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The application effectiveness of farmland water conservancy in the construction of high standard farmland

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Abstract

The water-saving and grain increasing project is an important measure to ensure food production and safety, improve soil quality, and protect arable land. It is also an effective means to promote rural revitalization. Taking the high standard farmland construction project as an example, combined with the soil and water resources, farmland water conservancy, and hydrogeological conditions of the project area, this study evaluates the impact of water-saving and grain increasing projects on farmland quality, and preliminarily estimates the production capacity of the project area. The results show that the implementation of the water-saving and grain increasing project can increase the original cultivated land by an average of 1-2 grades, achieve grain yield increase, and have significant economic benefits.

Keywords

High standard farmland; Water conservancy engineering; Farmland water conservancy; Water conservation; effect.

1. Introduction

In the current situation of limited land resources, it is necessary to make more efficient use of limited resources such as arable land and water in agricultural production, pay attention to the protection of agricultural ecological environment, and attach importance to sustainable development of agriculture. Therefore, in order to achieve the goal, it is necessary to strengthen the scientific and technological research and development of agricultural production, improve the professional skills and management level of farmers, optimize the agricultural industry structure, and continuously improve the competitiveness and sustainable development level of China's agriculture by introducing advanced foreign technologies and experiences. The water-saving and grain increasing project is an important measure to steadily improve agricultural production capacity, promote rural economy and modern agricultural development. In view of this, the article takes the Longcheng District water-saving and grain increasing project in Chaoyang City as an example, and through a comprehensive analysis of the actual conditions and construction content of the water-saving and grain increasing project area, studies and evaluates the impact of project implementation on improving the national utilization of arable land and grain production capacity, aiming to provide guidance and reference for further optimizing the water-saving and grain increasing project plan.

2. Project area overview

The project area is located in Fengxiang District, Baoji City, Shaanxi Province. It belongs to the warm temperate continental monsoon climate zone, with semi humid and semi dry early. The annual average temperature is 11.4 ℃, the average temperature of the coldest month is -5 ℃, the maximum frozen soil depth is 0.26m, the precipitation is 625mm, and the frost free period is 209 days. The four seasons are distinct throughout the year, with winter and summer being

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long and spring and autumn being short; Rain and heat in the same season are beneficial for crop growth. However, during the growing season of crops, there is strong solar radiation, significant interannual variations in temperature and precipitation, and drought is also prone to occur. Due to the influence of terrain, there is a significant difference in climate between the north and south of the project area. The average annual temperature in the southern plateau area is 4.2 ℃ higher than that in the northern mountainous area. The frost free period is about 20 days longer, and the annual precipitation is about 100mm less. The soil layer in the project area is deep and fertile, and the soil in the area is mostly sandy loam and yellow loess. Sandy loam soil refers to soil with moderate clay, silt, and sand content in its particle composition, and its sand content can reach 55% -85%. Between loam and sandy soil. The soil has a high nutrient content, loose soil, is well ventilated and permeable, not sticky or hard, and is suitable for cultivation, but has poor fertilizer and water retention. When fertilizing, the principle should be to eat less and eat more meals, apply it frequently and sparingly to prevent fertilizer loss. Huangmian soil is an agricultural soil formed by cultivation and maturation of loess sediment - loess parent material in different strata. The cultivated layer of agricultural land is loose and soft, with weak cementation, easy to scatter, uniform texture, and good permeability and ventilation.

3. Project construction conditions

3.1. Current situation of land leveling

The land leveling project in the project area is located in Sanlihe Village, Chengguan Town, with good soil quality, gentle terrain, close proximity to the village, and convenient transportation. But the local slope of the field is relatively large and uneven, which affects cultivation. Soil fertility is the foundation of land productivity. According to the soil nutrient analysis report provided by the Agricultural Technology Extension Service Center of Fengxiang District, the soil in the project area has low organic matter and moderate nitrogen, phosphorus, and potassium. In order to achieve the overall goal of high and stable yield, and to achieve the goal of fertile and flat land, according to the standards of high standard farmland, the soil nutrients in farmland should reach a moderate level or above. Therefore, it is necessary to conduct soil testing and fertilization to increase soil nutrient content.

