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The Impact of High Standard Farmland Construction Projects on Soil Remediation of Cultivated Land

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Abstract

In short, as is well known, the foundation of agricultural development and food production is arable land. With the current development of science, technology, and socio-economic development, the country has also put forward requirements for food security and production. In this regard, it is necessary to strengthen the construction of high standard farmland, enhance soil improvement, strengthen the protection of arable land resources, and control and restore polluted arable land in order to improve food productivity and soil properties. In the process of farmland construction, it is necessary to strengthen supervision and control, develop soil improvement measures and methods, optimize Soil structure, improve soil quality, and provide high-quality soil for crop production through soil microbial improvement, physical improvement, chemical improvement and other technical methods, so as to achieve the goal of increasing agricultural production and income.

Keywords

High Standard Farmland; Soil Improvement; Soil Remediation; Soil Exploration.

1. Introduction

In order to better implement the decisions and deployments of the Central Committee of the Communist Party of China and the State Council on strengthening the construction of high standard farmland, in 2019, the Shaanxi Provincial People's Government issued the "Opinions on Steadily Increasing Grain Production Capacity to Ensure Food Security" (Shaanxi Zhengfa [2019] No. 16), proposing to integrate projects such as farmland remediation, farmland water conservancy, increasing grain production capacity by 100 billion kilograms, and improving farmland quality in accordance with the requirements of "strengthening the foundation, increasing production capacity, and ensuring supply", Concentrate on investing in grain production functional areas, adopt the promotion of whole townships and counties, and strive to basically build high standard grain fields that are suitable for mechanized operations, with drought and flood protection, and improved soil fertility by one level within 5 years; In 2020, the People's Government of Shaanxi Province issued a notice on the issuance of the Implementation Plan for Accelerating the Construction of High Standard Farmland (Shaanxi Political Office [2020] No. 18), proposing to vigorously promote the construction of high standard farmland, laying a solid foundation for ensuring food security in the province.

Abstract: Although China has a large area of arable land, soil pollution is severe. According to relevant data statistics from the environmental protection department, it has been found that there are a large number and area of polluted arable land, which has had a significant impact on the development and construction of the agricultural industry. Therefore, relevant departments need to strengthen their attention. Overall, China's soil pollution control and improvement work started late and also seriously affected the construction of high standard farmland. With the deepening of China's modern agricultural construction work, the

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agricultural and financial departments have strengthened their attention and jointly implemented funding subsidies and support management methods for high standard farmland construction, clearly proposing the need to do a good job in areas such as land leveling, soil improvement, irrigation and drainage, water-saving facilities, field tractor roads, farmland protection, ecological environment preservation, farmland power transmission and distribution, and restoration of damaged projects, As the core work of high standard farmland construction, relevant departments need to grasp the basic content of high standard farmland construction and formulate targeted basic measures for soil improvement in high standard farmland.

2. Overview of the Project Area

The project area is located in the western hilly and gully area of the Weibei Plateau, with complex and diverse terrain. Jianweiling, a tributary of Wuyue in Nanping, has an altitude of 1000-15021 meters, and a thousand mountains lie horizontally in the north, with an altitude of 1000-1545.5 meters. The north and south mountainous areas cover an area of 782.31 Square kilometre, accounting for 78.5% of the total area of the county. The central part is a fault basin, and the gullies and streams flowing into thousands of rivers are cut into more than 20 pieces of irregular loess remains, covering an area of 138.7 Square kilometre, accounting for 13.9% of the total area. A thousand rivers run across the front of the mountain and form alluvial valleys, covering an area of 75.43 Square kilometre, accounting for 7.6% of the total area, with an altitude of 710-860 meters.The soil is mainly composed of loess, with a small amount of black and red soil. The loess particles are relatively rough and are prone to erosion under the action of wind, leading to a decrease in soil fertility and even damaging the land, eroding seeds, overturning crops, and resulting in reduced yields and harvests.

3. Main Construction Content of the Project Area

Conduct a general exploration and restoration project on the quality of cultivated land in the project area, using soil tillage and soil fertilization to improve the quality of cultivated land. The layout concept of the irrigation project is to utilize the existing water sources in the project area, and pump water from the newly built pump station to the high-level reservoir to flow to the field pipeline network for irrigation. The layout concept of field road engineering is to keep the current road position unchanged, and to harden the local machine plowed roads with mud and stones or concrete. Some field roads in the project area will be renovated to facilitate agricultural cultivation and planting. The ecological environment restoration project is to plant Protection forest on both sides of the road according to the new field road project.

4. Exploration and Restoration Engineering of Cultivated Land Quality

4.1. General Exploration Engineering

The general exploration project in the project area mainly involves investigating and collecting relevant natural, geographical, agricultural, economic, social and other information, and focuses on on-site exploration and sampling analysis of the soil foundation in the project area. Typical points are selected as fixed monitoring points to provide detailed basic data basis for project design.

4.2. Restoration Project

The cultivated land quality restoration project in the project area will focus on the low Soil organic matter and other problems found in the general exploration of the project area, and improve the Soil structure by using straw returning, adding Manure, deep soil reclamation,

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residual film recycling and other technologies, and improve the soil fertility by applying Manure, chemical fertilizer and microbial agents. After the completion of farmland quality restoration, the quality of farmland in the region shall be monitored and controlled for no less than three years.

