Study on the Impacts of Land Consolidation Project on Soil Quality

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Abstract. Taking Sunjiacha Town, Shenmu City, Shaanxi Province as an example, the nutrient characteristics and physical and chemical properties of soil samples were studied and analysed. The results showed that the soil pH of X001 sample was the lowest, 7.7, and the total salt content of X002 sample was the highest, which was 1.3 g.kg-, while that of X008 sample was the highest, which was 32.85 mg.kg-. The highest content of soil organic matter was 84.3 mg kg-, the highest content of total nitrogen was 1.75 g kg-, the highest content of available phosphorus was 7.4 mg kg-, and the highest content of available potassium was 103 mg kg-. According to the National Classification Table of Soil Nutrient Content, the soil texture in the study area is sandy, pH is alkaline, available phosphorus and available potassium are deficient or extremely deficient. Except for the rich organic matter and total nitrogen in the black clay layer, the organic matter and total nitrogen in other layers are extremely deficient.

Key words: Land consolidation; soil quality; Sunjiacha town.

1. Introduction
At present, the rapid economic development leads to the reduction of cultivated land and the decline of cultivated land quality [1-2]. As an important means, land consolidation plays an important role in improving the quantity and quality of cultivated land. The purpose of this paper is to explore the impact of land consolidation on the improvement of soil fertility through a variety of research methods, taking Sunjiacha Town, Shenmu County, Yulin City, as an example, through the study of soil physical and chemical properties and nutrient characteristics in the study area after land consolidation, so as to provide reference and help for the implementation of similar projects in the follow-up.
2. Materials and methods

2.1. Natural conditions in the study area
The sampling site is 40 kilometers north of Shenmu City, Shaanxi Province. Its geographic coordinates are 110 degrees 21'3 east longitude and 39 degrees 09'12 North latitude. It belongs to semi-arid continental monsoon climate. Its main characteristics are severe cold and summer, dry climate, long cold winter, short summer, big temperature difference, average temperature 8.9 °C. The frost-free period averages 199 days a year and the shortest 128 days northwest wind. The average precipitation is 440.8 mm, and the precipitation is mainly concentrated in July-September. It covers 422.1 square kilometers, 25 administrative villages and 98 natural villages.

2.2. Soil Collection Method for Testing
According to the soil type and the distribution of crop varieties, according to the high, medium and low fertility of soil, 150 mu was sampled with a mixed sample of tillage layer. At least 3-4 mixed agrochemical soil samples were collected from the main farming soil species in each demonstration village. Sampling points are distributed in serrated or serpentine patterns. The sampling routes and schemes should be determined as evenly and randomly as possible. According to the thickness of tillage layer, the sampling depth is 0-20 cm [5]. Soil samples were collected by multi-point mixed soil sampling method, and each mixed soil sample consisted of 20 samples. The distribution range of sample points is not less than 3 mu. The depth and weight of soil taken at each point should beuniform, and the proportion of upper and lower soil samples should be the same. The sampler should be vertical to the ground and buried to a specified depth. Sample handling, storage and other processes do not contact metal appliances and rubber products, in order to prevent pollution. Each mixed sample usually takes about 1 kg. If too many samples are collected, the surplus soil can be discarded by "quartering method". Sample number and file record, sampling record, soil sample number, sampling location and longitude and latitude, soil name, sampling depth, sampling date, etc. [6-8].

2.3. Sample testing items and methods
Detection items: pH, total salt content, chloride ion, texture, organic matter, total nitrogen, available phosphorus and available potassium.
The instruments used for detection are: PHS-3C, HH-M8-S, Mastersizer 2000, SY-2, HHH8, UDK129, Lambda 650S and Model 420.
Detection methods: Determination of pH in Soil from NY/T 1377-2007; Soil Detection from NY/T 1121.16-2006 Part 16: Determination of Total Soil Water Soluble Salt; Determination of Chloride Ion Content in Soil from NY-T 1378-2007; GB/T 19077.1-2008 Particle Size Analysis by Laser Diffraction Part 1: General Principles; Soil Detection from NY/T 1121.6-2006 Part 6: Determination of Soil Organic Matter; "HJ 717-2014, Kjeldahl Method for the Determination of Total Nitrogen in Soil", "NY/T 1121.7-2014 Soil Detection Part 7 Determination of Soil Available Phosphorus", "Determination of Soil Available Potassium and Slow-Available Potassium Contents in NY/T 889-2004" [9-10].

