

The Impact of High Standard Farmland Construction Projects on the Improvement of Farmland Quality and Grain Production Capacity

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Abstract

On the basis of analyzing the basic situation and construction conditions of high standard farmland construction in Qishan County, this article focuses on studying the social and economic benefits after construction, and estimates the new production capacity of high standard farmland construction projects. The results show that the implementation of the project is conducive to improving agricultural production conditions, improving the quality of arable land, increasing farmers' income, achieving a production value of 2.2747 million yuan, and achieving an additional grain production capacity of 532 tons, greatly enhancing the efficiency of high standard farmland construction projects.

Keywords

Water Conservancy Engineering; Construction; Safety Management; Quality Control.

1. Introduction

As the foundation of food production, the quality of farmland not only affects the grain yield, but also relates to the quality of agricultural products, which is the foundation of food security. At the same time, as an important component of the ecosystem, farmland and soil are important carbon sinks, playing an important role in promoting green and low-carbon development of agriculture and promoting the construction of ecological civilization in agriculture and rural areas. The Central Committee of the Communist Party of China and the State Council attach great importance to the protection of arable land and the construction of high standard farmland, continuously improving the ability to ensure food production. Major plans such as the "Rural Revitalization Strategic Plan (2018-2022)" and the "National Agricultural Modernization Plan (2016-2020)" have made arable land protection and construction an important content. According to the Opinion of the General Office of the State Council on Effectively Strengthening the Construction of High Standard Farmland and Enhancing the National Food Security Guarantee Capacity (Guo Ban Fa [2019] No. 50) issued by the State Council, it is pointed out that ensuring the supply of important agricultural products, especially grain, is the primary task of implementing the rural revitalization strategy. Building high standard farmland is a key measure to consolidate and improve food production capacity and ensure national food security.

This year, the No. 1 central document of the central government proposed to implement a new round of high standard farmland construction plan, and to build 100 million mu of high standard farmland with high yield and stable yield by 2021. According to the Implementation Plan for Preventing the "Non grain Conversion" of Cultivated Land and Stabilizing Grain Production in Shaanxi Province (Shaanxi Government Office [2020] No. 37), it is necessary to firmly maintain the red line of cultivated land, focus on grain production goals and tasks, implement the strictest farmland protection system in accordance with the requirements of "strong supervision, stable foundation, increased production capacity, and guaranteed supply",

firmly curb the increase of "Non grain Conversion" of cultivated land, and solidly promote the implementation of the "Two Tibet" strategy, Strengthen the construction of grain production functional zones and high standard farmland, strengthen scientific and technological equipment support, improve the grain production support and protection system, ensure that the grain planting area does not decrease, production capacity increases, and yield does not decrease, the self-sufficiency rate of major grain varieties steadily increases, the foundation of grain production is more stable, and the ability to ensure food security is significantly enhanced. In 2021, the Shaanxi Provincial Department of Natural Resources issued the "Notice on Standardizing the Management of Farmland Quality Improvement Projects and Effectively Implementing the Balance of Occupation and Compensation" (Shaanxi Natural Resources Zigengfa [2021] No. 14), which pointed out that the focus is on improving the quality of farmland, vigorously implementing high standard farmland construction projects, and increasing and supplementing the grain production capacity of farmland. The dual improvement of economic and production efficiency through the construction of high standard farmland has become an inevitable trend in the current development of high standard farmland construction.

2. Basic Overview of the Project Area

The project area is located in Qishan County, Baoji City, Shaanxi Province. The research area is located in a warm temperate semi humid and semi-arid monsoon climate, with an average annual temperature of 14.4 °C and a precipitation of 514mm. The terrain is flat, the soil is fertile, and the irrigation conditions are superior. The Luohui Irrigation Area, the Yellow River Drainage Area, the Wei River Drainage Area, and the Shayuanjing Irrigation Area cover the entire county, with an effective irrigation area accounting for over 80% of the total arable land. The total land area within the construction scale of the project area is 238.9997 hm², of which 89.2083 hm² is irrigated land, accounting for 37.33%; The dry land area is 149.7914 hm², accounting for 62.67%. The land reclamation rate and land utilization rate in the project area are both high, but due to the independent development of farmers, the water resource utilization rate in the project area is low, the supporting facilities are relatively incomplete, and the yield rate of farmland is low. Therefore, in the subsequent planning and design, the plots in the project area that need to improve supporting facilities will be designed and improved to increase the yield of arable land and improve the quality of arable land. According to the farmland quality grading database of Dali County, the current farmland in the project area is mostly classified as Grade 11 for dry land and Grade 9 for irrigated land.

