ISSN: 2688-8645

Soil Quality, Soil Permeability and Organic Fertilizer Composition of the Stope

Xubo Sun[1, 2, 3, 4], Meng Yuan[1, 2, 3, 4]

[1]Shaanxi Provincial Land Engineering Construction Group Co., Ltd., China

[2]Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd., China

[3]Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Natural Resources, China

[4]Shaanxi Provincial Land Consolidation Engineering Technology Research Center, China

Abstract

The pH value of the organic fertilizer to be selected in the project area is 8.9, which is slightly higher than the standard value (5.5-8.5). It can be adjusted by using acid fertilizers (ammonium sulfate, ammonium chloride, potassium sulfate) and other measures. The nutrient content is slightly lower than the standard. It is recommended that supplementary chemical fertilizers be used to provide richer nutrients for the reconstructed soil in the project area to meet biological nutrition protection. The content of heavy metals in the toxicity index, the coliform community, and the mortality of roundworm eggs all meet the environmental quality requirements of organic fertilizer.

Keywords

Soil quality; Soil permeability; Potassium sulfate; Environmental.

1. Introduction

Soil quality evaluation refers to the evaluation of the degree of soil pollution according to certain principles, methods and standards. It is a single-element evaluation in the environmental quality evaluation system. In terms of content, it is generally divided into single evaluation and multiple evaluation; in terms of evaluation methods, the principles of effective, reliable, sensitive, repeatable and acceptable indicators shall be adopted; in the selection of evaluation indicators, effectiveness, Sensitivity, practicality, and versatility are the principles.

2. Test Purpose

(1) Grasp the soil physical and chemical properties and nutrient characteristics of the soil in the soil field to provide a basis for fertilization management in the project area.

(2) Grasp the soil permeability characteristics in the project area, and provide basic data for the later irrigation management of the paddy field and lotus root field in the project area.

(3) Grasp the physical and chemical properties and toxicity indicators of organic fertilizer (sheep manure) to provide a basis for fertilization and soil properties improvement in the project area.

3. Test Plan

3.1. Determination of Soil Nutrients in the Soil Field

The Hancheng Xiayukou Land Improvement Project was originally planned to have 3 quarries and 4 new quarries, for a total of 7 quarries. The soil field soil is used to cover the sandbank in the project area to construct a soil body configuration suitable for rice growth. The undisturbed soil is collected from each soil field to test its soil quality.

Collection of soil samples from the soil field: the soil is divided into three layers: the upper, middle and lower layers, respectively, to collect 3 soil samples each to form a mixed sample, the upper layer (0-2m), the middle layer (2-4cm), and the lower layer (below 4m). A total of 21 samples.

Soil sample measurement items: pH, conductivity, texture, organic matter, total nitrogen, available phosphorus, and available potassium.

Soil sample detection method: pH is measured according to "NY/T 1377-2007 Determination of Soil pH"; electrical conductivity is measured according to "Soil Agrochemical Analysis (Bao Shidan, Third Edition), Chapter 9 Analysis of Soil Water-Soluble Salt" ; The particle size composition (texture) is determined by the laser particle size analyzer method; the organic matter is determined according to "NY/T 1121.6-2006 Soil Testing Part 6: Determination of Soil Organic Matter"; the total nitrogen is determined by the automatic discontinuous chemical analyzer; effective Phosphorus was determined according to "Soil Agrochemical Analysis (Bao Shidan, Third Edition), Chapter 5 Determination of Phosphorus in Soil"; available potassium was determined according to "NY/T 889-2004 Soil Available Potassium and Slow Potassium Content Determination".

3.2. Determination of Soil Permeability

3.2.1 Determination of soil permeability of paddy field

The loess covered in the project area was collected from 7 different soil fields nearby, and the loess collected in each soil field was distributed in a specific area of the project area (Figure 1). Sampling and testing the soil permeability of different soil-covered areas. 1) Collect the undisturbed soil with a ring knife in each soil-covering area, and do an indoor saturated hydraulic conductivity experiment. A total of 7 soil samples are collected (Note: The soil in the project area uses a unified compaction method after covering 30 cm of soil, so there is no layered collection The undisturbed soil does the saturated hydraulic conductivity experiment).

