

# Effects of Land Consolidation Projects on Cultivated Land Quality

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**Abstract:** In order to explore the improvement effect of land consolidation projects on soil physical and chemical properties, this paper takes Project A as an example to analyze the influence of soil structure and physical and chemical properties of the tillage layer before and after the implementation of the project. The results show that after the implementation of the land project, the soil pH value is lower than that before the implementation of the project. The increase range of available phosphorus content was significantly greater than that of available potassium, and the effect of sand covering on soil available phosphorus content was more obvious. The total nitrogen content of the soil decreased with the increase of soil depth. After 1 year of corn planting, the total nitrogen content increased compared with that before and after the project was implemented, and the organic matter content also increased. The implementation of the sand leveling project is beneficial to the improvement of the physical and chemical properties of the original saline-alkali soil.

**Keywords:** Land consolidation, Physical properties, Chemical properties, Cultivated land protection.

## 1. Introduction

Cultivated land resources are an important guarantee for food production and human activities. The central government clearly requires that the strictest cultivated land protection policy should be implemented to ensure that the red line of 1.8 billion mu of cultivated land will not be shaken. With the rapid and stable economic development, the importance of land resources has become more and more prominent. Therefore, it is the basic path that my country must adhere to for a long time in the future to continue to increase the development of unused land reserve resources and do a good job in the balance of occupation and compensation. Up to now, the reserve resources in the plain area have been exhausted, and only some reserve resources in the hilly area of Taiwan plateau have not been effectively developed and utilized, especially in the plateau area of Weibei, some barren land has not been fully utilized, which is not conducive to the rational and effective utilization of land resources. . Studies have shown that the implementation of land consolidation projects can effectively increase soil nutrients and improve crop planting effects.

## 2. Project Area Overview

The project area is located in A Village, Hebei Town, northeast of Longxian County, Baoji City, Shaanxi Province. It is 20 kilometers away from the county seat. °58'41". The project area is located in the western edge of the Weibei Plateau (mountain foothills of Guanshan Mountain), the terrain is high in the west and low in the east, the highest point is 2466 meters above sea level, and the lowest point is 800.2 meters above sea level. It belongs to the Yellow River system, and the main rivers include Qianhe and Beihe. It belongs to the warm temperate continental monsoon climate zone, the annual precipitation is 600 mm, the average accumulated temperature  $\geq 0^{\circ}\text{C}$  is  $4000^{\circ}\text{C}$ , the average accumulated temperature  $\geq 10^{\circ}\text{C}$  is  $3400^{\circ}\text{C}$ ; the frost-free period is 200 days; the annual average sunshine is 2033.3 h, the sunshine percentage is 46%,  $\geq 0$  The average sunshine in the period of  $^{\circ}\text{C}$

is 1605.5 h, the average sunshine in the period of  $\geq 10^{\circ}\text{C}$  is 1103.8 h, and the average annual temperature is  $10.7^{\circ}\text{C}$ . The main soil type in the project area is loess soil, and its fertility varies greatly with the length of cultivation time, fertilization conditions, types of planted crops, terrain location and degree of erosion. Generally, the upper layer is deep and pure, and the soil is poor in the middle, light in quality, loose in the mouth, water permeable and breathable, and good cultivating ability. The organic matter is deficient in nitrogen, relatively deficient in phosphorus, severely deficient in iron and zinc, poor in illumination, large in soil erosion and erosion patterns, and poor in water and fertilizer retention. With enhanced fertilization and management, wheat, corn and various grains can be grown. The average soil pH was 8.01, the average total nitrogen was 0.256 g/kg, and the average electrical conductivity was 1.35 ms/cm. In general, the organic matter content was low, the soil fertility was insufficient, and it was vulnerable to wind erosion and drought.

## 3. Influence of Land Leveling Engineering on Soil Physical Properties

The level of soil pH will reduce the availability of water-soluble nutrients in the soil, which will seriously hinder the normal growth and development of crops, thereby affecting the yield. Table 1 shows the composition of soil pH and soil particle size after the implementation of the land remediation project. It can be seen that after the construction of the land leveling project, the soil pH has been significantly reduced, and the soil pH of 0-10 cm is low, and 10 The pH value of the soil at ~20 cm is higher, and the pH value of the soil at 20-30 cm is lower. The pH value of the soil tillage layer is 3.81% lower than that before the implementation. The land leveling project can effectively improve the pH value of the surface soil. It can be seen that through the construction of land leveling project, the clay content in the soil is significantly increased, while the sand content in the soil is reduced, which is conducive to the formation of soil aggregates. After remediation, the clay content in the 0-30 cm soil depth range

increased by 36.34% compared with that before remediation, and the sand content in the 0-30 cm soil depth range decreased by 5.87% compared with that before remediation.