3. Analysis of Project Construction Conditions

3.1. Transportation Facilities

The external transportation conditions of the project area are relatively good, and the transportation is convenient and fast. The village level hardening is basically interconnected. The layout of the field road route is unreasonable, and the route bends with turns, with steep slopes, sharp turns, and narrow roads. The roadbed is of soil structure, with varying widths. Due to severe water flow damage to the roadbed, many parts of the roadbed are uneven and the overall road is severely damaged, which is not conducive to agricultural machinery entering the field for operation.

3.2. Status of Field Irrigation and Drainage Facilities

The current water source in the project area is relatively sufficient, but the irrigation facilities are not complete. There are relatively few irrigation and drainage facilities in the fields, and the distribution of irrigation and drainage in each plot is uneven during the high water season, with

significant differences. The matching irrigation and drainage facilities are not reasonably allocated, and some roads are damaged and the leakage loss of channels during soil irrigation is relatively serious, resulting in a low water utilization coefficient.

3.3. Road Condition Analysis

There are relatively few irrigation and drainage facilities in the field of the project area, and during the rainy season, the distribution of irrigation and drainage in each plot is uneven, with significant differences. Therefore, there is no reasonable allocation of supporting irrigation and drainage facilities. Most of the well houses in the project area lack supporting facilities and have damaged irrigation channels, which are currently unusable, resulting in a low water utilization coefficient. The layout of the field road route is unreasonable, and the route bends with turns, with steep slopes, sharp turns, and narrow roads. The roadbed is of soil structure, with varying widths. Due to severe water flow damage to the roadbed, many parts of the roadbed are uneven and the overall road is severely damaged, which is not conducive to agricultural machinery entering the field for operation.

3.4. Terrain Condition Analysis

Other grasslands in the project area have uneven terrain and uneven terrain, which is prone to soil erosion. The water and soil loss in the project area is mainly manifested by hydraulic erosion. If it is washed by rainstorm in flood season, it will lead to the destruction of fertile land, the decline of soil fertility, and affect agricultural production. Improve the impact of other grassland topography in the project area on agricultural production through land leveling projects. For a long time, these factors have constrained the improvement of the comprehensive agricultural production capacity in the project area, as well as the improvement of land utilization and output rate in the project area, greatly affecting the production enthusiasm of local farmers. There is an urgent need to address obstacles through scientific planning and design, and improve the utilization and output rate of land in the project area.

3.5. Soil Condition Analysis

Due to continuous cropping, unreasonable irrigation, and heavy application of inorganic fertilizers, agricultural production in the project area has caused soil nutrient imbalance, microbial population damage, and pesticide residue enrichment, resulting in a decrease in crop yield and quality, which restricts the improvement of land productivity. During the implementation of the project, increasing the application of bio organic fertilizers will improve soil conditions and increase land production levels.

3.6. Analysis of Arable Land Production Capacity

This project is a high standard farmland construction project, with the goal of building high standard basic farmland. Based on the overall land use planning and land remediation planning, land remediation activities are carried out in key areas and major projects of rural land remediation, basic farmland protection areas, basic farmland preparation areas, etc. Through rural land remediation construction, concentrated contiguous areas, supporting facilities, high and stable yields, good ecology, and strong disaster resistance are formed, Build basic farmland that is compatible with modern agricultural production and management methods. Therefore, through the implementation of the project, the quality of cultivated land has been improved, and production conditions have greatly improved, but there has been no new cultivated land. Through on-site exploration and investigation combined with the comprehensive analysis of the topographic map of the project area, it can be concluded that the current arable land area in the project area is 238.9996hm², and the utilized land area is 238.9996hm². The land reclamation rate is 100%, and the land utilization rate is 100%. The crops in the project area are harvested twice a year, and the cultivated land multiple cropping index is 200%. The land

reclamation rate and land utilization rate in the project area are both high, but some of the cultivated land is developed independently by farmers. The water resource utilization rate in the project area is low, and the supporting facilities are relatively incomplete. The output rate of cultivated land is low, and the quality level of dry land is low. Therefore, in the subsequent planning and design, the plots in the project area that need to improve supporting facilities will be designed and improved to increase the yield of arable land and improve the quality of arable land.