2) In each soil coverage area, select representative points, level the soil surface, spread a layer of fine sand, and measure the soil permeability with a disc infiltration meter.

3) In each soil coverage area, select a representative point to divide a 1m2 (1m*1m) plot, build a 0.3m high soil wall around the plot, and pour water into the soil. Maintain a water surface of 20cm high, measure the falling height of the water surface within a unit time, and calculate the soil permeability at a stable falling speed. There are 7 points in total.

4) Determination method of soil permeability after beating

In the original test field without beating treatment, the silt layer thickness is 10 cm, and the water level of the bright surface is maintained at 10 cm. The drop height of the water surface in a unit time is measured, and the soil permeability is calculated at the stable drop rate. There are 7 points in total.

3.2.2 Determination of permeability of lotus root soil

The river beaches in the project area are not covered with soil, and a certain depth of soil is directly digged down to plant lotus roots. Select representative sample plots for lotus root fields in the project area to determine their soil permeability.

ISSN: 2688-8645

The self-priming water pump lotus root field was used for irrigation experiment. Two observation points were selected to record the flow rate of the pump, the irrigation area, the rising of the water surface during irrigation, and the descending height after the end of irrigation.

3.3. Composition Analysis of Organic Fertilizer (Sheep Manure)

Sample collection: The organic fertilizer comes from a sheep farm near the project area, and one mixed sample of organic fertilizer is uniformly collected.

Sample measurement items: pH, organic matter, total nitrogen, total phosphorus, total potassium, heavy metals (chromium, nickel, copper, zinc, arsenic, cadmium, lead), the number of fecal coliforms, and the mortality of roundworm eggs.

Sample determination method: pH, organic matter, total nitrogen, total phosphorus, total potassium according to "NY 525-2012 Organic Fertilizer"; heavy metals according to "GB 18877-2009 organic-inorganic compound fertilizer"; Ascaris egg mortality according to "GB/T 19524.2-2004 Determination of Ascaris Egg Mortality in Fertilizers"; Fecal coliforms are based on "GB/T 19524.1-2004 Ascaris Egg Mortality in Fertilizers".

4. Analysis of the Soil Composition of the Stope

4.1. Analysis of the Physical and Chemical Properties of the Soil in the Quarry

The physical and chemical properties of the soil quality of the stope are shown in Table 1. The soil quality of the high-yield paddy fields is mostly slightly acidic to neutral (pH 6.0-7.0), and the pH value of each layer of soil yard 1-7 ranges from 7.53 to 8.7. It is alkaline, so you should pay attention to adopting organic fertilizer or acid fertilizer (such as potassium sulfate) and other measures to lower the pH in the later stage.

A good paddy field soil texture should be such that the particle size of the soil meets 5% ≤ clay particles (particle size <0.002 mm) ≤ 10%, 50% ≤ powder particles (particle size 0.002~0.05 mm) ≤ 70%, sand particles (particle size 0.05~2 mm) ≤45% of the required sandy loam-loam or soil particle size meets the requirements of 10%≤clay particles (particle size <0.002 mm) ≤25%, sand particles (particle size 0.05-2 mm) ≤35% Of light clay. The soil quality of each soil field selected in the project area is silt loam, which meets the requirements for rice growth.

4.2. Analysis of Soil Nutrients

In order to meet the basic needs of the first year of crop growth in the newly added paddy fields in the project area, the soil nutrient index of the soil organic reconstruction is based on the nutrient non-deficiency level in the "China Soil Nutrient Classification Standard" (see Table 2) as the design goal. The soil nutrients of the soil sources in the project area are shown in Table 3. According to the "China Soil Nutrient Classification Standard", except for the middle layer of No. 1 soil field, the middle and lower layers of No. 2 soil field, and the No. 3 soil field, the organic matter content is at a medium to rich level. In addition, the organic matter content of the remaining soil fields is at a lack, a very lacking level, and a very lacking level. Except that the total nitrogen content of the lower layer of No. 3 soil field, the upper layer and the lower layer of No. 7 soil field is medium level, the total nitrogen content of the other soil layers is at a deficient to extremely deficient level. The indexes of soil available phosphorus and available potassium in each soil field are all at a lack level. When using the soil field soil to construct the farming layer, the nutrient level of the soil should be improved through fertilization management measures (for example, the fertility of the soil can be improved by adding exogenous organic fertilizers and applying nitrogen, phosphorus and potassium fertilizers) to meet the needs of rice growth.

