the contents of soil organic matter, available phosphorus, available potassium and alkali-hydrolyzed nitrogen, and reduce soil pH, alkalinity degree, water-soluble salt content and electrical conductivity.

#### 4. Conclusion

How to improve soil has always been a hot topic for the majority of scholars, especially for the improvement of saline-alkali soil. Different amendments have different improvement effects on saline-alkali soil, but to achieve better and more thorough improvement, it is necessary to adopt the principle of "adapting measures to local conditions, using local materials and being economically feasible". Different improvement measures can be combined to give full play to better results.

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