

Effects of high-standard farmland construction projects on soil quality and arable land productivity

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Abstract

The quality of cultivated land and the level of grain productivity can be estimated through the evaluation of cultivated land grades, and some field engineering measures have a significant impact on the improvement of cultivated land grades. It is also an important goal of high-standard farmland construction to improve the level of arable land through engineering construction and thereby promote the improvement of grain production capacity. This paper studies the high-standard farmland construction in Qishan County, analyzes the impact of high-standard farmland construction projects on cultivated land quality and grain productivity, and provides necessary reference for the implementation of high-standard farmland construction projects

Keywords

High-standard farmland; land consolidation; soil quality; arable land productivity.

1. Introduction

Consolidating the basic position of agriculture, promoting the high-quality development of agriculture, and realizing the modernization of agriculture and rural areas are important tasks facing my country at present. The central government proposed that the construction of high-standard farmland with high yield, stable yield and high standard is a major strategy to implement "grain storage in the land" and "grain storage in technology". important measure. In recent years, the construction of high-standard farmland has become an important starting point for speeding up the "shortcomings" of agricultural infrastructure and helping rural revitalization. According to the economic and social development plan and rural revitalization plan and the requirements of the "National High-standard Farmland Construction Plan (2021-2030)", clarify the project area and schedule, and focus on fields, soil, water, roads, forests, electricity, technology, management, etc. Eight aspects, focus on the construction of high-efficiency water-saving irrigation projects. With the implementation of high-standard farmland construction, agricultural production conditions have been improved, and high-standard farmland has been built that is easy to cultivate and guarantees income under drought and flood, achieving a new situation of increasing grain production, agricultural efficiency, farmers' income, and rural greenery. Focusing on the goals and tasks of "leveling and fertile fields, supporting water conservancy facilities, smooth field roads, suitable forest network construction, advanced and applicable technology, high quality, high yield and high efficiency", focusing on irregular fields, completing soil improvement and soil fertility and fertilization has become the construction of high-standard farmland. basic means.

2. Introduction to the project area

The high-standard farmland project in Pucun Town, Qishan County is located in Pucun Town, Qishan County, Baoji City (107.716~107.749 107.716~107.749 °E, 34.474~34.510 °N), about 9km away from Qishan County, and the project involves 5 administrative villages. The landforms of Qishan County are complex and diverse. It is based on Qishan Mountain in the

north, Qinling Mountains in the south, and the central part is the piedmont alluvial fan plain, the loess plateau and the valley terrace, which is in the shape of a "concave". It is long and narrow from north to south and narrow from east to west. Mountainous areas account for 38% of the total area, original areas account for 50%, and river roads and river valleys account for 12%. The highest point in the territory is 2160 meters above sea level, the lowest point is 495m above sea level, and the relative height difference is 1665m. Qishan County has an average annual sunshine of 2066.6 hours, with a sunshine percentage of 47%, and August has the most sunshine hours with 213.6 hours and a sunshine percentage of 51%. September has the smallest sunshine hours at 142.0 hours, and the percentage of sunshine is 38%. The annual average temperature in the county is 11.9°C, and the hottest month is July with an average temperature of 24.9°C. Qishan County is located in the East Asian monsoon region. The precipitation has obvious seasonality, the dry and wet seasons are distinct, and droughts and floods occur from time to time. The distribution of precipitation in the four seasons is as follows: the minimum precipitation in winter is 18.4mm, accounting for 3% of the annual precipitation; the increase in spring is 144mm, accounting for 23% of the annual precipitation; the maximum precipitation in summer is 268mm, accounting for 42% of the annual precipitation; autumn precipitation The amount is 201mm, accounting for 32% of the annual precipitation.

The thickness of the tillage layer is 30 cm, the medium soil, granular and agglomerated structure, the bulk density of the tillage layer and the plow layer are 1.25 g/cm²-1.42 g/cm² and 1.40 g/cm²-1.78 g/cm², respectively; the porosity is 50.38%, respectively and 42.27%; the mature layer generally has an organic matter content of 1.0% to 1.2%, and a high content of total mineral nutrients. The total nitrogen is mostly 0.07% to 0.08%, and the total potassium is 2% to 3%, but the effective ingredients are low. More prominent, severe deficiency of boron, zinc, manganese and iron. The replacement amount of salt base in the plough layer is 10 me~14 me/100g soil, and the pH value is between 8.15~8.5, and the ability to maintain and supply fertilizer is good.

