

The Effect of Applying Bioorganic Fertilizer on Soil Nutrients and Farmland Quality

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Abstract

Land consolidation projects are the basic measures for human utilization and transformation of nature, and are a necessary requirement for social and economic development. The results of land quality grading can provide a clear direction for land improvement related work. Based on the grading results, select areas with low natural quality but good utilization and economic levels for land consolidation, providing reliable basis for project approval of land consolidation, and providing data support for the establishment of relevant evaluation systems for land consolidation..

Keywords

Biological organic fertilizer; Soil quality; Soil nutrients; Quality of cultivated land

1. Introduction

The Central Committee of the Communist Party of China and the State Council attach great importance to the protection of arable land and the improvement of soil fertility, and resolutely focus on the construction of high standard farmland, improving construction standards and quality. Building high standard farmland is a key measure to consolidate and improve food production capacity and ensure national food security. In 2021, the 14th Five Year Plan and the 2035 Vision Goal Outline proposed to build 1.075 billion acres of concentrated and contiguous high standard farmland; The National High Standard Farmland Construction Plan (2021-2030) aims to build 1.2 billion mu of high standard farmland by 2030, and increase the average production capacity of newly increased standard farmland by about 100kg per mu; In 2021, the No. 1 central document of the Central Government proposed that 100 million mu of farmland with high yield and high standard should be built in 2021.

2. Overview of the project area

Qishan County is located in the western part of the Guanzhong Plain in Shaanxi Province, bordering Linyou County to the north, Taibai County to the south, Fufeng County and Meixian County to the east, and Fengxiang District and Chencang District to the west. Starting from Qili River in the east, reaching Fengminggou in the west, Wafanggou in the south, and Mengjia Mountain in the north, it ranges from 107° 33' E to 107° 55' E and from 34° 07' N to 34° 37' N. The rivers within Qishan County belong to the Wei River system, with the main rivers entering from Laobaozi Village in Caijiapo in the west and exiting from Taoyuan Village in the town in the east. The Wei River, with a length of 9.6 km, has an annual transit flow of 3.986 billion m³, an average flow of 126.39 m³/s, and an annual runoff of 4.84 million m³ within the county. Qishan County has complex and diverse landforms. It is bordered by Qishan to the north, Qinling to the south, and the central part is composed of a mountain front alluvial fan plain, loess plateau, and river valley terrace, forming a concave shape. Narrow from north to south, narrower from east to west.

3. Main content of construction

3.1. Exploration and Restoration Engineering of Farmland Quality

This plan aims to conduct a general exploration of the quality of cultivated land in the project area, with 222000 soil samples and 12 water samples collected. Through engineering measures, all cultivated land in the project area will undergo quality restoration.

3.2. Irrigation and drainage engineering

Build one new pumping station, four 300m³ regulating tanks, and three 200m³ regulating tanks.

The water supply pipeline includes DN800 steel pipe 2572m, DN700 steel pipe 1601m, DN600 steel pipe 19m, DN500 steel pipe 934m, DN400 steel pipe 257m, DN350 steel pipe 1564m, DN250 steel pipe 3348m, and DN200 steel pipe 504m.

Irrigation pipelines include DN63UPVC pipes of 17551m, DN75UPVC pipes of 10603m, DN90UPVC pipes of 10950m, DN110UPVC pipes of 7680m, DN125UPVC pipes of 4814m, DN140UPVC pipes of 5627m, DN160UPVC pipes of 4210m, DN180UPVC pipes of 6698m, DN200UPVC pipes of 3665m, DN225PE pipes of 539m, DN250PE pipes of 4819m, DN280PE pipes of 2493m, DN315PE pipes of 3659m, DN355PE pipes of 2099m, DN400PE pipes of 1590m, and DN450PE pipes of 1349m.

The pipe fittings include 270 63mm water hydrants, 166 75mm water hydrants, and 583 90mm water hydrants. There are 10 two-way gate valve wells, 92 three-way gate valve wells, 22 four-way gate valve wells, 182 drainage wells, and 11 pressure reducing valves.