5. Analysis of Soil Permeability of Newly Added Paddy Fields

According to the distribution of each soil field in the paddy field area during the organic reconstruction of the soil, the paddy field was divided into 7 areas (Figure 1), and the soil bulk density and the soil bulk density of the plough bottom after the organic reconstruction of each area were determined. Saturate the hydraulic conductivity, and set up field tests in each area to determine the permeability of the soil under natural conditions.

5.1. Analysis of Saturated Hydraulic Conductivity

In order to ensure the good growth of rice, the suitable bulk density of the soil plough bottom layer after reconstruction should be 1.6~1.7 g/cm3, and the saturated hydraulic conductivity should be 0.0375~0.0625 cm/h. The bulk density and saturated hydraulic conductivity of the plow bottom in each area are shown in Table 4. The bulk density index of area 5 and area 6 is slightly lower, and methods such as repeated compaction can be used to make it reach the standard. The saturated hydraulic conductivity index is relatively high, and measures such as beating and grinding ground can be used to reduce the saturated hydraulic conductivity. The average saturated hydraulic conductivity of the soil in the 7 regions is 0.23 cm/h. Calculated on the basis of 5000 mu of paddy field in the project area, the daily leakage is 184,000 m3.

6. Conclusion

(1) The 7 soil fields selected in the project area are all silt loam, which meets the requirements for rice growth. The soil is relatively alkaline, and measures such as organic fertilizer or acid fertilizer (such as potassium sulfate) can be adopted to reduce the pH in the later management and protection. The soil organic matter, total nitrogen, available phosphorus, available potassium and other main nutrients in the soil are generally low and in a state of lack. The soil quality can be improved by fully applying base fertilizer before rice planting; at the same time, scientific and reasonable Fertilization management measures are used to increase the nutrient content of the soil to meet the needs of crop growth; in addition, after the first crop is harvested, reasonable straws can be returned to the field to increase the organic matter content of the cultivated layer to meet the needs of later rice growth.

(2) Comprehensive paddy field saturation hydraulic conductivity test, disc infiltration test, field infiltration test without beating treatment, field infiltration test with beating treatment, field infiltration test and actual planting after beating and leveling rice field The situation is the closest, so the field infiltration test results after beating and leveling are used.

Calculated based on the area of 5,000 mu of rice field in the project area, if the rice field needs to maintain a water surface of 10 cm, it is recommended that the daily irrigation volume of the rice field in the project area during the initial stage of rice planting should be 5.12-256,000 m3. It will get smaller and smaller.

(3) The lotus root field was irrigated with a self-priming water pump of 80 m3/h per hour for about 2000 m2 lotus root field. During the pump irrigation process, the water surface was raised by an average of 1 cm/h, and the water was stopped by an average of 0.3 cm/h per hour. h. That is to say, under recent hydrological conditions, the daily drop water level of lotus root fields in the project area was about 7.2 cm/d during the initial planting. This situation should be fully considered in actual planting.

References

[1] Yan Yumin, Huang Zhanbin, Jing Shengpeng, et al. Application of humic acid in agricultural production [C]. Papers of the 8th National Symposium on New Technologies and New Products of Green Fertilizers (Pesticides), 2009.

[2] Zhang Zeyou, Wang Rongli, Wang Junan, et al. Peat development technology and application in agriculture [J]. Humic acid, 2001 (3): 50-55.

[3] Wang Hui, Wang Quanjiu, Shao Mingan. Effects of surface soil bulk density on nutrient transport along runoff on loess slope [J]. Journal of Soil and Water Conservation, 2007, 21 (3): 10-18.

[4] Luca Bragazza, Chris Freeman, Gu Xiaonan, etc. High available nitrogen can reduce polyphenol content in peat moss peat [J]. Humic acid, 2014 (5).