Through the comprehensive analysis of on-site reconnaissance and field survey combined with the on-site topographic map of the project area, it can be seen that the current cultivated land area of the project area is 1494.4003hm², the land reclamation rate and land utilization rate are both 100%, and the multi-cropping index of the project area is 2. The land reclamation rate and land utilization rate in the project area are relatively high, but due to the relatively imperfect supporting facilities in the project area, the utilization rate of water resources is low, and the yield rate of cultivated land is low. Therefore, in the follow-up planning and design, the land plots in the project area that need to improve supporting facilities should be designed and perfected, so as to increase the yield of cultivated land and improve the quality of cultivated land. The quality of the original cultivated land in the project area is between 8-12, the national utilization level is between 9-12, and the national economic level is between 10-12.

3. Analysis of Land Use Limiting Factors

Precipitation in the project area is generally high and unevenly distributed in time and space. Although there is Fengjiashan Reservoir nearby, its surface water resources are not effectively utilized, making water shortage a major limiting factor for land use and agricultural production development. Through the scientific use of surface water, rational allocation of water resources, the development of water-saving irrigation, and solve the problem of farmland irrigation water. Due to continuous cropping, unreasonable irrigation, heavy application of inorganic fertilizers and other reasons, agricultural production in the project area has resulted in imbalance of soil nutrients, damage to microbial populations, and enrichment of pesticide residues, thus reducing crop yield and quality, restricting land Increased productivity. During the

implementation of the project, the application of bio-organic fertilizers will improve soil conditions and increase the level of land production.

For a long time, these factors have restricted the improvement of the comprehensive agricultural production capacity of the project area, and also restricted the improvement of the land utilization rate and output rate of the project area, and greatly affected the production enthusiasm of local farmers. It is urgent to solve the obstacle factors through scientific planning and design, and improve the utilization rate and output rate of land in the project area.

4. Analysis of the productivity of arable land

At present, the main problem of grain production in Qishan County is the low productivity of the land. The reason for the low output is the low effective utilization of water resources, and the situation of both shortage and waste of water resources. Whether water resources can be effectively utilized is the main issue that determines the increase of grain production in Qishan County, and it is the bottleneck of improving land productivity. If the effective utilization rate of water is increased by 10%-20% from the current level, the production potential of the land will have a very significant breakthrough. In accordance with the high-standard farmland construction project plan, Qishan County will vigorously promote the construction of pipe irrigation projects in well irrigation areas to improve water use efficiency; at the same time, it will increase the supporting facilities for continued construction and water-saving renovation of irrigation areas. Mechanistic water saving will follow the water management system of "total control, quota management, excess rewards and fines, association autonomy, government guidance, and public participation" to form water user associations, break through the model of relying solely on engineering water saving, and vigorously implement comprehensive agricultural conservation. Water, solve the problem of drinking "big pot of water" and wasting water, and achieve the purpose of saving water and reducing the burden on farmers.

The total area of the project area is 1494.4003hm², of which irrigated land is 174.4185 hm², accounting for 11.67%, and dry land is 1319.9818 hm², accounting for 88.33%. Through the comprehensive analysis of on-site reconnaissance and on-site investigation combined with the on-site topographic map of the project area, it can be seen that the current cultivated land area of the project area is 1494.4003 hm², the used land area is 1494.4003 hm², the land reclamation rate is 100%, and the crops in the project area are one The second cropping year, the multiple cropping index of arable land is 2. The land reclamation rate and land utilization rate in the project area are high. However, due to the self-development of farmers, the water resources utilization rate in the project area is low, and there is basically no irrigation facilities. Therefore, in the follow-up planning and design, the land plots in the project area that need to improve supporting facilities should be designed and perfected, so as to increase the yield of cultivated land and improve the quality of cultivated land.

5. Project construction content

The construction content of the project mainly includes land leveling, soil improvement, irrigation and drainage, field roads, farmland power transmission and distribution, etc. The details are as follows:

(1) Land leveling works

This time the land leveling area is 2500 mu, and the earthwork volume is 700400m³.

(2) Soil improvement project

The soil is improved by applying organic fertilizers, covering an area of 3,000 mu.