3.2. Current status of irrigation and drainage engineering

The existing well depth in the project area is 80-200m, with an average water output of 32m^3/h. Due to aging, some wells have problems such as no well room, damaged water pumps, and incomplete supporting facilities, resulting in low utilization efficiency of the wells. There are currently 201 machine wells in the project area, including 21 machine wells in Sanlihe Village, Chengguan Town, 21 organic wells in Daxin Village, 8 organic wells in Tofu Village, 22 organic wells in Gaowangsi Village, 23 organic wells in Majiazhuang Village, 21 machine wells in Wayaotou Village, and 14 organic wells in the preliminary design report of the 37600 acre central budget high standard farmland construction project in Fengxiang District, Baoji City in 2022; There are currently 11 machine wells in Xicun, Nanzhuangzhen, 9 organic wells in Tuncun, Henan, 18 organic wells in Taiwei Village, and 23 organic wells in Xizhuangcun. Due to the incomplete irrigation facilities in the field engineering of this project area, the guarantee rate of crop irrigation is low, which cannot meet the water requirements of crops in the irrigation area. The water conservancy projects in the project area affect the development of agriculture and rural economy, and constrain the effectiveness of the projects. Therefore, there is an urgent need to update and transform the field irrigation facilities in the project area. For fields where the original channels cannot reach, new machine wells, supporting low-pressure hidden pipes, and improving water conservancy facilities should be considered to ensure the food production safety in the project area and increase the income of the project area residents.

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3.3. Current situation of field road engineering

According to the survey, the village roads in the project area have basically hardened, making it convenient and efficient. However, most of the existing field roads are naturally formed by long-term compaction by agricultural machinery. The roads are narrow, low-lying, and uneven, with severe damage to the roadbed and road surface, overgrown weeds, and incomplete road facilities in some plots. Machinery and transportation vehicles are difficult to reach the field, which cannot meet the requirements of mechanical operations and transportation, seriously affecting mechanical operations and agricultural product transportation, and restricting the development of efficient agriculture. After on-site investigation and taking into full consideration the wishes of local villagers, this plan selects a section of road with severe damage to the existing road surface that is important for grain production and transportation as the planned field road. Cement hardening or sand and gravel cushion layer treatment will be carried out on the basis of the original road surface.

4. Water resource evaluation and supply-demand balance analysis

4.1. Surface water resources

The project area of Chengguan Town and South Command Town belongs to the well irrigation area, with no surface water flow.

4.2. Groundwater resources

The groundwater resources in Fengxiang District are 87.7673 million meters in plain areas and 52.9396 million meters in hilly areas. The sum of the two, after deducting the double calculation amount (i.e. the lateral recharge amount in the mountain front alluvial fan area), is 111.5637 million meters (with a total area of 1179 km). The exploitable groundwater resources refer to the amount of groundwater resources that can be continuously exploited and utilized under certain economic and technical constraints without significant impact on the water environment during the exploitation process. The groundwater resources are calculated by the equilibrium method. When the ratio of mining output to recharge (i.e. exploitation coefficient) is about 0.55, the groundwater level is basically in equilibrium and the average well layout method is used for verification. Since part of the groundwater in the hilly area is converted into surface water in the form of base flow, and the other part is recharged to the plain area in the form of side discharge, only the mining output of groundwater in the plain area is calculated, and the exploitation modulus is 102000 m^3/year * km^2.

4.3. Reservoir water resources

According to the investigation, Chengguan Town and Nanzong Town in the project area belong to the well irrigation area, with a groundwater resource of 5.102 million m^3, which is the total available water resource of 5.102 million m^3 in the project area

5. Construction scale and main content

The construction scale of this project is to construct a high-yield and stable grain field of 37597 acres, including land leveling engineering, soil improvement engineering, irrigation and drainage engineering, field road engineering, and agricultural power transmission and distribution engineering. The main construction content of the land leveling project includes leveling 14 acres of land; The soil improvement project includes the application of 37597 mu of bio organic fertilizer and 35267 mu of land rotary tillage. The main construction content of the water source project includes 27 new drilling wells, 32 repaired wells, 41 supporting well houses, and 38 water pumps. The main construction content of the water supply pipeline project includes the burial of UPVC Φ The 110 pipeline is 38016m long, with 639 supporting

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water hydrants, 294m long top pipes, 153 drainage wells, and 97 gate valve wells. The main construction content of the field road project includes a total length of 22965m for newly constructed field roads, 12595m for field concrete roads, including 6361m for 5m wide concrete roads and 6234m for 4m wide concrete roads; The total length of the sand and gravel road in the field is 10370m, including a 5m wide sand and gravel road of 353m and a 4m wide sand and gravel road of 10017m; The main construction content of the agricultural power transmission and distribution project includes adding 31 transformers, installing 10870m high-voltage lines, burying 1165m low-voltage cables, 31 measurement boxes, and 38 distribution boxes.

After implementing land leveling engineering, soil improvement engineering, irrigation and drainage engineering, field road engineering, farmland protection, and farmland power transmission and distribution engineering, the dryland planning in the project area can improve the quality of cultivated land by 1-2 points compared to before implementation.

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