3.3. Field road engineering

Construct a new 3m wide field road of 11.449km and renovate a 3m wide field road of 0.565km. Construct a 2.646km 2m wide production road.

3.4. Farmland Ecological Environment Restoration Project

Planting 8010 red leaf plums on both sides of the field road; Greening village roads for 5500m; 2900m of plain soil road renovation; 30500m of Tiankan renovation; Site leveling of 3000m²; Four village renovations were carried out, mainly by adding wooden fences around the houses, with a total length of 800m; Greening around the regulating pool. Basic principles of project construction

4. Assessment of cultivated land quality grades

4.1. Basic data collection, organization, and analysis

1. Collect and organize the annual updated evaluation results of cultivated land quality grades
Collect the updated evaluation results of county-level cultivated land quality in Qishan County in 2019, including databases, tables, and reports. Based on database data, determine the indicator area for evaluating the quality of cultivated land in Qishan County, standard farming system, designated crops and their light temperature (climate) production potential index, yield ratio coefficient, grading factors and their weight table, scoring rule table, equivalent area of land use coefficient, and soil economic coefficient.

2. Collect and organize the latest results of land change surveys

Collect the land change survey databases of Qishan County in 2018 and 2020.

3. Collect information on high standard farmland projects in Qishan County

Collect high standard farmland project planning and design, implementation plans, budget documents, design drawings, completion drawings, self inspection reports, etc.

4. Collect information on natural conditions

Collect data on the topography, climate, hydrology, soil type, soil organic matter content, surface soil texture, effective soil layer thickness, soil pH value, soil profile configuration, soil salinization degree, soil pollution status, and soil fertility in Qishan County and the project area.

5. Collect basic data related to new production capacity reporting and warehousing

Urban development boundaries, 25 degree slope range lines, mining rights, land improvement projects, nature reserves, ecological red lines, returning farmland to forests, construction land approval databases, etc.

4.2. Determine evaluation parameters and factors

1. Determination of classification factor indicator area

According to the "Classification Regulations for Agricultural Land Quality" (GB/T28407-2012), "Technical Guidelines for New Cultivated Land and New Production Capacity of High standard Farmland Projects in Shaanxi Province" (Trial), and "Technical Guidelines for Quality Grade Evaluation of Cultivated Land in Shaanxi Province" (Trial 2017), the national first level indicator area of Qishan County is the Loess Plateau area (VII), the national second level indicator area is the Fenwei Valley area (VII6), and the Shaanxi Province third level indicator area is the Guanzhong Weihe Plain area (VII302).

2. Determination of benchmark crops

The benchmark crop is the conversion benchmark for theoretical standard grain, which refers to the main grain crops that are widely planted in a certain region and have a significant impact on the national economy and people's livelihood. According to the "Regulations on Quality Grading of Agricultural Land" (GB/T28407-2012), "Technical Guidelines for New Farmland and New Production Capacity of High standard Farmland Projects in Shaanxi Province" (Trial), and "Technical Guidelines for Quality Grade Evaluation of Farmland in Shaanxi Province Land Improvement Projects" (Trial 2017), the benchmark crop in Qishan County is determined to be winter wheat, with a maximum yield of 550kg/mu.

3. Determination of designated crops

Designated crops refer to the crops involved in the standard farming system of the farming area under the jurisdiction of the administrative region. According to the standard farming system of Qishan County and the proportion of crop sown area in the total sown area in the multi-year statistical yearbook, and in accordance with the Standards of Agricultural Land Quality Grading Regulations (GB/T28407-2012), the Work Technology Guidelines for New Cultivated Land and New Capacity of High Standard Farmland Projects in Shaanxi Province (for trial implementation) and the Technical Guidelines for Grading of Cultivated Land Quality of Land Remediation Projects in Shaanxi Province (for trial implementation in 2017), the designated crops in the Weihe Plain in Guanzhong, the third level indicator area of Shaanxi Province, where Qishan County is located, are winter wheat and summer maize after demonstration by relevant experts.