(3) Irrigation and drainage works

A new pumping station will be built, with 750m of DN500 straight steel pipe, 2650m of DN400 straight steel pipe, and 2780m of DN350 straight steel pipe. The water main pipeline project lays 9300m of dn225UPVC pipe, 14200m of dn160UPVC pipe, the irrigation pipe network project lays 64500m of dn110UPVC pipe, 387 valve wells and 1290 sets of water supply hydrants.

(4) Field road engineering

Renovation of 4m wide field road 4.3km, refurbishment of 4m wide production road 13.1km.

(5) Farmland Protection Project

3275 oriental orientalis trees and 1075 red leaf plums were planted in the road protection forest.

(6) Farmland power transmission and distribution project

1 new S13M-4000/35/10kv transformer, 1 S13M-250KVA-10/0.4KV transformer, 2.7km of 10kV cable, 4.26km of 380V cable, 3.00km of 35kV line, and 1.00km of communication cable. 1 set of supporting computer monitoring system, 1 set of video surveillance system, 1 set of DC power supply system, 1 set of tool software.

6. Analytical method for equivalence assessment of cultivated land

According to the "Grading Regulations on Agricultural Land Quality" (GB/T 28407-2012), this evaluation adopts the multi-factor comprehensive analysis method to evaluate the quality of cultivated land for land consolidation projects. According to the evaluation results of the quality of cultivated land in Qishan County, combined with the project data, the basic parameters, evaluation factors, factor scores and weights required for the evaluation of the quality of cultivated land are determined. Cultivated land quality and other assessment. By collecting the information value of the evaluation index of cultivated land quality grade, calculate the natural quality score of the designated crops in each grading unit, and calculate the natural quality index of cultivated land according to the light temperature (climate) production potential index and yield ratio coefficient, and update the land use coefficient and land economy. Coefficients to calculate the cultivated land use index and economic index, and on this basis, the equal spacing method is used to divide the natural quality, utilization and economic levels of cultivated land in the province. Calculate the national-level equivalence index of the grading unit, and determine the national-level natural quality, utilization, economy, etc., according to the prescribed conversion formula between the national equivalence index and the grade. The newly added grain production capacity is calculated according to the increase of 100 kg/mu of production capacity for each grade of arable land.

According to the "Grading Regulations on Agricultural Land Quality" (GB/T 28407-2012), the grading factors for the selection of designated crops in the Weihe Plain of Guanzhong, where Qishan County is located are: effective soil layer thickness (cm), surface soil texture, soil salinity Chemical degree, soil organic matter content (g/kg), drainage conditions, terrain slope, irrigation guarantee rate and irrigation water source.

Table 1 Grading factors and weights of designated crops in the Weihe Plain of Guanzhong

factor crop	effective soil thickness(cm)	topsoil texture	degree of soil salinity	soil organic matter content(g/kg)	drainage conditions	terrain slope	irrigation Guarantee Rate	irrigation water
winter wheat	0.17	0.07	0.10	0.18	0.07	0.10	0.25	0.06
summer corn	0.15	0.07	0.09	0.16	0.07	0.10	0.29	0.07

This report adopts the "multi-factor comprehensive evaluation method" to evaluate the cultivated land in the project area, and conducts the evaluation in strict accordance with the "Classification Regulations for Agricultural Land Quality" (GB/T 28407-2012). The parameters specified in the "Evaluation Work Manual" (2014) are updated annually and formulated according to the actual situation, so the evaluation results are reasonable and reliable. After the implementation of the project, the national natural quality level is between 8-9, the national utilization level is between 9-10, and the national economic level is between 10-11. Between 8-12 grades, national utilization grades between 9-12 grades, and national economic grades between 10-12 grades. It is estimated that the new grain production capacity will be 3859.65t.

7. Related Suggestions

The construction quality and later management and protection of the project are closely related to the quality of cultivated land. Therefore, in order to ensure that the quality of cultivated land meets the design requirements after the implementation of the project, the following suggestions are put forward for this project:

- (1) According to the project construction drawing design, combined with the current technical specifications, standards, etc., formulate strict quality supervision standards, and strictly control the construction quality.
- (2) Establish and improve the project management and protection system, clarify the management and protection unit, the main responsible person, the management and protection responsible person and their respective rights and responsibilities.
- (3) Establish a project management and protection fund guarantee system, clarify the fund-raising channels, and establish the responsibilities for the collection, use, approval and supervision of funds.

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