5. Exploration and Restoration Engineering of Cultivated Land Quality

5.1. General Exploration Engineering

According to the divided areas, one profile is set within each area. If the terrain in the area is complex, additional profile points can be added according to the actual situation; The selection of profile points should have relatively stable soil development conditions, that is, an environment conducive to the development of the main characteristics of the soil, usually requiring flat and stable terrain, and representative soil profiles within a certain range; It is not advisable to excavate profiles in areas prone to human disturbance such as roadsides, residential areas, construction sites, and ditches.

When conducting profile exploration on site, if special plots of land are found, such as areas with pollution sources or significant human disturbance, appropriate point locations should be added. If the soil layer of the plot is relatively uniform and less affected by human disturbance, the layout of points can be appropriately reduced to maximize project cost savings.

When sampling on site, if local representative sampling locations cannot be found within the preset sampling points or are not suitable for on-site construction, on-site adjustments need to be made to meet the requirements of point layout.

5.2. Restoration Project

Based on the results of basic exploration such as field survey, profile observation, and sample testing, in order to address the different problems that may exist in the project area, such as structural water and fertilizer leakage, poor stability, and hard compaction, the mechanical composition of the cultivation layer is adjusted through physical methods such as soil mixing, mixing, and addition/reduction. The texture of the cultivation layer for high standard farmland in the region should be from loamy sandy soil to clay loam soil.In response to potential issues such as deep plow beds in the project area, it is determined to use reasonable fertilization and moderate tillage to solve the problem of soil compaction. The application of Manure can improve the physical and chemical properties of the soil, increase the permeability, moisture retention and heat preservation of the soil, and effectively alleviate the phenomenon of soil hardening; By reasonably controlling the depth of cultivation, the structure of the plow layer can be improved to prevent soil compaction. At the same time, 20-40kg/mu Soil structure improver can be applied as a base to effectively loosen the soil, increase the soil aggregate structure, promote soil water and fertilizer conservation, promote crop root growth, and improve crop cold and drought resistance. The surface soil (cultivation layer) of the project farmland was deeply loosened by mechanical means, with a depth of 30-50cm. The soil was plowed and the bulk density of each layer was reasonably controlled. The bulk density of the upper layer (0-30cm) was 1.1-1.3 g/cm3, and the bulk density of the lower layer (>30cm) was 1.3-1.5 g/cm3. Finally, an excellent soil structure with virtual upper and solid lower layers and stable structure was constructed.

5.3. Remediation of Soil Bionutrient Properties

Based on the results of basic exploration such as field surveys, profile observations, and sample testing, the project area may face issues such as lack of organic matter, poor biological activity, and poor soil fertility. Therefore, soil fertilization is used to quickly improve the quality of cultivated land. Based on the opinions of the local people, identify soil nutrient abundance and deficiency indicators (organic matter, alkali hydrolyzed nitrogen, available phosphorus,

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available potassium, and trace elements), and use inorganic, organic fertilizers, and microbial agents as soil productivity improvement materials for soil testing and formula fertilization to improve soil fertility, so that the cultivated soil meets the fertility requirements of crop planting.

According to the "Research Report on the Guidance System for Rapid Measurement and Fertilization of Soil Nutrients", the balanced fertilization method is selected. According to the planned yield, the difference between the fertilizer demand and the soil fertilizer supply can be supplemented through fertilization. In terms of planned yield, based on the average crop yield in the first three years of the project area, an increase of 15% -20% is used as the target yield, and then the total amount of nutrients required to achieve the planned yield is calculated using the nutrient coefficient; Multiply the measured value of soil nutrients by the conversion coefficient (0.15), and then multiply it by the soil nutrient correction coefficient to obtain the total amount of soil nutrient supply. Subtract the total amount of soil nutrient supply from the total amount of nutrients required for the target yield to obtain the total amount of nutrients that should be applied to the soil. Based on the type, variety, nutrient content, and relevant conditions of fertilizer utilization, calculate the amount of fertilizer that should be applied.

5.4. Acceptance of Repair Effect and Subsequent Monitoring and Management

In response to the problems of uneven soil layer thickness, tight soil compaction, and poor soil fertility in the project area, targeted samples were collected from special areas with problems. Through sample re inspection, on-site exploration, profile observation, remote sensing interpretation, and other methods, the restoration effects of different technical solutions such as rapid improvement of soil fertility and structural optimization and improvement were inspected to ensure compliance. Objective and truthful evaluations were conducted to summarize experience, identify problems, and promptly propose response measures, Provide technical support for improving the quality and efficiency of high standard farmland in the project area.

(1) During the acceptance of the soil cultivation layer, each project area is divided into three acceptance units based on the terrain and topography of the project area, the degree of connection, and the area of cultivated land. Each acceptance unit is sampled and accepted separately;

(2) Each acceptance unit collects 5-20 soil samples from the cultivation layer as a mixed soil sample, using the "S" shaped distribution or grid method. The physical, chemical, and biological nutritional indicators should meet the design requirements, and the soil quality should be improved year by year, ultimately forming a good growth environment for soil plants, animals, and microorganisms.

6. Conclusion

After implementing the general exploration and restoration project of farmland quality, irrigation and drainage project, field road project, and ecological environment restoration project, the quality of farmland in the project area can be improved by one grade after being upgraded to irrigated land. Based on the increase of farmland by one grade, an additional grain production capacity of 100 kilograms will be added, and it is expected that an additional grain production capacity of 502 tons will be added after the implementation of the project.

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