**Table 1.** Soil physical properties after project implementation

Soil thickness/cm	pH	cosmid	grit	powder
0~10cm	7.96	1.79	19.35	78.86
10~20cm	8.01	2.09	22.18	75.73
20~30cm	7.76	1.86	20.65	77.49

#### 4. Effects of Land Leveling Engineering on Soil Chemical Properties

Table 2 shows the soil nutrients within the depth range of 0-3 cm soil layer after the implementation of the project. It can be seen that the total nitrogen content of the soil before the implementation of the project, after the implementation and 1 year after the planting of corn is high at the surface layer, and with the soil layer The variation law of depth increases and decreases continuously, and is concentrated in the soil

tillage layer (0-20 cm), accounting for 56.49%, 50.93% and 63.35% of the total nitrogen in the range of 0-100 cm, respectively. Before and after the implementation of the project, the total nitrogen content of the soil is not much different, and the difference between the two is less than 20%. After the implementation of the project, the total nitrogen content of the tillage layer is slightly lower than that before the implementation of the project. This is mainly because the original saline-alkali soil has a higher salt content. high, which is not conducive to the growth and development of crops, but there is still a certain amount of total nitrogen content in the surface soil, and although a certain amount of nitrogen fertilization is carried out after sand covering, the decomposition and transport of nitrogen fertilizer has a certain delay. It shows that the total nitrogen content of the topsoil is slightly lower than that before the implementation of the project. With the planting of corn crops, the total nitrogen content of the soil has been significantly improved, which is 68.70% and 104.63% higher than that before and after the implementation of the project, especially in the soil ploughing layer, reaching the extreme value of 0.7 g/kg. This is due to the soil during the planting process. Fertilization, tillage and other measures have increased the total nitrogen content in the soil.

**Table 3.** Chemical properties of soil after project implementation

Soil thickness/cm	total nitrogen/ (g/kg)	Available phosphorus/ (mg/kg)	fast-acting potassium/ (mg/kg)	organic matter/ (g/kg)
0~10cm	1.87	10.91	187	13.76
10~20cm	2.06	11.72	176	12.82
20~30cm	1.92	11.03	167	12.76

#### 5. Benefit Analysis

Through the implementation of land remediation, the soil pH value was significantly reduced, and the soil pH value showed the distribution law of lower surface layer and higher deep layer. After 1 year of corn crop planting, the soil pH value continued to decrease, which also showed a trend of low surface layer and high deep layer. The soil pH value of the tillage layer decreased by 3.40% compared with that after the project was implemented. Before the implementation of the project, the change law of soil salinity with soil depth was not significant, but after the implementation of the project and after planting corn for 1 year, the soil salinity generally increased with the increase of soil depth. The implementation of the sand-covering project has a significant effect on improving the soil quality of the cultivated layer.

Before the implementation of the project, after the implementation and one year after planting maize, the total nitrogen content of the soil showed a change rule that the surface layer was high, and it continued to decrease with the increase of the soil layer depth, and it was concentrated in the soil tillage layer, accounting for 0~ 56.49%, 50.93% and 63.35% of the total nitrogen in the range of 100 cm. With the planting of corn crops, the total nitrogen content of the soil has been significantly improved, which are 68.70% and 104.63% higher than those before and after the implementation of the project, respectively. After the implementation of the sand leveling project and the development of crop planting, the content of soil available phosphorus and available potassium has been significantly improved. The overall soil available phosphorus content in the three stages showed a trend of first decreasing and then

increasing slightly with the increase of soil depth. The distribution is relatively balanced, and the distribution law of soil available potassium content is similar to the distribution law of soil total nitrogen content. The increase of available phosphorus content is significantly greater than that of available potassium, and the effect of sand covering in saline-alkali soil on the increase of soil available phosphorus content is more obvious. The implementation of projects such as sand leveling and soil fertilization is conducive to the improvement of soil organic matter. By planting corn, it provides a better activity site and oxygen supply for the accumulation of soil microbial communities, which intensifies the transformation efficiency of soil organic matter content. Planting corn The soil organic matter content after 1 year was 41.57% and 121.70% higher than that before and after the project was implemented. The implementation of the sand leveling project is beneficial to the improvement of the physical and chemical properties of the original saline-alkali soil.

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