3. Results and analysis

3.1. Physicochemical Characteristics of Soil
From the first table, it can be seen that the pH value of soil samples is X005 > X006 (X007) > X003 > X002 (X004) > X001, and the soil in the study area is alkaline; the total salt content of soil samples is X002 > X003 > X007 > X001 (X006 > X004 > X005), which shows that the soil in the study area belongs to middle saline soil; the chloride content of soil samples is X007 > X006 > X004 > X001. X005 > X003 > X002; soil sample organic matter size as follows: X001 > X006 > X003 > X002 > X004 > X005 > X007; soil sample available phosphorus content as follows: X001 > X002 > X003 > X006 > X005 > X004 > X007; soil sample available potassium content as follows: X001 > X006 > X007 > X002 > X004 (X005) > X003.
### Table 1. Soil sample test results of land consolidation project in Sunjiacha Town, Shenmu City

| sample number | pH  | Total salt content (g/kg) | Chloride ion (mg/kg) | organic matter (g/kg) | total nitrogen (g/kg) | Available phosphorus (mg/kg) | Available potassium (mg/kg) |
|---------------|-----|---------------------------|----------------------|-----------------------|-----------------------|----------------------------|------------------------------|
| X001          | 7.7 | 0.7                        | 12.69                | 84.3                  | 1.75                  | 7.4                        | 103                          |
| X002          | 7.9 | 1.3                        | 10.00                | 1.89                  | 0.14                  | 2.1                        | 30                           |
| X003          | 8.0 | 1.1                        | 11.23                | 2.53                  | 0.27                  | 1.6                        | 25                           |
| X004          | 7.9 | 0.7                        | 13.77                | 1.62                  | 0.16                  | 1.1                        | 28                           |
| X005          | 8.2 | 0.6                        | 11.25                | 1.07                  | 0.17                  | 1.3                        | 28                           |
| X006          | 8.1 | 0.6                        | 23.41                | 2.58                  | 0.22                  | 1.4                        | 71                           |
| X007          | 8.1 | 0.9                        | 32.85                | 0.768                 | 0.16                  | 1.0                        | 40                           |

3.2. Analysis of soil physicochemical properties and nutrient characteristics

From the experimental results in Table 1, it can be seen that the organic matter and total nitrogen content of soil samples at sampling site X001 are the highest, the available phosphorus and available potassium content are also higher, and the overall nutrient content is the best, and the soil quality is improved most obviously after treatment. The physical and chemical indexes of X007 were above the middle level except for the low content of available phosphorus. The physicochemical properties of the remaining samples at different sampling points differ slightly.

4. Conclusion

According to the National Classification Table of Soil Nutrient Content, the soil in Sunjiacha Town of Shenmu County is Sandy in 0-20 cm, and its pH is alkaline. The available phosphorus and available potassium are deficient or extremely deficient. Except for the black clay layer, which is rich in organic matter and total nitrogen, the organic matter and total nitrogen in other layers are extremely deficient. The physical foundation of each layer is silt, and the pH value is alkaline. Organic matter, total nitrogen, available phosphorus and available potassium are deficient or extremely deficient. According to the "Index of Soil Salinization Classification in China", the 0-20cm soil mass in the field belongs to mild salinization or non-salinization, and all layers belong to non-salinization.

References

[1] France. Land Consolidation in Bavaria—Rural Regionalization by Means of Land Consolidation [J]. Code Rural, 2003, 15(9), 18-20.
[2] Rainer MULLER-JOKEL. Land Readjustment- A Win-Win Strategy for Sustainable Urban Development [J]. TS14 Spatial Planning for Sustainable Development-Policies and Tools, 2004.
[3] Blume HP. Toward Sustainable Land Use [J]. Geoderma, 2002, 96: 1-2.
[4] Wang Z H, Li S X. Effects of N forms and rates on vegetable growth and nitrate accumulation [J]. Pedosphere, 2003, 13(4): 309-316.
[5] Chen G C, He Z L, Wang Y J. Impact of pH on microbial biomass carbon and microbial biomass phosphorus in red soils [J]. Pedosphere, 2004, 14(1): 9-15.
[6] Arshad M A. Tillage and soil quality ,Tillage practices for sustainable agriculture and environmental quality in differentagroecosystems [J]. Soil Tillage Res., 1999, 53(1):1-2.
[7] Mumrs R. Physiological. Processes limiting plant growth in saline soils: some dogmas and hypotheses [J]. PNatCellEnviron, 2005, (16): 15 ~ 24.
[8] Zhang T L, Pan J J, Zhao Q G. Progress and orientation of soil quality research. Soils, 1999, 31 (1): 1~7 (in Chinese).
[9] Brunetti G, Plaza C, Clapp C E, et al. Compositional and functional features of humic acids from
organic amendments and amended soils in Minnesota, USA[J]. Soil Biology and Biochemistry, 2007 (391): 1355–1365.

[10] M.A.N. Anikwe, C. N. Mbah, P. I. Ezeaku, et al. Tillage and plastic mulch effects on soil properties and growth and yield of cocoyam (Colocasia esculenta) on an ultisol in southeastern Nigeria [J]. Soil & Tillage Research, 2007 (93): 264 ~ 272.