4. Main Construction Content

The current situation of the project area is the cultivated land operated and planted by farmers. Based on the terrain and planting structure of the project area, local fields will be leveled, and fine farmland will be integrated into concentrated and contiguous areas for mechanical cultivation. The sorted fields are required to be conducive to the normal growth of crops, mechanical farming in the field, and meet irrigation and drainage needs. After the land leveling is completed, soil improvement needs to be carried out on the cultivated land to improve its quality. Common improvement measures include the application of technologies such as returning straw to the field, increasing organic fertilizer application, deep soil improvement, and recycling of residual film. The improvement standard should meet the requirements for improving soil organic matter. Bioorganic fertilizer should be applied at a standard of 100kg/mu, with a total of 358 tons. Measures to improve soil organic matter should be implemented continuously for at least 2 years. Bioorganic fertilizers should comply with the requirements of Organic Fertilizers (NY525-2011). The project area mainly draws water from Luohui Canal and Erhuang Canal, as well as utilizes existing motor wells for field irrigation. The project plans to maintain and repair part of the water conveyance channels of the existing irrigated land, and build new irrigation channels to irrigate the surrounding dry land plots that can be covered; For other dry lands, use existing machine wells or pump houses to lift water to low-pressure pipelines in the fields for irrigation. The project plans to repair, build new channels, and bury low-pressure pipelines for water transmission. The field road engineering is the skeleton of high standard farmland block division and an important component of the transportation network in the entire project area. The main purpose of the project is to renovate the existing dirt roads in the project area and combine them with the Dou and Nong channels, connecting them with existing roads inside and outside the area. Based on the requirements of implementing ecological civilization construction, new requirements have been put forward for the ecological construction of high standard farmland construction projects, which not only focus on land leveling and the construction of supporting facilities, but also promote farmland protection and ecological environment construction, adjust and optimize the layout of farmland structure, play the role of farmland landscape and ecological functions, and establish a sustainable development of farmland ecological environment.

5. Benefit Analysis

After the completion of the project, a relatively complete field road system and farmland irrigation and drainage system will be formed. The inconvenient cultivation and reliance on weather in the project area will be completely changed, and the quality of arable land will be comprehensively improved. The arable land will meet the land standards of drought and flood protection. In addition, the agricultural production conditions in the project area have been improved, land use efficiency and agricultural production efficiency have been improved, the agricultural foundation has been consolidated, the development momentum of agricultural comprehensive production capacity has been strengthened, and a solid foundation has been laid for the adjustment of agricultural industrial structure and the increase of farmers' income.

At the same time, the infrastructure of farmland will be more complete, and the productivity of farmland will gradually increase, which is beneficial for farmers to apply advanced production technologies, improve agricultural production structure, increase yield and improve agricultural product planting structure, develop diversified management, reduce production costs and risks, thereby increasing farmers' income, improving farmers' living conditions, narrowing the wealth gap, and promoting the sustainable development of the economy in the town where the project area is located. In addition, it will provide and accumulate experience for the comprehensive management of farmland, water, and roads in the local area; Through land consolidation, the cultivated land in the project area can be concentrated and connected, laying a solid foundation for the construction of high-yield farmland. It will also greatly increase grain production, reduce agricultural production costs, and provide a significant demonstration for large-scale agricultural production and operation in other regions. It is also a major measure for the country to ensure food security, Enable the general public to understand and support land consolidation work, thereby promoting the comprehensive, long-term, in-depth, and smooth development of land consolidation work. After the implementation of the project, the agricultural production conditions in the project area have been improved, and the land output rate has been increased. The focus of economic benefit analysis is mainly on the benefits generated by cultivated land, that is, the benefits brought about by the increase in yield per unit area. Before the implementation of the project, the cultivated land and other planting areas were 238.9996hm². Due to weak water conservancy facilities, the cultivated land in the project area could not be irrigated sufficiently and timely, seriously affecting crop yield.

6. Analysis of Productivity Benefits of Cultivated Land

According to the "Regulations on the Grading of Agricultural Land Quality" (GB/T 28407-2012) and "Quality Grades of Cultivated Land" (GB/T 33469-2016) standards, based on the land use status map of the project area, a single unit division is carried out for the relatively concentrated and contiguous cultivated land within the project area, with consistent land types, little difference in current situation, and consistent reference scores for grading factor indicators.

The increased production capacity of high standard farmland construction=(average quality grade of farmland before construction - average quality grade of farmland after construction) × High standard farmland construction area × fifteen × one hundred.

In the formula: D - Capacity calculation constant, $D \leq 16$ (when the capacity is 0, $D=16$).

15- represents 1 hectare=15 acres.

100- represents mu/kg.

The average national utilization level of the original cultivated land in the project area ranges from 7 to 11. After the implementation of the project, the dry land is transformed into irrigated land, effectively improving the quality of the cultivated land in the project area. The national utilization level of the original cultivated land is increased by one grade compared to before the implementation, adding 100 kg of new grain production capacity and 532 tons of new grain production capacity.

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