4. Determination of standard farming system

The standard farming system is a widely adopted farming method in the local area, which is conducive to production or maximizes the potential of local land production at the current socio-economic level, production conditions, and technological level. It has great development prospects, does not cause ecological damage, and can meet social needs. According to the "Regulations on Grading the Quality of Agricultural Land" (GB/T28407-2012), "Technical Guidelines for Adding Cultivated Land and Increasing Production Capacity in High standard Farmland Projects in Shaanxi Province" (Trial), and "Technical Guidelines for Evaluating the Quality Grade of Cultivated Land in Land Improvement Projects in Shaanxi Province" (Trial 2017), a quick reference table for standard tillage systems in various counties (districts, cities) in Shaanxi Province was searched to determine the Guanzhong Weihe Plain, a third level

indicator area in Shaanxi Province where Qishan County is located. The standard tillage system is "winter wheat summer corn", and the multiple cropping type is "two crops a year".

5. Determination of basic parameters for farmland classification

(1) Designated crop light temperature (climate) production potential index

The production potential of light and temperature refers to the maximum yield that an ideal crop population can achieve under local light and heat resource conditions, when agricultural production conditions are fully guaranteed, water and CO₂ supply are sufficient, and other environmental conditions are suitable.

Climate production potential refers to the maximum yield that a crop population can achieve under the actual local conditions of light, heat, water, and climate resources, when agricultural production conditions are fully guaranteed and other environmental factors are in their optimal state. After further considering the limiting effect of precipitation on the potential production of light and temperature, the theoretical yield of crops is determined.

According to the "Regulations on Quality Grading of Agricultural Land" (GB/T28407-2012), "Technical Guidelines for New Farmland and New Production Capacity of High standard Farmland Projects in Shaanxi Province" (Trial), and "Technical Guidelines for Quality Grade Evaluation of Farmland in Shaanxi Province Land Improvement Projects" (Trial 2017), the designated crop winter wheat light temperature production potential index in Qishan County is determined to be 938, and the climate production potential index is determined to be 690; The production potential index of summer corn for light and temperature is 2055, and the climate production potential index is 1707.

(2) Specify the maximum crop yield and yield ratio coefficient

According to the "Regulations on Quality Grading of Agricultural Land" (GB/T28407-2012), "Technical Guidelines for New Farmland and Production Capacity of High standard Farmland Projects in Shaanxi Province" (Trial), and "Technical Guidelines for Quality Grading Evaluation of Farmland in Shaanxi Province Land Improvement Projects" (Trial 2017), the maximum yield of designated crops in Qishan County for winter wheat is 550kg/mu, and the maximum yield of summer corn is 650kg/mu; The yield ratio coefficient for winter wheat is 1.00, and the yield ratio coefficient for summer corn is 0.85.

(3) Specify the maximum yield cost index for crops

According to the "Regulations on Quality Grading of Agricultural Land" (GB/T28407-2012), "Technical Guidelines for New Farmland and Production Capacity of High standard Farmland Projects in Shaanxi Province" (Trial), and "Technical Guidelines for Quality Grading Evaluation of Farmland in Shaanxi Province Land Improvement Projects" (Trial 2017), the maximum yield of designated crops in Qishan County for winter wheat is 550kg/mu, and the maximum yield of summer corn is 650kg/mu; The total input for designated crops is 653.5 yuan/mu for winter wheat and 575 yuan/mu for summer corn; The designated crop yield cost index for winter wheat is 0.84kg/yuan, and for summer corn is 1.13kg/yuan.

5. Analysis of the evaluation results of cultivated land quality in the project area

There are 577 evaluation units for the quality of cultivated land in the Qishan area's high standard farmland construction project, with a total evaluation area of 22024.50 acres. The area weighting method is used to calculate the average national natural, utilization, and economic factors before and after the implementation of the high standard in the project area. Before and after the implementation of the project, the quality of cultivated land has significantly improved. Among them, the average increase in national natural resources is 2.4;

The average increase in national utilization is 2.2 grades; The average increase in national economy is 1.8.

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